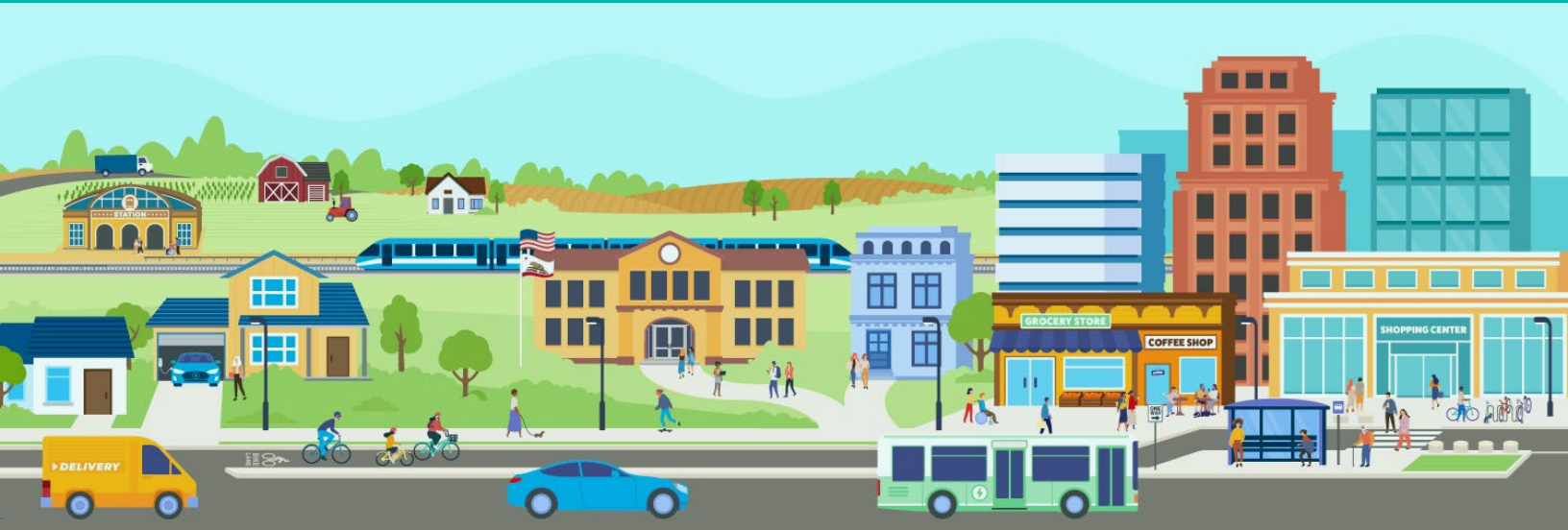


Caltrans VMT Reduction Program



Mitigation Playbook

MAY 2026



Director's Office of
Sustainability

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INTRODUCTION

The Playbook is intended for users looking to mitigate transportation impacts related to vehicle miles traveled (VMT). Caltrans seeks to avoid induced travel, as measured in VMT, as it manages and evolves the State Highway System (SHS). This effort arises out of the Department's implementation of the California Environmental Quality Act (CEQA) and the State CEQA Guidelines (California Code of Regulations (CCR) § 15064.3), related to determining the significance of transportation impacts. The Playbook serves as a reference when induced VMT impacts have been identified based on guidance from the Caltrans 2nd Editions of the Transportation Analysis Framework (TAF)¹ and Transportation Analysis under CEQA (TAC)². For more on determining impacts, see Section 5.6, Determining Significance, of the TAC.

Mitigation measures are those measures incorporated into a project to reduce impacts determined to be significant (PRC§ 21100(b)(3)), including those from VMT. However, mitigation is not the first option for addressing induced VMT. The primary method is to plan and develop projects in a way that avoids or minimizes VMT. Project teams may develop alternatives, for example, that would not substantially or measurably lead to VMT increases. Where induced VMT is unavoidable, design and lane-management strategies may minimize it. Mitigation is required when significant induced VMT remains after exhausting these options. Formally, mitigation is memorialized in an environmental document and environmental commitment record, where it must meet CEQA standards regarding essential nexus, enforceability, and proportionality. The mitigation must also be additional to any other VMT reduction required by law, or which would occur otherwise. And, most relevant to this guide, it must be quantifiable and effective at reducing VMT.³

¹ [Transportation Analysis Framework \(TAF\) 2nd Edition \(California Department of Transportation, September 2024\)](#)

² [Transportation Analysis Under CEQA \(TAC\) 2nd Edition \(California Department of Transportation, September 2024\)](#)

³ [For more on additionality, see Section 5.7, Mitigation, of the Transportation Analysis Under CEQA \(TAC\).](#)

For transportation agencies, mitigation is a familiar concept with respect to other types of environmental impacts. Mitigation for VMT is less familiar for most of those agencies, but it has a long history in other settings. Local and regional governments and Transportation Management Associations (TMAs), for example, have run programs to reduce single-occupant vehicle (SOV) transportation demand for many years.⁴ For transportation agencies, mitigating environmental impacts determined to be significant under CEQA is a familiar concept. However, mitigating impacts to transportation from VMT may be less familiar, though many agencies have engaged in VMT reducing activities already. The Caltrans Tulare State Route 66 Lane Widening and Paige Avenue Project, for example, funded vanpool programs, increased transit service frequency, and implemented lane management strategies to provide viable mitigation options to reduce induced VMT from the project.

In California, a particularly comprehensive listing of VMT-reducing measures was published in 2010 and updated in October 2024, by the California Air Pollution Control Officers Association (CAPCOA). The [Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity](#) provides methods to quantify greenhouse gas (GHG) emission reductions from a specified list of measures. However, in many instances described in the handbook, GHG reductions are accomplished through VMT reductions, and so the measure descriptions and quantification are useful in considering VMT mitigation. The CAPCOA handbook is referred to frequently in the discussion on mitigation measures in this document and is a recommended resource for anyone seeking to reduce VMT or mitigate impacts.

Related, many local governments have developed VMT calculators, based on CAPCOA or the same body of literature used by CAPCOA. In this guide we use the

⁴ Note that many of these programs are aimed at reducing peak-period congestion, rather than VMT. Often, but not always, measures aimed at peak period congestion also reduce VMT. See [“Modernizing Mitigation: A Demand-Centered Approach” \(SSTI, 2018\)](#) for more details.

Alameda CTC VMT Reduction Calculator Tool (Alameda County VMT Calculator)⁵ as an example and list others in Appendix B. These calculators, like CAPCOA, can provide ways of assessing many potential VMT-reduction measures. Direct use is quite convenient because the calculators are pre-loaded with default data. Where such custom calculators do not exist, the formulas for making assessments can be useful, though the burden on the analyst to find data is greater.

With CAPCOA, the calculators, and other sources, we can assess many, but not all, mitigation measures for effectiveness. This guide includes measures that are well-defined and quantified, and those that are conceptually impactful but do not yet have standard metrics associated with them. Project teams may still consider these measures for VMT mitigation if they can provide context-specific evidence demonstrating a measurable reduction in VMT. As research and modeling tools evolve, some measures may become more robustly supported, suitable for broader application in the future, and included in future Playbook updates.

Caltrans and many stakeholders are interested in organizing mitigation efforts through banks or exchanges, which are discussed later in the playbook. An entity would collect and validate VMT mitigation opportunities – from land-use developers, transit agencies, TMAs,⁶ local active transportation programs and others – and make them available to transportation agencies whose projects need mitigation. These arrangements are currently emerging or are region specific, so project development teams may have to develop VMT-reduction measures themselves. A future statewide VMT Mitigation Bank, established by Assembly Bill 130 (2025), will provide applicants and lead agencies with an additional, streamlined approach to mitigate VMT impacts under CEQA. Meanwhile, the Playbook can help practitioners formulate project-specific mitigation options. The rest of this guide summarizes mitigation measures,

⁵ The Alameda County VMT Calculator referenced in this playbook uses 2010 CAPCOA data.

⁶ See Appendix A for a list of TMAs in California.

providing factors to consider, analysis methods, and some examples of assessing efficacy.

HOW TO USE THIS PLAYBOOK

This Playbook is designed as a practical reference for transportation professionals, planners, and project teams responsible for identifying, evaluating, and implementing VMT mitigation strategies. It aims to guide users through the process of selecting appropriate, quantifiable, and enforceable actions that align with state policy goals. While not exhaustive, the Playbook offers consistent methods, data sources, and examples to support informed decision-making and documentation of mitigation approaches.

Each section of the Playbook focuses on a specific category of mitigation measures including land use, active transportation, or pricing and includes key factors to consider, methods for quantification, and illustrative examples of application. Tables summarize the relative ease of implementation and potential efficacy of each measure, while appendices provide additional resources, including VMT calculators, supporting data references, and lists of partner organizations. Users are encouraged to begin with the mitigation summary table to identify relevant measures, then consult the detailed sections and appendices for guidance on analysis, documentation, and coordination with local or regional partners.

The Playbook lays out various quantifiable approaches to mitigating VMT, but it is not comprehensive. In some cases, agencies may wish to use mitigation measures that are not in this Playbook, or are not readily available in other sources such as CAPCOA and are difficult to quantify. Caltrans funded a research project through the UC Davis Institute of Transportation Studies to assess various VMT mitigation measures. The release of this report⁷ in December 2024, updated in June 2025, and its recommendations helped to inform application and effectiveness of potential VMT mitigation measures outlined in this Playbook.

⁷[Assessment of Options for Quantifying Reduction in Vehicle Miles Traveled \(VMT\) from Mitigation Measures \(Volker and Handy, 2025\)](#).

This Playbook includes other mitigation measures, such as mobility hubs that do not include a given quantification approach. While various methodologies exist to calculate the VMT reductions from such measures, the lack of a recommended approach indicates additional research may be needed to quantify their effects. It is important to acknowledge that this Playbook is not comprehensive and that the field and practice of analyzing and quantifying VMT mitigation is evolving. As research, modeling tools, and policy guidance continue to evolve, this Playbook should be used in conjunction with current Caltrans guidance, CAPCOA resources, and emerging best practices in VMT analysis and mitigation.

MITIGATION MEASURES

Table 1 summarizes many mitigation measures that could be applied to a project to reduce significant transportation impacts. “Ease of implementation” is higher when costs are lower and fewer parties are involved. “Efficacy” is higher for measures that have the potential to reduce more VMT in most common situations. “On-System” or “Off-System” refers to whether the measure applies directly to the State Highway System (SHS) or not. The ratings are general and actual conditions will vary with particular projects. Note that while these measures could constitute mitigation if incorporated as a way to reduce significant impacts, they could alternatively serve as features of projects that eliminate or reduce the need for mitigation, if included.

For example, added highway capacity may induce 1 million VMT annually, while transit improvements that are part of the same project may reduce VMT by 500,000 annually, leaving 500,000 VMT in need of mitigation. Developing mitigation strategies to reduce impacts from 500,000 VMT would be the next step in this case.

Mitigation measures may be combined and [CAPCOA p. 38](#) provides guidance for combining measures. In most cases a combination would reduce the effectiveness of each individual measure. Consider a combination of new transit service and dense affordable housing, aimed at reducing 1 million VMT. When combining both measures, transit would offset 10 percent or 100,000 of the VMT from a project, while the dense affordable housing would offset 20 percent or 200,000. In total, both transit and dense affordable housing would result in a reduction of 300,000 VMT. A reduction of 700,000 VMT would still be needed to fully offset the 1 million VMT induced from the project.

Table 1. VMT Mitigation Measures Summarized

Measure	Ease of implementation	Efficacy	On- or Off-System	Key considerations
Active transportation	High	Low ⁸	Both (Note: for the SHS, may be most effective when integrated with conventional "main-street" highways)	Must provide access to destinations, not simply recreational opportunities.
Land use – residential	Low	High	Off	Requires partnership agreements with land use jurisdictions housing authorities, and private developers. VMT benefits come from density, affordability and location.
Land Use – Transit-Oriented Development (TOD)	Low	High	Off	Requires partnership agreements with land use jurisdictions housing authorities, and private developers. VMT benefits come from mode shift, affordability and location/access to destinations.
Land use – employment	Low	High	Off	Requires partnership agreements with land use jurisdictions housing authorities, and private developers. VMT benefits come from density and location.
Transportation Demand Management (TDM)	High	Medium	Off	Services can be tailored to meet specific user needs. Must be supported with long term maintenance of effort.

⁸ This is not to imply that Active Transportation projects are not a high priority for Caltrans and worth doing for their own sake. While Active Transportation projects do have a downward VMT effect, the amount of VMT that can be reduced by these projects is often much smaller than the VMT induced by highway projects. This scale is important to consider when developing mitigation.

Measure	Ease of implementation	Efficacy	On- or Off-System	Key considerations
Transit service improvement	Low to high	Low to high	Both	Usually requires partnership agreements with transit operators.
Local road networks/connectivity	Low to high	Low to high	Off	Can relieve pressures on SHS and provide more direct, multimodal access to destinations.
Micro-mobility	High	Low	Off	Requires partnership agreements with transit operators and/or transportation network companies.
Road diets	High	High	Both	Lane removals can be considered roughly equivalent to lane additions for similar facilities.
Pricing	Low to high	High	Both	Operational details and market analysis needed during PA&ED.
Lane management	Low to high	Low	On	VMT effect depends on specific management strategy such as transit/HOV priority.
Parking pricing/restrictions	High	High	Off (On in some limited cases)	Potentially powerful tool for specific land uses in a highway corridor.
Mobility hubs	High	Low	Both	Removes commute trips. Effect on total VMT needs to be addressed in a mitigation plan.
Land preservation	Low to high	Unclear	Off	Could work in theory but measurement is difficult. May be best combined with transfer of development rights to spur infill TOD.
Telecommuting	High	Minimal	NA	Telecommuting tends to shift trip-making but does not reduce VMT. Any

Measure	Ease of implementation	Efficacy	On- or Off-System	Key considerations
				claim here would need careful, specific support.
Schedule-shifting	NA	None	NA	Reschedules rather than reduces trips. Likely increases VMT.

Note: this list is not exhaustive, and other measures that satisfy CEQA requirements could be developed.

Active Transportation

An integral component of Caltrans mission is to provide comfortable, connected and convenient complete streets facilities on the state highway system (SHS). As outlined in the [Department's Complete Streets Policy \(DP-37\)](#), Caltrans must provide walking and biking facilities for "all ages and abilities" where applicable, regardless of the need for VMT mitigation. When VMT mitigation funds are used for active transportation, that facility must reduce motor vehicle use. In addition, new or improved active transportation facility whose main objective is recreational use would generally not serve as effective mitigation.

Factors to consider:

- **Proximity.** Most transportation-related use of active transportation facilities is for short trips that function as first and last mile network connections that are to or from transit options. Short trips are often less than 20 minutes, or about a mile walking or 3 miles cycling. Demand curves are steep; an additional minute or two can reduce active transportation demand significantly. Therefore transportation-generating facilities must link land uses that are fairly close, with as few traffic stops or diversions (including lengthy stairs on an overcrossing, or pedestrian crossing facilities that are located too far from one another) as possible (see Figure 1). Therefore, projects that reduce travel time between relatively proximate land uses are good candidates for VMT reduction. A pedestrian overpass connecting two relatively dense residential and commercial areas that are separated by a highway would be an ideal VMT-reducing active transportation project.

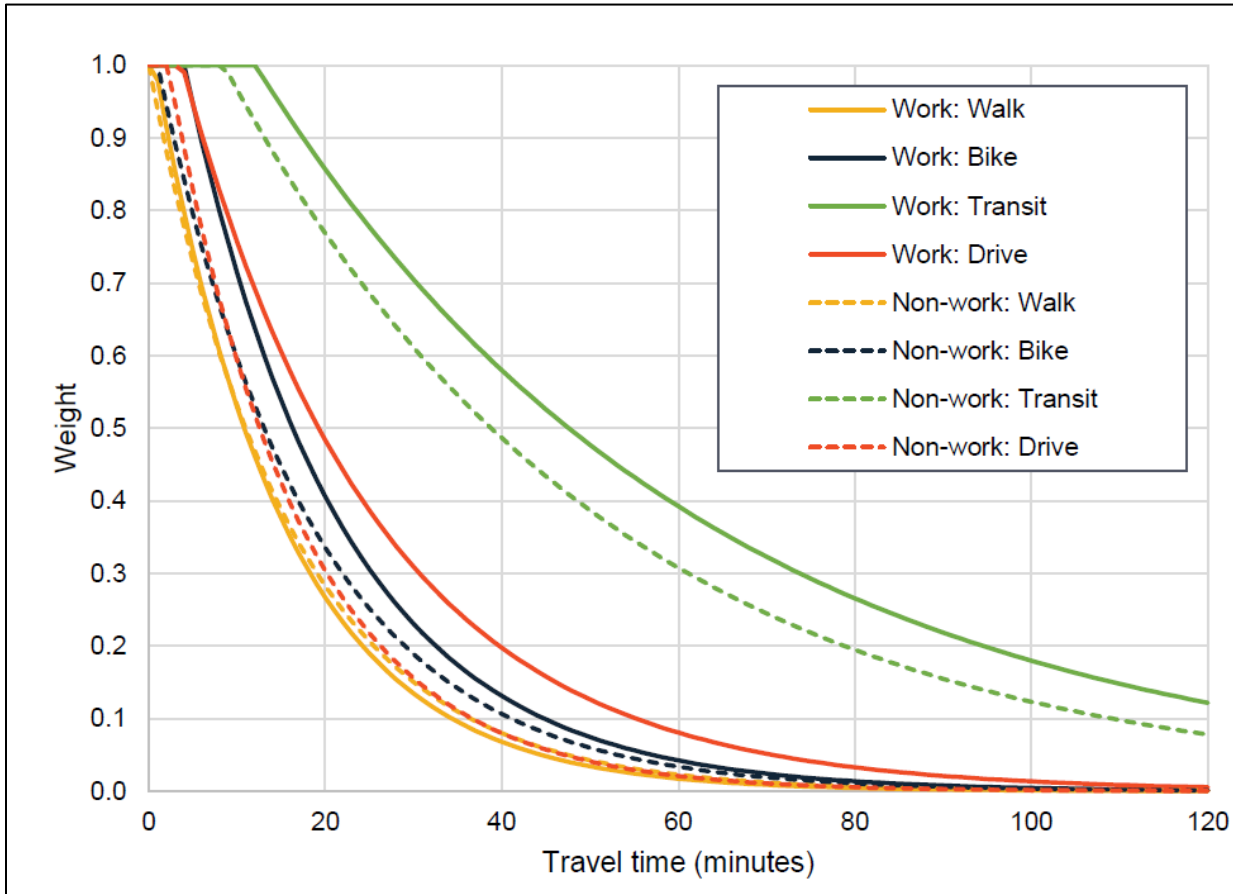


Figure 1. AT usage drops rapidly as time and distance increases. Source: SSTI.

- **Level of traffic stress (LTS).** Even if the network for AT appears robust on a map, with destinations in close proximity, travelers will not use it if it is perceived to be unsafe. Therefore, projects that reduce LTS, for example by providing buffered or separated cycling lanes, are good candidates for VMT reduction.
- **Scale.** Large highway projects generally have large impacts as they can affect auto accessibility across a region. AT projects are almost always more modest in scope and have lower efficacy at reducing VMT, since they influence shorter local trips which result in a lower share of vehicle travel reduction. In general AT

improvements will only offset a small percentage of induced VMT from a highway project.

Ways to measure VMT reduction:

- Most demand models are unable to reliably measure effects from AT projects, due to lack of granularity and/or AT mode inclusion. For a very large newly constructed AT facility, such as a river or freeway crossing that links two transportation analysis zones, a regional demand model may be viable pending appropriate calibration, validation, and sensitivity testing.
- Various data/software packages are available to measure outputs from small network and land use changes. [UrbanFootprint](#) is a commonly used package, and it could estimate effects from AT network changes. Caltrans' local partners may have access to this tool.
- Some local governments have adopted VMT estimation tools for use in evaluating land-use and transportation projects. These tools often include AT facility improvements as measures, giving VMT outcomes. [An example is the Alameda County VMT Calculator](#). Where these tools are available online or as macro-enabled spreadsheets, they can be of use in assessing VMT reductions from AT facilities. It may also be possible to use one of these tools where it exists in a neighborhood similar to one where the project will be, if there is no tool there. Alternatively, the underlying formulas may be of use with project-area data; the Alameda formulas are cited below.
- For new pedestrian facilities, several formulas exist, including⁹:
 - “Alternative Quantification Method” prepared for the California Air Resources Board (CARB) in 2019. [See pp. 26-30.](#)

⁹ Note that the changes in VMT indicated will be for a relatively small project area, compared to the area affected by highway VMT.

- “Pedestrian Facility Improvement” prepared for Alameda County (similar to formulas used by other local governments). [See pp. 34-35.](#)
- For new bike facilities, several formulas exist, including!
 - “Existing Quantification Method” prepared for CARB in 2019. [See pp. 5-7.](#)
 - “Bikeway Network Expansion” and “Bike Facility Improvement” prepared for Alameda County (similar to formulas used by other local governments). [See pp. 37-40.](#)
- To quantify improvements in LTS, formulas also exist. These may be applied along with the new facility formulas; for example, if a facility may be considered utility-constrained by LTS, with improvements counting toward additional utility and VMT reduction:
 - “Low-Stress Bicycling and Network Connectivity” by the Mineta Transportation Institute in 2012. [See pp. 17-22 for segments, pp. 23-26 for intersection approaches, pp. 27-30 for crossings.](#)
 - LTS by the State Smart Transportation Initiative in 2021. [See pp. 27-29.](#)
 - The [Alameda County VMT Calculator](#) provides adjustment factors for various bike improvements. If a new Class II bike lane is the base, a new Class I bike path or Class IV bikeway will be 1.54 times as impactful, while a Class II to Class IV conversion will be 0.54 times as impactful. [See pp. 38-39.](#)
- Sometimes a more ad hoc or qualitative case can be made. This might be the case if new or improved AT facilities were designed to serve a particular, perhaps new, activity center. If trip lengths can be determined, the Auto Substitution rates in the CARB formulas may help estimate the VMT reduced. As well, facilities that clearly improve AT connectivity and/or traffic stress in relatively dense areas with a variety of land uses can be assumed to have beneficial VMT impacts. In the Sacramento region, [SACOG’s Project Performance Assessment](#) tool provides density and land-use mix data for project areas, which can be easily input.

Examples:

- When considering new AT elements, consider possible expansions and connectivity to the existing AT network such as sidewalks and bikeways. The [Alameda County VMT Calculator](#), or similar calculators in other cities, are a convenient way to determine VMT impacts. Figure 2 below shows the calculator estimate, using built-in default values and a handful of user inputs to show the location and extent of the bikeway improvements. The result is in terms of percentage of VMT, so a final step would be to apply that percentage to total VMT in the affected area, which could be obtained from the Metropolitan Planning Organization (MPO) or other planning entity, or from a big-data tool. [Caltrans also tracks VMT at the municipal and county levels](#), though most active transportation improvements would affect much smaller geographies. Where calculators are not available, the formulas above or in the calculator may be used, but data burden will be higher.
- Improved AT elements: Consider an improvement to a facility, rather than new facilities. The analyst needs to make a finding about the improved utility. If the improvement is very significant, e.g. there was a pedestrian route but it was very difficult to use, not ADA compliant, and/or clearly unsafe, and the improved route addresses such issues, it might be considered to have as much impact as a new facility. More typically, an improved facility will get “partial credit.” For example, the [Alameda County VMT Calculator](#) documentation cited above would provide 54 percent of the VMT reduction for a Class II to Class IV conversion, compared to a new facility.

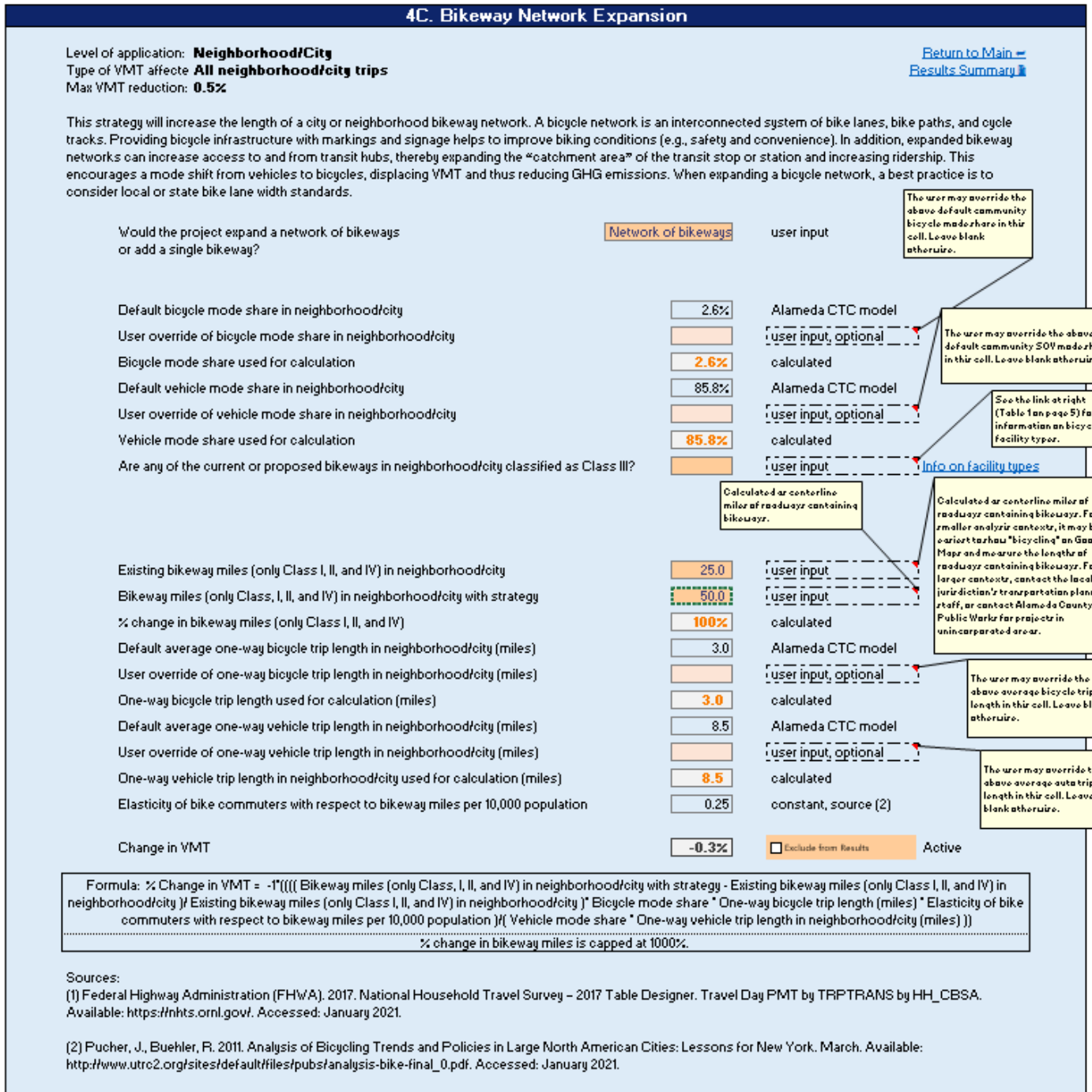


Figure 2. Alameda County VMT Calculator, an Excel tool. Addition of 25 miles of bikeway results in a 0.3 percent reduction in VMT.

Land Use – Residential (Density and Affordability)

Compact housing can reduce VMT compared to housing that is lower density. Affordable housing also produces less VMT compared to market-rate housing. To the extent a project contributes to such housing, it can take credit for the VMT reduction achieved by a project that is designed with a higher density of dwelling units compared to the average residential density. Transportation agencies or project sponsors can make commitments to directly fund, or provide contributions to, a statewide or regional mitigation bank or exchange that would fund affordable housing or high-density housing. Project sponsors can also work with entities that provide housing, such as a regional or public housing authority or the California Department of Housing and Community Development, to identify projects with a funding gap, to which the proposed transportation project can contribute to and claim as VMT mitigation. Compared to other options, denser, more affordable housing is a powerful VMT-reduction tool. Much of the information from this section utilizes the CAPCOA formulas T-1 and T-4 (see [CAPCOA, pp. 70-82](#)). Additional guidance on location-efficient affordable housing as VMT mitigation is currently being developed by the Governor's Office of Land Use and Climate Innovation through the AB 130 process by LCI.

Factors to consider:

- Density of housing relative to typical or existing
- Affordability of new housing
- Current household VMT
- Location of the housing project
- Potential for mode shift from proximity to transit or bike and pedestrian networks

Ways to measure VMT reduction:

- For projects that increase density, CAPCOA provides an elasticity of -0.22. That is, for every percentage increase in residential density, VMT decreases by 0.22 percent. Additionally, there is a starting point; density must be higher than the

existing baseline of the surrounding city in order to qualify as a VMT reducer. CAPCOA sets that typical starting point at 9.1 units/acre. These factors are built into the CAPCOA formula, which is reproduced below. The CAPCOA formula results in a percent reduction in GHG emissions for the project. The percent reduction in VMT would be the same as the percent reduction in GHG emissions. To calculate an absolute number for the VMT reduction from the mitigation, Caltrans recommends applying the resultant percent reduction to the annual typical household VMT, which is listed in Appendix C of this Playbook as 19,641.8.

- The CAPCOA formula may be utilized to calculate a percentage decrease in VMT, or alternate formulas could be developed using local or regional geographic context, as long as they are supported by substantial evidence, per CEQA. Lower density developments would usually not reduce VMT, unless affordable multi-family housing is included. CAPCOA caps the reduction at 30 percent for developments that increase density. For more details, see [CAPCOA, pp. 70-72](#). Table A-3.1 in Appendix C shows VMT reductions in percentages and per household (assuming typical VMT), for various densities.

Equation 1: Increase Residential Density

$$A = \frac{B - C}{C} \times D$$

ID	Variable	Value	Unit	Source
Output				
A	Percent reduction in GHG emissions from project VMT in study area	0-30.0	%	calculated
User Inputs				
B	Residential density of project development	[]	du/acre	user input
Constants, Assumptions, and Available Defaults				
C	Residential density of typical development	9.1	du/acre	Ewing et al. 2007
D	Elasticity of VMT with respect to residential density	-0.22	unitless	Stevens 2016

See table A-3.1 in Appendix C for comprehensive VMT reduction values for increased residential density.

- For projects that include affordable multifamily housing¹⁰, VMT for units dedicated as affordable can be estimated at 28.6 percent reduced from market. For more details, see [CAPCOA, pp. 80-83](#).
- CAPCOA cautions that “This measure is most accurately quantified when applied to larger developments and/or developments where the density is

¹⁰CAPCOA defines affordable housing: “Multifamily residential units must be permanently dedicated as affordable for lower income families. The California Department of Housing and Community Development (2025) defines lower income as 80 percent of area median income or below, and affordable housing as costing 30 percent of gross household income or less.”

somewhat similar to the surrounding neighborhood." A dense housing project in a very disconnected, low-density area will be unlikely to provide the VMT benefits desired. In other words, infill rather than edge development is the goal.

- For projects where the Lead agency is the sole entity claiming credit for housing mitigation, full mitigation credit can be claimed if it is demonstrated that the housing project would not have occurred without the project's contribution. It must also meet CEQA requirements on Additionality, that the housing project would not have happened or happened substantially earlier than projected. See Sections 5.7 and 5.7.1 of the Transportation Analysis Under CEQA (TAC) for Additionality, Housing, and VMT.
 - Mitigation may be proportional based on the project contribution. For example, if a project contributes half of the backing (funding, land, infrastructure, etc.) needed to deliver the housing units that reduce VMT by 1,000 miles/day, it could claim 500 miles/day as VMT reduction.

Examples:

- New density: CAPCOA assumes a minimum density of 9.1 dwelling units/acre. Housing provided at greater than 9.1 units/acre can be assessed for VMT reduction as follows: A new project will provide 1,000 housing units at a density of 10 units/acre, a 10 percent increase over the existing baseline of the surrounding city. Per the elasticity cited in CAPCOA, we should expect VMT to be reduced by 2.2 percent. Applying that 2.2 percent reduction to the typical household annual household VMT of 19,641.8 would result in an absolute number of 432 VMT annually for a typical household (see Table A-C.1 in Appendix C). The CAPCOA formula for increasing housing density is based on the reduction from the new units, so the reduction per household (432) should be multiplied by the number of units in the development. For 1,000 units, the development will reduce VMT by 432,000 annually in this example.

- **Affordability:** For the example above, if a project proposed 1,000 affordable housing units at the standard 9.1 units/acre, it could assume an annual VMT reduction of 5,618 per household based on the 28.6 percent reduction from the typical 19,641.8 per year (see Appendix C). Based on this reduction, 1,000 units could claim a reduction of 5,617,555 VMT per year. If the project was also denser than 9.1 units/acre, it could claim both reductions from affordability and density, subject to the rules of combining measures in CAPCOA.

Transit-Oriented Development (TOD)

Transit-oriented development (TOD) can have a slightly greater effect in reducing VMT than simply increasing residential density in non-TOD areas. TOD refers to compact, walkable, mixed-use communities centered around high-quality public transit. These areas are designed to maximize access to transit and reduce dependence on private vehicles. TOD not only supports mode shift to transit but also enables low-VMT lifestyles through proximity to jobs, services, and amenities. Effective TOD includes not just proximity to transit, but walkability, a rich mix of land uses, reduced car ownership incentives, and high-quality public spaces. These features support transit use and reduce reliance on single-occupancy vehicles. To be considered TOD, a project must be located within a half mile or within a 10-minute walk of a high frequency transit station which includes either rail or bus rapid transit.

Factors to consider:

- Access to and frequency of transit
- Incentives for transit use, such as free or subsidized transit passes
- Parking management to discourage car usage
- Land use mix, density and affordability

Equation 2: Provide Transit-Oriented Development

$$A = \frac{(B \times C)}{-D}$$

ID	Variable	Value Output	Unit	Source
A	<u>Percent reduction in GHG emissions from project VMT in study area</u>	<u>6.9-31.0</u>	<u>%</u>	<u>calculated</u>
User Inputs				
B	<u>Transit mode share in surrounding city</u>	<u>[Scale should be no larger than Census Tract]</u>	<u>%</u>	<u>FHWA 2017a</u>
D	<u>Auto mode share in surrounding city</u>	<u>[Scale should be no larger than Census Tract]</u>	<u>%</u>	<u>FHWA 2017b</u>
Constants, Assumptions, and Available Defaults				
C	<u>Ratio of transit mode share for TOD area with measure compared to existing transit mode share in surrounding city</u>	<u>4.9</u>	<u>unitless</u>	<u>Lund et al, 2004</u>

Ways to measure impacts:

[CAPCOA \(pp. 76-79\)](#) provides maximum VMT reduction of 31% for projects located in TOD areas. "Unmitigated" or "baseline" VMT should not already account for reductions from transit proximity. Where available, MPO TOD readiness or scoring tools (e.g., [SACOG's TOD Toolkit](#) or [LCI's Site Check](#)) can help identify promising sites for VMT-effective TOD. These tools combine transit accessibility, land-use diversity, and infrastructure support. Transportation agencies can facilitate TOD by partnering with local governments to offer surplus land, infrastructure grants, or through contributions towards mitigation banks or in lieu payments in return for dense, mixed-use development with lower parking ratios. Reductions should be combined carefully per CAPCOA guidance to avoid double-counting.

Example:

Caltrans signs a cooperative agreement with a local housing authority in Los Angeles to fund 100 new housing units within a 10-minute walk of a high frequency light rail station. The housing development would also provide last-mile pedestrian walkways to the station by adding protected crossings, sidewalks, and other safety improvements. The CAPCOA formula would calculate a 22% VMT reduction for projects in the Los Angeles-Long Beach-Anaheim Census Bureau Statistical Area (CBSA). Assuming an adjusted typical household annual VMT of 19,641.8, the amount of VMT reduced through TOD alone would be 4,321.19 per household or 432,119.6 VMT in total for 100 units. Utilizing the CAPCOA method for combining measures, the project would see a reduction of an additional 6.4% VMT from that total figure for the pedestrian improvements or 29,816.25 VMT. In total, the reduction from both the 100 TOD units and pedestrian improvements would result in a reduction of 461,935.85 VMT. If the housing is denser than 9.1 units per acre, it could also claim VMT reductions for density, subject to the rules of combining measures in CAPCOA.

Land use – Employment (Density)

As with residential density, job density can shorten trips and reduce VMT. If a transportation project contributes to development of dense employment facilities, it could claim some VMT reduction as mitigation.

Factors to consider:

- Density of prospective employment center
- Typical VMT for employment in the area
- Proportion of backing for the employment center from the mitigation effort

Ways to measure impacts:

- [CAPCOA \(pp. 73-75\)](#) provides a density-to-VMT elasticity of -0.07. It sets 145 jobs/acre as a floor for seeing VMT benefits, and a cap of 30 percent on VMT reductions from density. Equation 3 below can be used to estimate VMT reduction from increased job density. Reductions are shown in Table A-C.2 in Appendix C. These must be applied to typical commute VMT for the development, a number that may be developed during the traffic and parking study or may be available from the MPO or other planning entity. Local VMT calculators may also provide estimates. If typical commute VMT is not available, it could be calculated by referring to the [ITE Trip Generation Manual](#) and multiply the trips by trip lengths from a big-data tool.

Equation 3: Increase Job Density

$$A = \frac{B - C}{C} \times D$$

ID	Variable	Value Output	Unit	Source
A	Percent reduction in GHG emissions from project VMT in study area	0-30.0	%	calculated
User Inputs				
B	Job density of project development	[]	jobs per acre	user input
Constants, Assumptions, and Available Defaults				
C	Job density of typical development	145	jobs per acre	ITE 2020
D	Elasticity of VMT with respect to job density	-0.07	unitless	Stevens 2016

See table A-3.2 in Appendix 3 for comprehensive VMT reduction values for increased job density.

- Local VMT calculators may also provide estimates of outcomes from employment density. The Alameda County VMT Calculator does so, requiring the user to input location and density information.

Example:

- New job center: In order to mitigate VMT from a transportation project, funds are made available to an office developer that is planning a new activity center. The activity center will cost \$20 million, and mitigation supplies \$10 million in order to capture half the VMT reduction benefit as mitigation. The facility will house 2,000 workers at 400 employees per acre. From the table, this level of

density implies a 12.3 percent reduction in commute VMT compared to typical conditions. A traffic study for the project indicates typical commute VMT in the area is 75 miles per week per employee. The denser development will reduce commuting by 9.2 miles per week for 2,000 workers, or 18,466 per week, or 960,207 per year assuming a 52-week year, for the workforce. Because the project provided half the support to develop the employment center, it can claim 480,103 in reduced annual VMT as mitigation.

Transportation Demand Management (TDM)

Transportation Demand Management (TDM) is a longstanding practice most often aimed at getting workers to their jobs while reducing peak-hour vehicle travel. However, TDM can also be focused on other groups, such as students or tourists, or at a general community level. While TDM was developed as a response to peak-hour congestion, most of the measures commonly employed also tend to reduce VMT. Exceptions discussed elsewhere in this guide are telecommuting and schedule-shifting, which have peak-hour benefits but minimal or no VMT benefits. Measures that are more useful to consider include transit and micro-mobility pass discounts, carpool matching and incentives, parking pricing (discussed separately in this guide), bike facilities at workplaces, vanpools, emergency-ride-home service for non-driving employees, education and information on non-SOV travel, and more. ["Modernizing Mitigation" \(2018\) from the State Smart Transportation Initiative](#), describes VMT-focused TDM in more detail.

Mobility Wallets

Transportation Mobility wallets are an emerging strategic tool to reduce VMT by shifting trips away from SOV use and towards more sustainable, multimodal alternatives. Mobility wallets can limit SOV use through transit fare discounts, dynamic pricing, or financial incentives/credits that make non-driving options more attractive. One such example is LA Metro's [Mobility Wallet Pilot Program](#) which subsidizes multi-modal transportation options to eligible participants across LA County. Agencies implementing mobility wallet programs may be able to bank the VMT reduction from such programs to be utilized as mitigation credit for future VMT inducing projects.

Factors to consider:

- TDM can shift trips to other modes or increase car occupancy.
- TDM may be funded by mitigation or project-generated toll revenues.

- TDM may already be required by local governments or are offered by Transportation Management Associations (TMAs)/Congestion Management Agencies (CMAs).

Ways to measure impacts:

- The large number of TDM measures available, combined with variable effects by setting, make it impossible to summarize measurement methods in this short guide. However, TDM providers may be able to calculate VMT effects of their services, based on the [CAPCOA guide](#) or similar literature, or their own analysis of their programming. Some of the local VMT calculators capture this effect; the [Alameda County VMT Calculator](#) calculates effects for employee and residential transit subsidies and vanpools for specific sites. (Note that the calculator does show reductions for telecommuting for employment sites, but it does not address effects other driving, so it would not be useful for VMT mitigation of a highway project.) If a TMA or other entity has ready evidence of program effectiveness, purchasing VMT reduction may be fairly straightforward. In other cases, project teams will have to work with the literature, local VMT calculators, or other sources to estimate VMT effects.

Example:

- Transit-pass subsidies: Consider a highway project that adds HOT lanes. The city through which the highway passes has piloted a mobility wallet program, which provides free passes for transit and bike- and scooter-share. The program costs \$50 per participant per month, and surveys of pilot participants showed that on average each reduced their VMT by 50 miles per month while in the program. As part of its mitigation package, the highway project commits toll revenues of \$50,000 per month to support 1,000 users, claiming 50,000 miles of reduced VMT per month.

Transit Service Improvement

Transit can be an important VMT reduction strategy. Not only may it replace auto trips, but over time it can foster TOD, which provides low-VMT housing, employment, retail, and other land uses. TOD may be developed intentionally around transit service, or it may occur organically as land uses adapt with features such as higher densities (accomplished in part by parking reductions), walkability and public-area amenities, and a mixture of land uses in close proximity. Note that even community members who never ride transit will enjoy shorter trips via this effect. VMT reduction through the land use effect is sometimes referred to as a “transit multiplier.”

Factors to consider:

- Mitigation should reflect actual, measurable transit service improvements.
- Coordinate with transit agencies to assess impacts on service and reliability.
- Directly funding increased transit service creates a more compelling argument for mitigation.

Ways to measure impacts:

- Determining the VMT effect from increased transit service can be done with different calculations:
 - Ridership. For major transit projects, the provider may estimate ridership for state capital funding or federal capital funding programs, such as New Starts and Small Starts. Such applications could provide the needed estimate, which should be in the form of passenger-miles-traveled. If such an application is not being made, the transit provider would need to make an estimate using similar methods.
 - Converting ridership into VMT is discussed in [“An Update on Public Transportation’s Impacts on Greenhouse Gas Emissions” \(Transit Cooperative Research Program \(TCRP\), 2021\).](#)¹¹ In summary, a passenger-mile on transit directly replaces .329 VMT (not all transit trips would have

¹¹ [2021 Update on Public Transportation’s Impacts on Greenhouse Gas Emissions](#)

been taken by car). Adding the land-use multiplier effect, which reduces travel for transit users and non-users alike, the overall savings in VMT is 2 miles for every 1 passenger-mile.

- Alternatively, local VMT calculators may provide VMT reduction estimates. The [Alameda County VMT Calculator](#) provides estimates both for transit network expansions and for transit frequency improvements.
- When no more direct or simple method is available, a regional travel demand model may be used to estimate VMT reduction. Model application should include and document project-level validation, calibration, assumptions, and limitations.

Example:

- Lane-management. A freeway expansion includes transit-priority at ramps and lane-management that gives buses markedly improved travel times and reliability. The transit provider is able to improve headways as well, because buses are no longer stuck in traffic. As a result of these improvements, the transit provider estimates a ridership increase of 100,000 passenger-miles per year. With the TCRP formula discussed above, such ridership should reduce VMT by 200,000 per year. If the transit priority and lane-management strategies are committed for the project lifecycle, the 200,000 VMT reduction could be used to offset the VMT increase from the highway project (as part of the project's estimated net VMT or as a mitigation measure).
- Light-rail extension. A transit provider has a planned but unfunded light-rail extension in a corridor where Caltrans is adding an HOV lane, which will be converted to HOT, for \$400 million. Capital cost of the transit project is \$200 million. The freeway contributes \$100 million in mitigation, and the transit provider raises the other \$100 million for the project. The transit provider estimates the extension will grow ridership by 2 million passenger-miles per year. Employing the mode-shift factor and transit multiplier from TCRP, this

ridership would imply a reduction of 4 million VMT per year. Project mitigation paid half the capital cost and could claim 2 million VMT in mitigation, assuming it also covers half the ongoing operating cost from toll revenues. If Caltrans is the only lead agency claiming credit for the transit improvements, full mitigation credit of 4 million VMT reduced per year can be claimed for the project.

Local Road Networks/Connectivity

Though highways were originally conceived as intercity or rural-serving facilities, today in most places they facilitate mostly local and intraregional travel. The large volume of short-distance traffic is both a problem – it undercuts highways' original purpose, for example by delaying intercity or farm-to-market freight in traffic – and an opportunity. In many cases local travelers use the SHS for short trips because local networks are incomplete or disconnected. Creating better-connected, multimodal networks off the SHS offers options for travelers to make more direct trips, sometimes by non-auto modes, reducing not only VMT but pressures to add expensive highway capacity. The planning literature cites “intersection density” as a measure of connectivity, and one that indicates lower VMT. Assisting owner-operators of local networks could thus reduce the need for highway capacity and may provide mitigation opportunities where needed as well.

Factors to consider:

- Origins and destinations of travelers in a corridor or on a facility.
- Gaps and other identified needs in the local modal networks.

Ways to measure impacts:

- Needs and gaps can be demonstrated through the use of big data, to examine origins and destinations of travelers, and circuitry of routing. Where travelers are diverting significantly from direct routes, or where they are nearly all driving despite origins and destination that are close by, improvements in the auto and active transportation networks are worth considering. See Figure 3 as an example.
- Accessibility tools can measure gaps in the multimodal systems as well, comparing existing accessibility to ideal accessibility where origins and destinations are linked directly.
- If local network improvements are sufficient to avoid capacity on the SHS, and they are screened as unlikely to induce VMT, mitigation is a moot issue. If new

capacity on the SHS is still pursued, local network improvements may be applied to mitigate some of the resulting induced VMT. Quantification of new active transportation facilities and improved transit service are discussed in separate sections. A more robust street network would likely require analysis with a travel demand model or a similar tool, e.g. UrbanFootprint, to demonstrate it was not adding VMT-inducing capacity and to assess VMT reductions from greater connectivity.

- When a more direct or simple method is not available, a regional travel demand model may be used to estimate VMT reduction. Model application should include and document project-level validation, calibration, assumptions, and limitations. In order to assess changes to the local network, the model used must include a level of network disaggregation appropriate to the improvements under examination, i.e., a trip-based model with analysis at the zonal (TAZ) level will likely be inappropriate.

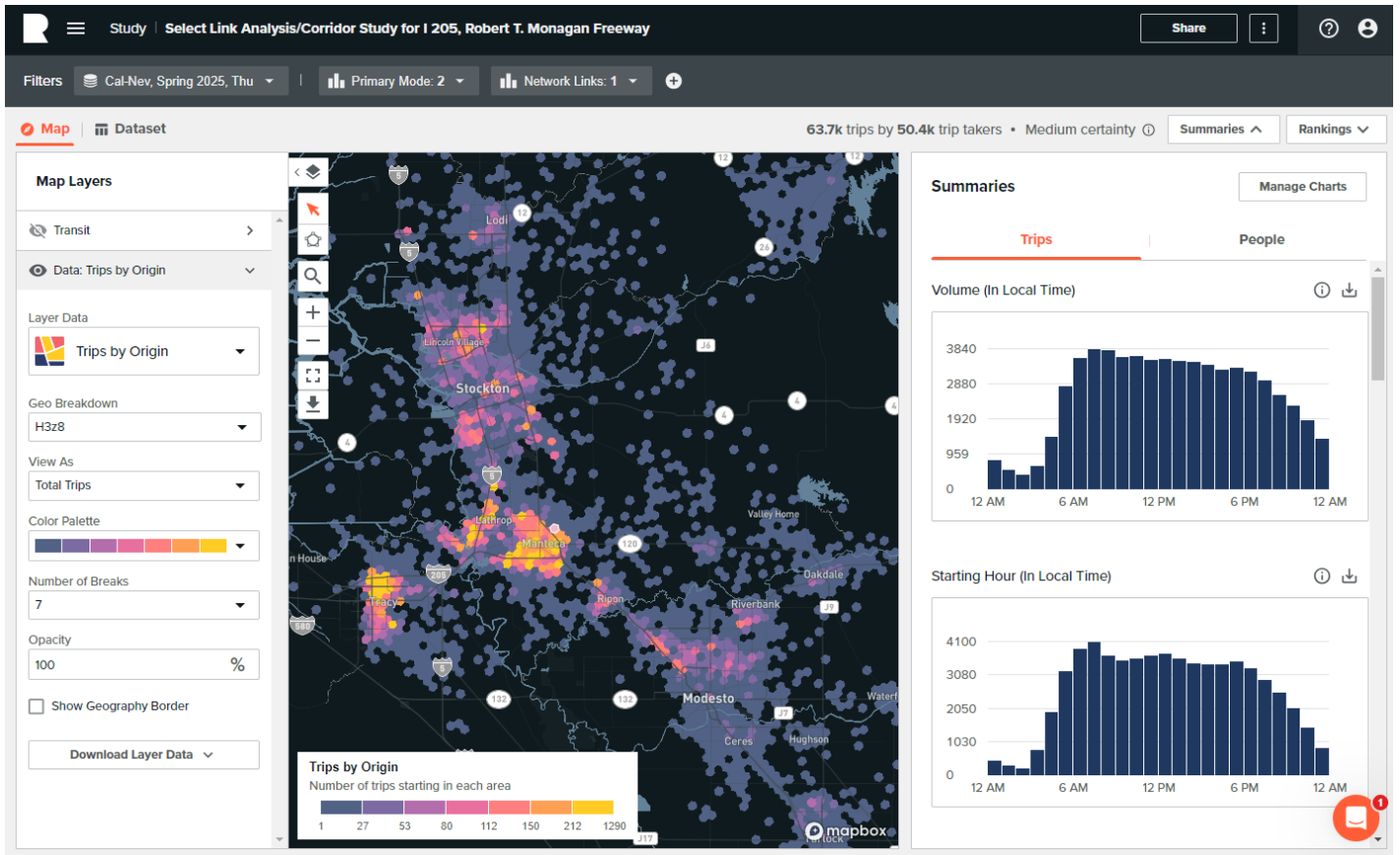


Figure 3. Select Link Analysis Example. Big data indicates destinations of travelers passing through a select link in the Central Valley between Stockton and Modesto. While some travel long distances, a large number are making local trips, suggesting local network improvements might relieve pressures on the Interstate.

Example:

- Critical added link: A freeway serving a major activity center is experiencing congestion, and widening is under consideration. Some of the heaviest traffic occurs on a bridge connecting the activity center to medium-density neighborhoods and smaller activity centers. There is no nearby surface facility paralleling the freeway bridge, but the locality has been studying such an option, potentially carrying autos, bikes, pedestrians, and extended light-rail service. Origin-destination studies show significant circuitous auto travel in the corridor, which might divert to the more direct route afforded by a new bridge. While the bridge is not screened as categorically unlikely to induce travel, travel-

demand analysis suggests it will provide meaningful route-shortening. A Delphi panel determines that as a slow-speed, local-serving surface facility connecting likely infill areas, it is unlikely to induce low-VMT land use. Transit and active transportation provide additional VMT reductions. A decision is made to forego the freeway widening and to support the local government in pursuit of the VMT-reducing reliever bridge.

Micro-Mobility

Micro-mobility helps reduce VMT by replacing short car trips and improving first and last mile connectivity to transit. Examples of micro-mobility could include bike share or e-scooter programs, protected bike lanes, or employer incentives that encourage alternative modes of transit. Micro-mobility programs can reduce VMT and provide other benefits such as enhanced mobility. However, widescale deployment of micro-mobility programs is ongoing, and the VMT-reducing effects of such programs are not well-understood and vary greatly by context.

Factors to consider:

- For its cost, micro-mobility delivers fewer benefits than other potential mitigations.

Ways to measure impact:

- [CARB](#) recommends a simple approach to quantify VMT reductions from Micro-mobility implementation. Using default assumptions on bike and scooter share trip lengths and induced trips, VMT reductions can be derived given an expected number of micro-mobility trips. Equation 4 below can be used to estimate VMT reduction given an expected number of trips.

Equation 4: Implement micro-mobility

$$R = (T) \times (A) \times (L)$$

ID	Variable	Value Output	Unit	Source
R	Reduction in auto VMT	[]	VMT	calculated
User Inputs				
T	Number of annual trips expected in the first year	[]	trips	user input
Constants, Assumptions, and Available Defaults				
A	Adjustment factor to account for induced trips and recreational bike share use	0.5 (bike and scooter)	unitless	CARB 2019
L	Average length of micro-mobility trip	1.5 (bike), 1 (scooter)	miles	CARB 2019

Example:

- As mitigation for a large highway widening project, Caltrans funds the rollout and operations of a dockless bikeshare program for a one-year period in a mid-sized city where the widening will occur. Based on previous dockless bikeshare rollouts in similar-sized cities, it is expected that approximately 500,000 trips will occur during the first year. Using the assumptions for bikes, the bike-share program is expected to reduce VMT by 375,000 annually, or by 1,027 per day. Since Caltrans funded the program, the full 375,000 annual VMT reduction can be claimed as mitigation.

Road Diets

Caltrans determines VMT impacts by considering highway capacity, essentially as a proxy for reduced travel times that spur additional driving. Because additional lane-miles are a critical factor in calculating increases in VMT, it may be useful to think about lane reductions, aka road diets, as a VMT-reduction measure. Road diets have become popular in recent years, as reduced road widths can improve safety at intersections or along the roadway due to speed reductions, and they can accommodate bike lanes and/or wider sidewalks, as well as parking for local destinations. Reduction in number of through lanes are screened as unlikely to induce VMT ([TAC, p. 14](#)). Where lane reductions can offset lane additions, the reduction can be used to offset VMT predicted to occur from the additions.

Factors to consider:

- Reducing lanes to offset added lanes can avoid burdens around calculating VMT outcomes. The showing of net-zero lane additions would be sufficient for full mitigation.
- The offsetting reductions must be reasonably equivalent to the lanes being added. A freeway lane-mile could not be offset by reducing a lane-mile on a collector street. In general, induced VMT decreases with functional classification. Therefore, it would be appropriate to cite lane reductions for a facility equal to or higher in functional classification of the facility receiving the additional lanes.
- The analysis should factor whether these trips will be dispersed to other routes or have an effect on the share of trips that disappear.
- Any multimodal benefits from the lane reduction such as added bikeways or sidewalks, or safer crossings or operating speeds, should be cited to provide extra evidence for the VMT-reducing effects of the road diet.
- The road diet does not need to be within the project boundaries of the capacity project, or in the same corridor but it is recommended that mitigation should

have geographic proximity and remain within the same metropolitan region or county. If the widening project adds VMT in an underserved community and the road diet benefits a different community, particularly one that is not distressed, equity would be a policy concern.

Ways to measure impacts:

- Show that lane reductions are equal or greater to lane additions both in terms of length of travel lanes affected and functional classification. Cite multimodal improvements as additional support.
- Where lane reductions do not fully mitigate a project's lane additions, they can be used in combination with other mitigation measures.
- It may be possible to show a mitigation benefit where functional classifications or project types are not easily comparable, e.g. where the road diet on a minor arterial is part of a mitigation package for a freeway addition or for an interchange. As of now there is no simple formula for this instance, and it would require substantial specific analysis by a project team and/or a consultant.
- It should be noted that the NCST calculator is applied for projects that add lane miles and increase capacity, it is not an appropriate tool to calculate reduction in VMT from lane reductions or road diets.

Example:

- Road diet offset: A project to add two lane-miles to a principal arterial in an industrial neighborhood (functional class 3) will generate 500,000 VMT annually. A mile away in a residential/commercial neighborhood, the locality is considering reducing a four-lane principal arterial to two travel lanes, a turn lane, and bike lanes. That project would reduce travel lanes by 2.5 miles. Conditioning the widening project on funding and construction of the road diet would lead to a net reduction of travel lanes and would satisfy the VMT mitigation requirement for the widening project.

Pricing

Pricing literally raises the cost of travel, which would seem to discourage driving and reduce VMT. However, when lanes are priced to improve flows, travelers may find it advantageous to pay the dollar cost in exchange for time-cost savings or shift trips to off-peak periods. In addition, some studies have shown that HOV-to-HOT conversions result in travelers paying to avoid carpooling, lowering vehicle occupancy and raising VMT. Congestion pricing though, tends to be negatively associated with traffic counts and positively associated with transit ridership (Handy et al., 2025). Therefore, pricing strategies can result in both increases and decreases in induced travel. Determining when pricing reduces VMT, and by how much is largely dependent on the tolling strategies employed by the project.

Use of tolling revenue from HOT lane conversion projects can be a strategy by providing a financial contribution for a broad range of VMT mitigation activities that would be aimed at reducing dependency on SOV travel. Some activities could include using net toll revenue towards enhancing active transportation infrastructure and implementation of TDM programs. The projects or programs to be funded by toll revenues should be identified as part of the mitigation, and it is essential to have a commitment to provide revenue for VMT mitigation activities in the financial planning for any HOT lane addition. Additional discussions on use of excess toll revenue as mitigation strategies can be found in Sections 5.3.1 and 5.7.2 of the TAC.

In 2003, London adopted a congestion charge for vehicles entering the central city during peak travel times. Excess toll revenues were reinvested in public transit including the London Underground, bus improvements and cycling infrastructure. The congestion charge was later linked to a 40% reduction in traffic accidents.¹² Recently in the US in 2025, New York City established a congestion zone where a fee is collected

¹² [Green, Colin \(2015\) In addition to saved travel time, the London congestion charge has saved lives. British Politics and Policy at LSE.](#)

from drivers entering Manhattan, with revenue to be reinvested into its public transit network.

Factors to consider:

- When using net toll revenue for ongoing operational mitigation commitments, the project must consider years with toll revenue shortfalls.
- Tolling adjustments can be a possible strategy to explore to achieve neutral or negative induced VMT.
- Transit priority can result in additional VMT reduction by encouraging mode shift and increasing transit reliability.

Ways to measure impacts:

- When no more direct or simple method is available, a regional travel demand model may be used to estimate VMT reduction.
- Model application should include and document project-level validation, calibration, assumptions, and limitations.

Example:

- A new tolled express lane is added to the SHS within the existing median. It is determined that physical VMT reducing infrastructure cannot entirely offset the amount of induced travel from the HOT lane addition. Caltrans, in partnership with the regional tolling authority, commits to utilizing excess toll revenues generated by the project to fund a mobility wallet program aimed at enhancing equity, purchasing of new rapid transit buses, and new employee vanpools. Utilizing CAPCOA formulas, and committing to ongoing operational expenses, the project is adequately able to offset VMT induced by the project. The VMT reduction, commitments, and quantification are properly documented within the environmental document and environmental commitment record.

Lane Management

Lane management strategies, which could include High Occupancy Vehicle (HOV) lanes, High Occupancy Toll (HOT) or express lanes, and dedicated bus lanes can reduce VMT by increasing person throughput, promoting shared rides, and enabling mode shift. However, the VMT impacts of these strategies vary significantly depending on design, implementation, and enforcement, which is why lane management effects on VMT is still a research topic that Caltrans is pursuing.

Lane management strategies vary and, with them, VMT outcomes vary too. Caltrans guidance, for example, treats the addition of a HOV2+ lane as the equivalent in most cases as the addition of a general-purpose lane, because HOV2+ lanes on the facility simply sort themselves into the new lane. HOV3+ lanes hold more promise for raising vehicle occupancy and reducing VMT compared to general purpose lanes. HOT lane additions have the potential to offset induced travel with strategies such as using toll revenues to provide funding for VMT mitigation and adjusting tolls to achieve volumes consistent with negative or neutral VMT.

Factors to consider:

- **HOV Thresholds:** Caltrans generally treats HOV2+ lanes as equivalent to general-purpose lanes in terms of VMT impact, since they do little to shift mode or increase occupancy. HOV3+ lanes, on the other hand, may potentially yield real occupancy increases and VMT reductions, especially when strictly enforced.
- **HOT Additions:** HOT lanes may encourage some travelers to pay rather than carpool, potentially reducing vehicle occupancy. HOT lane revenues, as discussed in the Pricing section above, can be reinvested into TDM programs or transit improvements, which can help offset increases in VMT.
- **Transit Priority:** Dedicated bus-only lanes, shoulder running for buses, or ramp queue-jumps can improve reliability and travel time, increasing ridership and decreasing VMT via mode shift.

Ways to measure impacts:

- A travel demand model can be used to calculate induced VMT for an HOV lane added to a single existing GP lane or an added HOV3+ lane, as long as the travel demand model results are 20 percent below the NCST calculator and the required methods and checks of the travel demand model are followed.
- Regional travel demand models, UrbanFootprint or local VMT calculators can be used to assess impacts from specific lane-management proposals. Proper model calibration and validation are necessary.

Examples:

- Examples of Lane Management measures to reduce VMT are not currently available.

Parking

Parking management is one of the more powerful measures that either spurs driving or reduces it. Typically, these measures are applied at multifamily residential or employment land uses, in the form of parking charges or capacity limitations. As such, these measures could work in tandem, subject to the rules of combining measures, of denser housing or employment. There could be ways to achieve VMT benefits from parking management outside of specific land uses, though the calculations would be more complex. Note that some localities enforce parking minimums and would require exceptions for major capacity limitations.

Factors to consider:

- Standard parking-demand rates (based on unlimited free parking).
- Type and degree of parking management (extent of capacity limitation, amount of fees).

Ways to measure impacts:

- For capacity limits at residential land uses, CAPCOA calls for calculating the standard parking demand from the ["ITE Parking Generation Manual,"](#) finding the difference between that figure and the proposed lower figure, and applying constants. The result is a percentage decrease in VMT compared to typical conditions; that percentage could be applied to an average household VMT figure to get the predicted reduction in VMT per household. The reduction is capped at 15.7 percent. An important caveat is that this measure will not work if free parking is readily available on the street or elsewhere near the housing project. For more details, see [CAPCOA pp. 122-125](#).
- For parking charges at residential land uses, CAPCOA provides a formula that only requires the amount of the fee. Results are shown in Table A-C.3, based on the household VMT average from the [2017 National Household Traffic Survey's Summary of Travel Trends](#). The percentage reduction would be applied to an average household VMT figure to get the predicted reduction in VMT per

household. The reduction is capped at 15.7 percent. For more details, see [CAPCOA, pp. 126-129](#).

Equation 5: Unbundle Residential Parking Costs from Property Cost

$$A = \frac{B}{C} \times D \times E$$

ID	Variable	Value	Unit	Source
Output				
A	Percent reduction in GHG emissions from project VMT in study area	0-15.7	%	calculated
User Inputs				
B	Annual parking cost per space	[]	\$ per year	user input
Constants, Assumptions, and Available Defaults				
C	Average annual vehicle cost	\$ 9,282	\$ per year	AAA 2019
D	Elasticity of vehicle ownership with respect to total vehicle cost	-0.4	unitless	Litman 2020
E	Adjustment factor from vehicle ownership to VMT	1.01	unitless	FHWA 2017

See table A-C.3 in Appendix 3 for comprehensive VMT reduction values for unbundled parking costs.

- For parking charges at employment land uses, CAPCOA offers a variation on the residential formula. See [CAPCOA, pp. 109-112](#). It produces percentage decreases in commute VMT associated with the land use, which would need to be separately calculated. It caps the reduction at 20 percent.
- Some local VMT calculators provide easy ways to calculate VMT reductions from parking policies. The [Alameda County VMT Calculator](#), for example, has options

for pricing residential and employee parking, as well as “parking cash-out” (another form of pricing), and for limiting parking supply.

Example:

- Unbundled residential parking: A highway expansion is mitigating induced VMT by supporting a new housing development (see Land Use – residential). The development will produce 1,000 housing units, and the project is providing half the backing to build the project. The development is located in an area where street parking requires residential permits, which are not available to residents of the new buildings. It will charge \$208 per month for parking in addition to rent. Per Table 2, the \$2,500 annual parking cost implies a reduction of 10.9 percent in VMT, or 2140.9 in lowered VMT compared to typical households. The development as a whole produces 2,140,900 less VMT than typical in a year. Because mitigation is responsible for half the backing of the project, it amounts to 1,070,450 per year. If the housing is denser than 9.1 units per acre, it could also claim VMT reductions for density, subject to the rules of combining measures in CAPCOA.

Mitigation Banks/Exchanges

As VMT mitigation becomes increasingly complex and often requires coordination across regions, Caltrans and project sponsors are showing greater interest in flexible approaches. Promising approaches include mitigation banks and exchanges.

Mitigation banks allow project sponsors to buy VMT reduction credits from a centralized bank to offset VMT induced by the project, usually by paying a fee based on the cost per VMT credit reduced that could be paid for over the lifetime of a mitigation plan. A VMT exchange functions slightly different from a mitigation bank. Rather than purchasing credits, a VMT exchange provides flexibility by allowing project sponsors to match mitigation obligations by selecting from a list of mitigation measures or contributing to a specific VMT reducing project or strategy.

Utilizing a VMT mitigation bank, exchange or fee offers a pathway to more deliverable, efficient, scalable, and impactful reductions in vehicle travel. By aligning with regional transportation and land use plans, and holding all participants accountable to measurable outcomes, these approaches consolidate red tape and help project teams fulfill mitigation obligations. These approaches also address the timing factor associated with project-specific VMT mitigation. An established mitigation bank or exchange would have the flexibility of containing multiple eligible mitigation projects or programs. With an exchange, the project sponsor could even choose specific mitigation projects that best match the timing of the proposed VMT-inducing project. A forthcoming statewide VMT Mitigation Bank¹³, established by Assembly Bill 130 (2025), will provide applicants and lead agencies with an additional, streamlined approach to mitigate VMT impacts under CEQA.

¹³ LCI's [informational flyer](#) for the Statewide VMT Mitigation Bank (December 2025).

Factors to consider:

- Mitigation must be quantifiable, enforceable and address additionality.
- A designated entity (e.g., CMA, MPO, government entity or nonprofit) should be designated to oversee program administration, including fund allocation, project selection, monitoring, and reporting.
- Mitigation effectiveness should match the lifecycle of the VMT-inducing project especially if operating support is involved.

Ways to measure impacts:

- The VMT reductions must be quantifiable and based on accepted tools, such as the CAPCOA formulas or empirical evidence.

Example:

Caltrans is proposing a freeway interchange expansion that is estimated to induce annual VMT by 1 million. Rather than directly implementing mitigation, Caltrans contributes \$5 million to a regional mitigation bank managed by the local CMA. The CMA applies the funds towards subsidizing affordable housing in a TOD zone, launching a workplace vanpool program, and improving a nearby bus corridor with enhanced headways and service span.

The CMA uses the CAPCOA calculator to estimate a cumulative VMT reduction of 1.2 million miles annually, adequately offsetting the project's impact. The mitigation package is documented in the CEQA environmental document, with performance tracking included in a monitoring and reporting program.

Measures with Limited or Uncertain VMT Reduction Potential

The inclusion of measures in this section does not imply they are without value in a broader transportation planning context or not reasonable as environmental mitigation. While these strategies may not consistently yield substantial or quantifiable reductions in VMT across contexts, they may still support safety, equity¹⁴, GHG reduction, or other important policy goals. Continued research may uncover ways in which these measures can become more effective or quantifiable for VMT mitigation purposes in the future.

Project teams may still consider these measures as part of a VMT mitigation package if they can provide context-based justification or localized evidence of effectiveness. This may include empirical evidence, before-and-after studies, pilot program outcomes, or other documented sources demonstrating a measurable VMT reduction under similar conditions. In these cases, project teams should clearly document the rationale, methodology, and assumptions used in their analysis to fulfill CEQA requirements for enforceability, additionality, and quantification.

¹⁴ See sections 5.3 and 5.7, pages 21 and 29, of the [TAC 2nd Edition \(California Department of Transportation, 2024\)](#) for a discussion on Equity and Mitigation Location Considerations

Mobility Hubs (formerly Park-and-Ride Lots)

Mobility hubs offer a convenient and safe location to transfer from active transportation modes or a single passenger vehicle to a local or regional transit bus, carpool, or vanpool. Ridesharing saves commuters time and money, while reducing traffic congestion and energy consumption. Caltrans' mobility hubs originated from the park-and-ride program and have since been refined to better support multimodal options.

Mobility hubs, when serving transit, vanpooling, and carpooling, can be important facilities for reducing commute travel. Caltrans categorizes mobility hubs into two categories, multimodal which has an increased focus on multimodal travel, and commuter rideshare which is more closely aligned with traditional park-and-ride facilities. If they serve a well-defined activity center (multimodal), calculating the VMT reduction is straightforward. If they serve carpooling or less well-defined activity centers (commuter rideshare), the math becomes more complicated.

Factors to consider:

Some mobility hubs are not well integrated with regional transit plans, bike and pedestrian infrastructure plans, and land use plans, which leads to inefficiencies. Successful implementation involves integration with regional planning to effectively site, plan, and coordinate efforts between state transportation agencies, transit agencies, municipalities, and Regional Transportation Planning Agencies (RTPAs) and Metropolitan Planning Organizations (MPOs).

Commuter rideshare lots primarily benefit commuters who already own cars, which may further deepen social and economic inequities for transit-dependent and low-income communities. Mobility hubs emphasize first/last-mile transit connections such as shuttles, bike lanes, and sidewalks as multimodal accessibility options.

Mobility hubs often occupy large surface parking lots which could be used for higher density development (affordable housing, mixed-use development, transit-oriented

development). Consider smart growth, climate goals, and housing needs when siting lots, as well as creative solutions like cooperative agreements with private landowners to utilize surface parking during peak commute hours and weekdays on days and at times when these lots go unutilized.

Ways to measure impacts:

Conduct mobility hub utilization surveys and research studies to determine utilization rates between peak morning and evening commute windows. Monitoring as well as adjusting access dynamically (e.g., access restrictions, informing commuters of proper facility use via public information officers, or pricing for non-state-owned facilities) can help reduce use of lots for non-transit and non-carpooling uses (e.g., unauthorized storage, long-term parking, and more).

Prioritize and track investments for mobility hub improvements that make lots safer and more appealing for commuters. Large surface lots can contribute to heat islands, storm water runoff, and habitat disruption. Benches, covered bus shelters, crosswalks, green infrastructure improvements such as bioswales to mitigate runoff, impervious and cool pavement, and more are features that can improve the functionality of lots for all users, regardless of mode choice.

Examples:

Establishing and updating maintenance agreements between Caltrans, other agencies, and lot owner(s) ensures the ongoing functionality of mobility hub lots. Ongoing improvements such as curb cuts for ADA access, bus islands, and bicycle racks can be co-funded by Caltrans with other entities, such as municipalities or transit agencies. Improvements to amenities in or near mobility hubs encourage safe and convenient mode switch for commuters between vehicles, active transportation, and transit service or vanpools. Amenities include shaded bus shelters, seating, trash cans, bicycle racks, landscaping, public art, and safety improvements for pedestrians such as sidewalk gap closures and safer pedestrian crossings. Explore opportunities to

couple priority ramp meter improvements for buses near mobility hubs, to improve service and improved operations for buses between mobility hubs and the State Highway System.

Land Preservation

Generally speaking, open space lands in regional hinterlands that are feasible to convert into residential uses, regional service centers, or large-scale, stand-alone employment centers can lead to sprawling development patterns that drive increases in VMT. There are several tools available to acquire and preserve or otherwise enter into agreements that place permanent conservation easements on developable open space and channel future growth toward VMT efficient development patterns. For example, Transfer of Development Rights (TDR) is a zoning tool that protects valuable land with conservation value by shifting development potential to areas designated for growth. TDR programs financially compensate landowners for choosing not to develop some or all of their land. These landowners are given an option under municipal zoning to legally sever the development rights from their land and sell these rights to another landowner or a real estate developer for use at a different location.

The land from which the development rights have been severed is permanently protected through a conservation easement or a restrictive covenant. The development value of the land where the transferred development rights are applied is enhanced by allowing for new or special uses; greater density or intensity; or other regulatory flexibility that zoning without the TDR option would not have permitted. Other land use planning tools such as the Density Bonus can also be paired with TDRs as a larger package of incentives intended to help make affordable, location-efficient housing more economically enticing to develop. Density bonus tools include reduced parking requirements and concessions such as reduced setback and minimum square footage requirements. And a local government can purchase open space outright.

By establishing partnerships with local land use authorities and interested developers, Districts could engage and influence strategic TDRs and even directly participate in the creation of Development Agreements that steer future development to where it is adequately supported by active transportation, transit, intercity passenger rail, and similar non-auto mobility options. This might be a particularly valuable strategy where

there is interest from local or regional governments (or even non-governmental conservation organizations) to employ land preservation strategies or where there is interest by individual developers to swap development rights for locations or increased densities that might be more lucrative or less expensive to develop.

Ways to measure impacts:

- The VMT effect of land preservation will be context-specific, and available research such as the [April 2025 CARB Policy Briefs](#) currently only provide indirect evidence. As noted below, it is possible to increase VMT by creating more dispersed development. Caltrans is not aware of a simple way to measure the effect; however, evidence suggests that combining land preservation adjacent to urban growth boundaries with other VMT reduction strategies such as promoting compact development can lead to decreases in VMT.

Factor to consider:

- Compact growth reduces per capita VMT by encouraging infill and limiting outward expansion.
- Smart growth and land conservation help prevent greenfield and open space development.
- Avoid leapfrog development, which increases VMT by pushing growth to distant, cheaper land.
- Prioritize new infrastructure in compact, low-VMT areas.

Examples:

- Examples of land strategies to reduce VMT are not currently available.

Telecommuting

Telecommuting is a tool that has been used to reduce peak-hour congestion, and one that has been popular as workplaces shut down during the COVID pandemic. It may appear attractive as a VMT-reduction measure, but caution is warranted.

Factors to consider:

- Telecommuting's effect in reducing VMT is doubtful, and it may actually generate more. [CAPCOA \(p. 54\)](#) cautions that “While this measure [telework] certainly reduces commute-related VMT, recent research has shown that total VMT from telecommuters can exceed VMT from non-telecommuters ([Goulias et al. 2020](#)).” [Pandemic-era VMT patterns](#) documented in big data and mobility analytics firm Streetlight suggest “WFH didn’t necessarily mean all workers were driving less. Many just may have been driving differently. Our analysis found a shift in peak driving hours, with a dip in morning driving but a slight rise and wider peak time for afternoon driving. Also, essential workers still commuted, and Census data showed a large increase in online retail, which created more delivery vehicle miles.” More researched-based evidence of telecommuting's poor performance in reducing VMT include [Boise State University's study titled *The Impact of Telecommuting on Personal Vehicle Usage and Environmental Sustainability*](#) and [a study titled *Does Telecommuting Promote Sustainable Travel and Physical Activity?* published in the Journal of Transport & Health](#).

Ways to measure impacts:

- Measuring reduction in commute VMT is straightforward if motor-vehicle-based commute volumes and distances are known, and the effect of a telecommuting program were also predictable. However, any claim for reduced VMT from telecommuting would need careful and specific support to show how it would address non-work travel, or longer work-travel distances

created when workers who frequently telecommute move further from the workplace.

Examples:

- Examples of telecommuting VMT reduction measures are not currently available.

Schedule-Shifting

Alternative work schedules, encouraging workers to commute during non-peak hours, is a congestion-reduction strategy, but probably not a VMT-reduction strategy.

Factors to consider:

- Because it shifts travel times rather than eliminating or shortening them, there is no rationale for considering it as a VMT-reduction measure. Schedule-shifting may actually increase VMT if it allows commuting during periods of faster traffic and/or involves off-peak work travel when transit service is less robust.

Ways to measure impacts:

- Ways to measure impacts of schedule-shifting on VMT reduction are not currently available.

Examples:

- Examples of schedule-shifting on VMT reduction are not currently available.

Appendix A: Congestion Management Authorities and Transportation Management Associations

Two potentially valuable sources of VMT mitigation partnerships are Congestion Management Authorities (CMAs) and Transportation Management Associations (TMAs). Congestion Management Authorities are governmental agencies incorporated under state law that typically provide TDM services as a part of their regional planning, programming, and service delivery portfolios. Transportation Management Associations are typically private or public-private partnerships, frequently formed as voluntary non-profit organizations involving large employers.

These organizations each provide different services to different user groups in different travel sheds. Travel sheds are a geographic area from which a destination, service, or facility can be reached within a specified travel time or distance using one or more modes of transportation. CMAs and TMAs may also have differing levels of data collection capabilities needed to document VMT reduction for use toward SB 743 mitigation purposes. Practitioners are advised to contact the CMAs and TMAs in their areas and proactively participate in data collection and/or program development activities as needed. This could range from simply requesting available data from existing TDM measures to working collaboratively with relevant partners to identify expanded TDM services that could specifically serve as VMT mitigation measures for SHS projects. Creating strong working relationships and mitigation agreements with CMAs and TMAs could also prove valuable when it comes to the long-term maintenance-of-effort that will likely be needed for TDM measures to be successful in reducing VMT.

Congestion Management Authority (CMA)s

In order to identify a variety of potential mitigation measures for SHS projects, Caltrans practitioners can review relevant planning documents produced by CMAs, such as the Regional Transportation Plan or Short-Range or Long-Range Transit Development

Plans. These types of regional planning documents outline specific mobility services, TDM measures, and in-fill development opportunity areas that have been planned but are not fully funded. They may provide valuable data such as service-specific ridership forecasts that could be used as the basis for estimating related VMT reductions if the services were to be funded as mitigation. Other good sources for identifying potential TDM measures and acquiring important data on potential VMT reduction is active participation on regional Transit Coordinating Committee and Social Services Transportation Advisory Councils, engaging in the annual Unmet Transit Needs Hearing process. In such venues, Caltrans staff may identify pilot services that are being planned for a test period to measure actual ridership against forecast ridership or to determine if farebox recovery requirements can be met. Transit operators and CMAs may have also developed grant applications for new start or expansion services based on projected ridership. To attract and support this projected ridership, they may also have Transit Asset Management Plans that outline fleet needs, capital investments, or supporting infrastructure such as shelters or modal-transfer stations that could also be used as mitigation.

In essence, the planning processes that CMAs and RTPAs manage can provide valuable data on the potential for specific TDM services to reduce VMT. The most direct way to explore the potential mitigation partnerships and acquire related data is for relevant district staff, including district transit staff, to schedule meetings with their transit operators and CMA counterparts to initiate these direct discussions.

Below is a list of regional agencies that Districts can contact regarding information about California's CMAs and their VMT reduction efforts:

Table A-A.1: List of Congestion Management Authorities (CMAs)

Congestion Management Authorities (CMAs)
Alameda County Transportation Commission
City/County Association of Governments of San Mateo County
Contra Costa Transportation Authority
Council of San Benito County Governments
Fresno Council of Governments
Imperial County Transportation Commission
Kern Council of Governments
Kings County Association of Governments
Los Angeles County Metropolitan Transportation Authority
Madera County Transportation Commission
Merced County Association of Governments
Metropolitan Transportation Commission
Napa Valley Transportation Authority
Orange County Transportation Authority
Placer County Transportation Planning Agency
Riverside County Transportation Commission
Sacramento Area Council of Governments
San Bernardino County Transportation Authority
San Diego Association of Governments
San Francisco County Transportation Authority
San Joaquin Council of Governments
Santa Barbara County Association of Governments
Santa Clara Valley Transportation Authority
Santa Cruz County Regional Transportation Commission
Shasta County Regional Transportation Planning Agency
Solano Transportation Authority
Sonoma County Transportation Authority
Stanislaus Council of Governments
Transportation Agency for Monterey County
Transportation Authority of Marin
Tulare County Association of Governments
Valley Transportation Authority (VTA)
Ventura County Transportation Commission
Yolo County Transportation District

Transportation Management Association (TMA)s

Although TMAs are typically non-governmental organizations and they do not carry out the same comprehensive regional transportation planning functions, they are similar to CMAs in that they may have identified TDM measures that they would like to implement but are not fully funded and could be used as potential mitigation measures. However, one significant difference between TMAs and CMAs that practitioners should be aware of is the variation in capacity and technical capability for data collection and analysis. While nearly all TMAs collect data on their service users in terms of “auto-trips avoided,” additional data such as user trip lengths may be needed to calculate VMT reduction.

This is another example of the need for District Transit Representatives or similar staff members to proactively contact potential mitigation partners and discuss available options with them directly. Similar to identifying mitigation options and measuring effectiveness through the regional transit planning process, there are limitations on using existing VMT reduction methodologies based on current research, as TDM efficacy will vary based on context-specific market factors and travel-shed characteristics. Further, Districts will ultimately need to form long range relationships or even programmatic agreements to address and resolve issues such as monitoring, reporting, and maintenance-of-effort (i.e. the mitigation “performance period”).

A partial list of TMAs in California is shown below:¹⁵

¹⁵ [Directory of Transportation Management Associations](#)

Table A-A.2: List of Transportation Management Associations (TMAs)

Transportation Management Associations (TMAs)	Location
50 Corridor TMA	Sacramento
Altrans TMA	San Jose
Anaheim Transportation Network	Anaheim
Burbank Transportation Management Organization	Burbank
Commute Kern	Bakersfield
dibs	Stockton
GoSaMo Transportation Management Organization	Santa Monica
Emeryville TMA	Emeryville
Go Glendale	Glendale
McClellan Park TMA	McClellan
North Natomas Jibe	Natomas
Perry Park Rides	Sunnyvale
Ride-on TMA	San Luis Obispo
South Natomas TMA	Sacramento
Spectrumotion TMA	Irvine
The Presidio Trust	San Francisco
TMA of San Francisco (TMA SF)	San Francisco
Traffic Solutions	Santa Barbara
Truckee North/Lake Tahoe TMS	Truckee
Warner Center Transportation Management Organization	Woodland Hills
Yolo TMA	Woodland

A list of local/regional transit operators, specialized transportation service providers, and Consolidated Transportation Services Agencies that has been assembled by the American Public Transportation Association can be found [here](#).

For further information on opportunities to connect with mobility service providers, Districts can contact the California Association for Coordinated Transportation, or [CalAct](#).

Appendix B: Local VMT calculators

Performance Assessment Tools and VMT Calculators: Several local planning jurisdictions and regional planning agencies such as SACOG have launched performance assessment tools to analyze anticipated outcomes from transportation investments at the project level. The goal of the [Project Performance Assessment tool](#) is to align with federal and state emphasis on outcome-based performance measurement and to prioritize cost-effective transportation projects with desired performance benefits, such as increased travel reliability and reducing VMT per capita. In light of the fact that these tools typically result from extensive development and data-collection efforts, development reports may be valuable references to cite the methodologies used, explain the variable considered, understand how to add user inputs, and how to extract VMT reduction figures from the tool's indicators output table. Caltrans practitioners are encouraged to contact their RTPA/MPO counterparts to identify the availability of any such tools for their collective use. For example, Appendix 3 of the tool's Development report, Supplemental Indicator Methodology, gives a detailed technical description of several complex data sources and indicators.

Given that potential mitigation measures are similar in many respects to planned mobility improvements, performance indicators from these types of tools can be applied to assess their impact on VMT reduction. For VMT, the SACOG tool looks at the number of transit trips and average vehicle occupancy that a freeway project would add, the number of jobs and dwelling units, mixed uses, and neighborhood services that a complete-street project would provide access to, and the change in jobs, dwelling unit, mixed uses and neighborhood services that a transit or local network expansion would result in.

Similarly the [City of Los Angeles Department of Transportation Vehicle Miles Traveled \(VMT\) Calculator](#) uses a mixed-use development methodology and was originally developed by the U.S. Environmental Protection Agency to better estimate trip

generation in urban areas considering a number of factors including the relative numbers of residents and jobs, the density of development, the connectivity for walking or driving among different activities, the availability of transit, the number of convenient trip destinations within the immediate area, vehicle ownership, and household size. The calculator's assumptions were validated and are explained in the calculator's development report for practitioners to cite in their analysis on the potential VMT reductions available from 22 different types of TDM site modifications, system improvements, and operational changes. The calculator follows CAPCOA guidance by either directly applying the CAPCOA methodology, applying the alternative literature methodology, or adjusting the methodology offered by CAPCOA to account for local needs. A methodology is specified for each TDM strategy, with individual levels of anticipated effectiveness identified. The calculator uses four place-types, or travel behavior zones, (Urban, Compact Infill, Suburban Center, and Suburban) and allows TDM strategies to be combined with a maximum VMT reduction result of 75% for measures in urban locations, 40% compact infill locations, 20% for suburban center locations, and 15% for suburban locations.

The calculator's TDM measures and maximum VMT reduction rates are show below and specific methodologies are provided [here](#):

1. Reduce Parking Supply: 12.5%
2. Unbundle Parking: 26% of residential-based VMT
3. Parking Cash-Out: 7.7% of commute VMT
4. Price Workplace Parking: 19.7% of commute VMT
5. Residential Area Parking Permits: 0.25%
6. Reduce Transit Headways: 2.5%
7. Implement Neighborhood Shuttle: 13.4%
8. Transit Subsidies: 20%
9. Voluntary Travel Behavior Change Program: 8%
10. Promotions & Marketing: 4%

11. Required Commute Trip Reduction Program: 21% of commute VMT
12. Alternative Work Schedules and Telecommute Program: 5.5% of commute VMT
13. Employer Sponsored Vanpool or Shuttle: 13.4% of commute VMT
14. Ride Share Program: 15% of commute VMT
15. Car Share: 0.7%
16. Bike Share: 0.25%
17. School Carpool Program: 15.8% of school VMT, or 0.9% of overall VMT
18. Implement/Improve On-Street Bicycle Facility: 0.625%
19. Include Bike Parking: 0.625%
20. Include Secure Bike Parking and Showers: 0.625%
21. Traffic Calming Improvements: 1%
22. Pedestrian Network Improvements: 2%

A variety of similar VMT calculators have been developed for local and regional agencies across the state that Districts could explore for mitigation purposes. The following are among other VMT calculators and TDM assessment tools that have been developed by some of Caltrans external partners:

- [Fresno Council of Governments](#)
- [San Gabriel Valley Council of Governments](#)
- [County of Santa Barbara](#)
- [City of San Jose](#)
- [San Diego Association of Governments](#)
- [Alameda County Transportation Commission](#)
- [Sonoma County Transportation Authority](#)

Furthermore, some local jurisdictions have already completed updates to their local impact assessment guidelines that include specific methodologies for estimating VMT reductions from various TDM mitigation measures that Caltrans District staff could adapt

for use on transportation projects. For example, below are some examples from across the state that District staff could refer to:

- [Appendix H of the Escondido Transportation Impact Analysis Guidelines](#)
- [Appendix A and B of the City of Long Beach Transportation Impact Analysis Guidelines](#)
- [Appendix A of the City of Fremont's Transportation Impact Analysis Handbook](#)
- [Appendix F of the City of Carlsbad's VMT Analysis Guidelines](#)

Appendix C: VMT Reduction Tables for Select Mitigation Measures

Table A-C.1: VMT effects from dense residential development following the CAPCOA formula. The CAPCOA formula results in a percentage reduction in GHG emissions from a project/site VMT for multifamily residential developments. CAPCOA notes that the percent reduction in VMT would be the same as the percent reduction in GHG emissions. To calculate an absolute number for the VMT reduction from dense residential development, the following table applies the percent reduction to the annual average typical household VMT. Household figures assume an adjusted typical household annual VMT of 19,641.8, from the [2017 NHTS](#).

**Note: 2017 NHTS survey was used as a baseline for formula inputs as this year assumes typical and unaltered travel behavior from pre-pandemic conditions.*

Density (DU/acre)	Change in VMT from typical	Change in annual VMT for typical household
9.1	0.0%	0.00
9.2	-0.2%	-39.3
9.3	-0.5%	-98.3
9.4	-0.7%	-137.5
9.5	-1.0%	-196.4
9.6	-1.2%	-235.7
9.7	-1.5%	-294.6
9.8	-1.7%	-333.9
9.9	-1.9%	-373.1
10.0	-2.2%	-432.1
11.0	-4.6%	-903.5
12.0	-7.0%	-1374.9
13.0	-9.4%	-1846.3
14.0	-11.8%	-2317.7
15.0	-14.3%	-2808.7
16.0	-16.7%	-3280.1
17.0	-19.1%	-3751.5
18.0	-21.5%	-4222.9
19.0	-23.9%	-4694.3

Density (DU/acre)	Change in VMT from typical	Change in annual VMT for typical household
20.0	-26.4%	-5185.4
21.5	-30.0%	-5892.5

Table A-C.2: VMT reductions from increased job density, following the formula in CAPCOA.

Density (jobs per acre)	Percent VMT reduction from typical
145	0.0%
150	-0.2%
155	-0.5%
160	-0.7%
165	-1.0%
170	-1.2%
175	-1.4%
180	-1.7%
185	-1.9%
190	-2.2%
195	-2.4%
200	-2.7%
205	-2.9%
210	-3.1%
215	-3.4%
220	-3.6%
225	-3.9%
230	-4.1%
235	-4.3%
240	-4.6%
245	-4.8%
250	-5.1%
255	-5.3%
260	-5.6%
265	-5.8%
270	-6.0%
275	-6.3%

Density (jobs per acre)	Percent VMT reduction from typical
280	-6.5%
285	-6.8%
290	-7.0%
295	-7.2%
300	-7.5%
305	-7.7%
310	-8.0%
315	-8.2%
320	-8.4%
325	-8.7%
330	-8.9%
335	-9.2%
340	-9.4%
345	-9.7%
350	-9.9%
355	-10.1%
360	-10.4%
365	-10.6%
370	-10.9%
375	-11.1%
380	-11.3%
385	-11.6%
390	-11.8%
395	-12.1%
400	-12.3%
405	-12.6%
410	-12.8%
415	-13.0%
420	-13.3%
425	-13.5%
430	-13.8%
435	-14.0%
440	-14.2%
445	-14.5%
450	-14.7%

Density (jobs per acre)	Percent VMT reduction from typical
455	-15.0%
460	-15.2%
465	-15.4%
470	-15.7%
475	-15.9%
480	-16.2%
485	-16.4%
490	-16.7%
495	-16.9%
500	-17.1%
505	-17.4%
510	-17.6%
515	-17.9%
520	-18.1%
525	-18.3%
530	-18.6%
535	-18.8%
540	-19.1%
545	-19.3%
550	-19.6%
555	-19.8%
560	-20.0%
565	-20.3%
570	-20.5%
575	-20.8%
580	-21.0%
585	-21.2%
590	-21.5%
595	-21.7%
600	-22.0%
605	-22.2%
610	-22.4%
615	-22.7%
620	-22.9%
625	-23.2%

Density (jobs per acre)	Percent VMT reduction from typical
630	-23.4%
635	-23.7%
640	-23.9%
645	-24.1%
650	-24.4%
655	-24.6%
660	-24.9%
665	-25.1%
670	-25.3%
675	-25.6%
680	-25.8%
685	-26.1%
690	-26.3%
695	-26.6%
700	-26.8%
705	-27.0%
710	-27.3%
715	-27.5%
720	-27.8%
725	-28.0%
730	-28.2%
735	-28.5%
740	-28.7%
745	-29.0%
750	-29.2%
755	-29.4%
760	-29.7%
765	-29.9%

Table A-C.3. Calculated values for VMT reduction from parking pricing from CAPCOA formula.

Annual parking price	% VMT change	Absolute VMT change per household
\$200	-0.9%	-176.7
\$300	-1.3%	-255.3
\$400	-1.7%	-333.9
\$500	-2.2%	-432.1
\$600	-2.6%	-510.6
\$700	-3.0%	-589.2
\$800	-3.5%	-687.4
\$900	-3.9%	-766.0
\$1,000	-4.4%	-864.2
\$1,500	-6.5%	-1276.7
\$2,000	-8.7%	-1708.8
\$2,500	-10.9%	-2140.9
\$3,000	-13.1%	-2573.0
\$3,500	-15.2%	-2985.5

Appendix D: List of Common Acronyms

Acronym	Explanation
AT	Active Transportation
CAPCOA	California Air Pollution Control Officers Association
CCR	California Code of Regulations
CARB	California Air Resources Board
CBSA	Census Bureau Statistical Area
CEQA	California Environmental Quality Act
COG	Council of Governments
CMA	Congestion Management Authority
FHWA	Federal Highway Administration
GHG	Greenhouse Gas
GP	General Purpose
HOV	High Occupancy Vehicle
HOT	High Occupancy Toll
LTS	Level of traffic stress
MPO	Metropolitan Planning Organization
NCST	National Center for Sustainable Transportation
PRC	Public Resources Code (state)
RPTA	Regional Planning Transportation Agency
SB	Senate Bill
SCS	State Highway System
SOV	Single-Occupant Vehicle
TAC	Caltrans Transportation Analysis Under CEQA
TAF	Caltrans Transportation Analysis Framework
TDM	Transportation Demand Management
TDR	Transfer of Development Rights
TMA	Transportation Management Association
TOD	Transit-Oriented Development
TAZ	Traffic Analysis Zone
VMT	Vehicle Miles Traveled

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