VMT ANALYSIS

With the implementation of SB 743 the focus of a transportation impact analysis under CEQA moves from consideration of operating Level of Service (LOS) to evaluation of a project's effects on regional VMT. Solano County has adopted guidelines for evaluating VMT impacts under SB 743, and this report addresses the project's impacts based on those guidelines.

The materials which follow describe the approved and proposed land uses on the Midway Plaza site and explain the methodology and significance criteria employed to determine regional VMT impacts. The results of analysis have been described in terms of quantitative analysis based on a review of the relationships between the project and its surrounding land uses.

Background. SB 743 changes the focus of transportation impact analysis in CEQA from measuring impacts to drivers to measuring the environmental impact of driving. The change has been made by replacing LOS with VMT. This change was made to align CEQA transportation impact analysis and mitigation with the State's goals for reducing greenhouse gas (GHG) emissions, to encourage infill development, and to improve public health through more active transportation. Level of Service is still used to assess a project's effects outside of CEQA and a traffic operational analysis under Solano County guidelines has been prepared for this project and documented separately.

In January 2019, the Natural Resources Agency finalized updates to the CEQA Guidelines including the incorporation of SB 743 modifications. The Guidelines' changes were approved by the Office of Administrative Law and are now in effect. The provisions apply statewide as of July 1, 2020.

To help aid lead agencies with SB 743 implementation, the Governor's Office of Planning and Research (OPR) produced the *Technical Advisory on Evaluating Transportation Impacts in CEQA*[1] (December 2018). This document provides guidance regarding the variety of implementation questions to be faced with respect to shifting to a VMT metric. Key guidance from this document includes:

- VMT is the most appropriate metric to evaluate a project's transportation impact.
- OPR recommends tour- and trip-based travel models to estimate VMT, but ultimately defers to local agencies to determine the appropriate tools.
- OPR recommends measuring VMT for residential and office projects on a "per capita" and "per employee" basis.
- OPR recommends that a per capita or per employee VMT that is fifteen percent below that of existing development may be a reasonable significance threshold. In other words, an office project that generates VMT per employee that is more than 85 percent of the regional average VMT per employee could result in a significant impact. OPR notes that this threshold is supported by evidence that connects this level of reduction to the State's emissions goals.
- OPR recommends that where a project replaces existing VMT-generating land uses, if the replacement leads to a net overall decrease in VMT, the project would lead to a less-than-significant transportation impact. If the project leads to a net overall increase in VMT, then the thresholds described above should apply.

[1] *Technical Advisory on Evaluating Transportation Impacts in CEQA*. Governor's Office of Planning and Research State of California, December 2018.

- OPR states that by adding retail opportunities into the urban fabric and thereby improving retail destination proximity, local-serving retail development tends to shorten trips and reduce VMT. Generally, OPR suggested that retail development including stores smaller than 50,000 square feet might be considered local serving.
- Lead agencies have the discretion to set or apply their own significance thresholds.

Solano County Guidelines. In 2021, the Solano County Department of Resource Management completed the Solano County *Interim Modifications of Standards for the Department of Resource Management Regarding CEQA Considerations for Traffic, Vehicle Miles Traveled and their Thresholds of Significance* (June 15, 2021) to support Solano County with implementation of SB 375 and SB 743, including the selection of VMT analysis methodology, setting thresholds of significance, and potential mitigation.

Outside of the incorporated cities, Solano County is primarily rural County, and the Solano County VMT Guidelines are focused on rural elements. To determine the extent and potential for a Use Permit or other discretionary development to impact traffic operations and VMT, an applicant may be required to submit information and studies that vary depending on the amount of traffic generation. The County's VMT measures include the following:

1) A Use Permit application that generates 10 truck trips per day or less and 50 total vehicle trips per day or less does not need to provide a traffic study as part of the application.
2) An application which generates more than 10 truck trips per day and / or more than 50 total vehicle trips per day must provide a traffic study as part of the application.

Department staff will consider the findings and measures of the traffic study in order to determine if, and to what extent, mitigations will be required for the trips and VMT generated in the application. The following are recommended guidelines for less than significant impacts and mitigation determinations:

<u>"Less Than Significant Impact"</u>

1) A Use Permit or other discretionary development which generates 110 total vehicle trips per day or less (770 total vehicle trips per week or less) will have less than significant impact on VMT. Employee trips are not considered in the total vehicle trip generation due to the reduction in regional commute trips and VMT due to local job creation.

2) An agricultural development that facilitates farm products primarily to local ag processing centers, cities, and markets in Solano County will have less than significant impact on VMT.

3) A development that is within Â½-mile of an active transit stop with reasonable transportation connections qualifies for less than significant impact on VMT.

4) A development that is adjacent to a fully developed and connected system of bike lanes qualify for less than significant impact on VMT for up to 125 total vehicle trips per day or less (875 total vehicle trips per week or less).

5) Permitted special events that include advertisements for and coordinated assistance with carpool and/or transit options for attendees.

<u>Mitigation Options for VMT:</u>

1) Construction of bike racks, a charging station, and/or other various multimodal improvements at

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the development site will be considered as minor mitigation.

2) Business plans that include carpool/vanpool coordination for employees at the development site will be considered as minor mitigation.

3) Operating a vanpool or providing on-demand transit services for employees at the development site to reduce trips to below 110 vehicles per day will be considered as major mitigation.

4) Construction of a nearby active transit stop in the public right of way by the applicant will be considered as major mitigation.

5) Construction of sidewalks and other pedestrian gap improvements in the public right of way by the applicant to connect to other fully connected public pedestrian facilities will be considered as major mitigation.

6) Construction of frontage Class 2 (or better) bike lanes in the public right of way by the applicant to connect to other fully connected public Class 2 (or better) bike lanes will be considered as major mitigation.

These impact and mitigation guidelines may be supplemented with pertinent information related to the application, site location, Solano Transportation Authority's Active Transportation Plan, as well as local and regional transit services. Staff may also consider technological changes and advances that reduce VMT that are not currently in active use on the date of this memorandum.

The Director of Resource Management may also make changes to the staff recommendations for impact findings and mitigation requirements.

The County's policies do not readily account for retail services that could generate over 110 daily trips. As an example, using ITE Trip Generation Land Use 820, "Shopping Center less than 150,000 square feet", would result in a 3,000 square foot retail store; a 3,000 square foot fast food restaurant will generate about 1,400 daily trips. Most zoning within the County is agricultural or rural residential uses; however, there are a few parcels designated as highway commercial (C-H) uses located along I-80 that have yet to be developed. The County notes that C-H Districts are "intended for commercial uses to serve the highway traveler. C-H Districts are to be established in areas of four acres or larger and shall be located only where need is clearly indicated." Thus, the County expects that most traffic for this project will be existing trips diverted from I-80.

The County VMT policy does not address trips for C-H zoning, considering that a four acre or larger site would contain more than a 3,000 square foot retail store, generating more than 110 daily trips. As the site is creating trips by diverting existing traffic an alternative assessment to analyze VMT was used because of unique circumstances of the particular project not captured in the County's policies.

The OPR *Technical Advisory* provides for a general threshold of 50,000 square-feet as an indicator as to whether a commercial use can be considered local serving or not. This is an important consideration in terms of a VMT-related significant impact determination. While the *Technical Advisory* notes local serving retail it does not discuss highway commercial retail, i.e., those uses along a travel corridor that serve existing traffic. Aside from employees most trips will be either pass-by or diverted link trips, and not new primary trips based on the project location adjacent to I-80 in rural Solano County. Instead of creating new trips this land use is generally rerouting trips from other similar uses.

Page 16 of the *Technical Advisory* specifically addresses some of the key issues surrounding how a local serving retail store should be evaluated in terms of its VMT impact. As described, the threshold for significance is "a net increase." This means that if a proposed store produces one additional VMT, it would result in a finding of significance. However, the document further explains that local retail uses can be determined to result in an overall VMT reduction by the lead agency. This finding is consistent with the desire to develop more sustainable communities that have fewer transportation impacts. While the *Technical Advisory* does not address diverted link trips similar reasoning can be applied as these trips do not create new primary trips.

Commercial uses, such as those proposed, primarily serve pre-existing needs (i.e. they do not generate new trips because they meet existing demand). Because of this, these types of commercial uses can be presumed to reduce trip lengths when a new retailer is proposed. Essentially, the assumption is that someone will travel to a newly constructed gas station, truck stop or fast-food restaurant because of its proximity to the roadway facility, rather than the proposed retailer fulfilling an unmet need. This results in an existing trip on the roadway network likely becoming shorter, rather than a new trip being generated along the roadway network.

The *Technical Advisory* also provides that a less than significant finding can be further substantiated by showing the proximity of other similar uses. Although a specific market study is not being provided as part of this memorandum, the proximity of other similar uses are shown in Figure 1.

Quantitative Analysis. In order to estimate the Project's effect on area VMT, the Project's gas station, truck stop and fast-food restaurant trips were evaluated before and after development of the Project. As noted above, these uses are generally serving diverted trips from I-80, i.e., traffic along I-80 exits the freeway to utilize these services and then reenters the freeway. The proposed uses generate few new trips, with most trips rerouted from other locations. The introduction of a new fast-food restaurant or gas station / truck stop at this location is expected to reroute trips from other locations along the I-80 corridor.

Figure 1 shows the closest gas stations, truck stops and fast-food restaurants relative to the Midway Plaza project. To the west, the closest gas station or fast-food restaurant in Vacaville is at the I-80 / Leisure Town Road intersection, about three miles west of the project while the closest gas station or fast-food restaurant to the east in Dixon is at the W. A Street / I-80 interchange, also about three miles away. Four diesel fueling locations were identified, three in Dixon and one in Vacaville. The Dixon Gas & Shop is located at the W. A Street / I-80 interchange and provides gasoline and diesel sales with a convenience market. The Ramos Oil Company Mini-Mart is located along N. First Street in Dixon and provides gasoline and diesel sales and includes a convenience store and car wash. A Chevron gas station at the Sievers Road / I-80 interchange at the east side of Dixon also provides both gasoline and diesel fuel and includes a convenience store. In Vacaville, the Vaca Valley Travel Center located near the I-505 / Vaca Valley Parkway interchange provides gas and diesel sales and includes several fast-food restaurants and a car wash.

Tables 2-4 summarize the projected change in customer trip length for the proposed site. To estimate the potential net change in VMT, and based on the project location relative to adjacent similar uses that may have traffic rerouted to the proposed project, the following assumptions were made:

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FIGURE 1
VICNITY MAP

- Nearest fast-food restaurant or gas station to the west (Vacaville) – 2.79 miles
- Nearest fast-food restaurant or gas station to east (Dixon) – 2.90 miles
- Diesel fuel locations
    - Dixon Gas & Shop, W. A Street – 2.90 miles (east)
    - Ramos Oil, N. 1st Street – 6.28 miles (east)
    - Sievers Road Chevron – 7.45 miles (east)
    - Vaca Valley Travel Center – 5.89 miles (west)
- Nearest gas station from Midway Road / SR 113 intersection – 2.25 miles
- Nearest gas station from Lewis Road / Hawkins Road intersection – 3.84 miles
- Nearest gas station from Midway Road / Leisure Town Road intersection – 2.45 miles

TABLE 2
Change in Daily VMT due to Project Primary / Diverted and Pass-By Trips– Gas Station & Fast-food

Origin/Destination	Trips	Change in Distance (mi)	Change in VMT
I-80 East			
Leisure Town	393	+0.14	+55.0
A Street	314	+0.60	+188.6
Vaca Valley	79	-0.01	-0.80
I-80 West			
Leisure Town	314	+0.24	+75.5
A Street	393	-0.30	-117.9
Vaca Valley	79	-0.03	-2.4
Midway Road East	253	+2.12	+537.0
Midway Road West	456	-0.21	-95.8
Lewis Road	253	0	0
Pass-By			
A Street (EB)	1680	-0.17	-285.6
Leisure Town (WB)	672	-0.63	-423.4
Leisure Town (EB)	672	-0.04	-77.3
Vaca Valley (NB)	168	-0.78	-131.0
Vaca Valley (SB)	168	-0.31	-52.1
Total	**5984**	**-**	**-330.2**

Note – numbers may not equal due to rounding

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TABLE 3 Change in Daily VMT due to Project Primary / Diverted and Pass-By Trips – Truck Stop			
Origin/Destination	**Trips**	**Change in Distance (mi)**	**Change in VMT**
I-80 East			
Vaca Valley	5	-2.55	-12.2
A Street	5	+0.54	+2.7
1st Street	5	-0.86	-4.1
I-80 West			
Vaca Valley	5	-3.72	-18.3
A Street	5	-0.77	-3.7
1st Street	5	-1.01	-4.8
Pass-By			
A Street (EB)	8	-1.05	-8.8
A Street (WB)	8	-0.23	-1.9
Vaca Valley (WB)	4	-3.32	-13.9
Vaca Valley (NB)	6	-0.78	-4.9
Vaca Valley (SB)	6	-0.31	-1.9
1st Street (WB)	4	-1.63	-6.8
1st Street (EB)	4	-1.29	-5.4
Total	72	-	**-84.0**
Note – numbers may not equal due to rounding			

Overall, the project will result in shorter trips. This is consistent with the OPR Technical Advisory discussion on local serving retail projects. Table 4 presents the total projected net change in daily VMT due to the project. The project is expected to produce a net decrease of 414.2 VMT. Since the project is not projected to increase VMT within Solano County this would result in a less than significant impact.

TABLE 4 Net Change in Daily VMT due to Project	
Trip Type	Change In VMT
Primary / Diverted and Pass-By – Gas Station / Fast-food	-330.2
Primary / Diverted and Pass-By – Truck Stop	-84.0
Net Change	**-414.2**

CAPCOA Reductions. Guidance provided by California Air Pollution Control Officers Association (CAPCOA)[2] was reviewed to determine whether the Project can implement features that would result in further VMT reductions. Due to the location of the project, adjacent to I-80 in rural Solano County, few CAPCOA reductions are available.

A total of four electric vehicle charging stations, two beyond what is required by CALGreen standards will be installed. This falls under CAPCOA Reduction Measure T-14, *Provide Electric Vehicle Charging*

[2] *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity*. California Air Pollution Control Officers Association (CAPCOA). December 2021.

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Infrastructure. The projected reductions in GHG emissions (1.29%) are illustrated in Table 5. Calculations for this reduction measure can be found in the appendix.

Additional measures that could be implemented include T-5, Implement Commute Trip Reduction Program (Voluntary), T-10, Provide End-of-Trip Bicycle Facilities, although their use would likely be limited.

T-5 - This measure implements a voluntary commute trip reduction (CTR) program with employers. CTR programs discourage single-occupancy vehicle trips and encourage alternative modes of transportation such as carpooling, taking transit, walking, and biking, thereby reducing VMT and GHG emissions. This measure may not be a practical measure based on the number of employees, the hours worked and the alternatives. For example, an employee may choose to ride their bike if working during the day but not at night. It was assumed that half of all employees may choose to participate in either carpooling or another reduction program such as bicycling. This could result in up to a 1% reduction in employee VMT.

T-10 – This measure would install and maintain end-of-trip facilities for employee use. End-of-trip facilities could bike parking, bike lockers, showers, and personal lockers although it is likely that only bike parking would be provided were this measure to be implemented. The provision and maintenance of secure bike parking and related facilities encourages commuting by bicycle, thereby reducing VMT and GHG emissions. Employee bicycling to and from the project could reduce VMT by about 0.66%.

TABLE 5
CAPCOA REDUCTIONS

	Reductions
T-14 - Electric Charging Infrastructure	-1.29%
Total Reductions	**-1.29%**
Possible Additional Reductions	
T-10 Bicycle Amenities	-0.66
T-5 - End-of-Trip Facilities	-1.00
Total Possible Additional Reductions	**-1.66%**
Net Potential Total VMT Reductions	**-2.95%**

Findings

Based on the results of this analysis, the following finding is made:

- The analysis summarizes that the addition of the proposed Project can shorten trip lengths and result in a decrease in VMT. This is considered to be a less than significant impact.
- The introduction of CAPCOA VMT reduction measures will also result in a reduction of VMT between 1.29% up to 2.95%.

California Air Pollution Control Officers Association

Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity

Designed for Local Governments, Communities, and Project Developers

CAPCOA CALCULATIONS						
T-5	IMPLEMENT COMMUTE TRIP REDUCTION PROGRAM (VOLUNTARY)					
A=	BXC					
A	% Reduction in GHG Emissions					
B	Percent of employees eligible for program		25%			
C	Percent reduction in commute VMT from eligible employees		-4%			
		A=	-1.00%			
T-10	PROVIDE END OF TRIP BIKE FACILITIES					
A =	C x (E - (B x E))/D x F					
		Low	High			
A	% Reduction in GHG Emissions					
B	Bike mode adjustment factor	1.78	4.86			
C	Existing bicycle trip length for all trips in region	2.9	2.9			
D	Existing vehicle trip length for all trips in region	10.9	10.9			
E	Existing bicycle mode share for work trips in region	2.50%	2.50%	avg of Sac area and SF area		
F	Existing vehicle mode share for work trips in region	78.30%	78.30%			
	A=	-0.66%	-3.28%			
T-14	PROVIDE ELECTRIC VEHICLE CHARGING INFRASTRUCTURE					
A=	B x D x (F - E) x (G - (H x I x K x L))/ -C x J					
A	Percent reduction in GHG emissions from vehicles accessing the office building or housing					
B	Number of chargers installed at site		2	beyond required by CalGreen		
C	Total vehicles accessing the site per day		5966			
D	Average number of PHEVs served per day per charger installed		2			
E	Percent of PHEV miles in electric mode without measure		46			
F	Percent of PHEV miles in electric mode with measure		80			
G	Average emission factor of PHEV in gasoline mode		205.1			
H	Energy efficiency of PHEV in electric mode		0.327			
I	Carbon intensity of local electricity provider		206			
J	Average emission factor of non-electric vehicles accessing the site		307.5			
K	conversion from lb to g		454			
L	Conversion from kWh to MWh		0.001			
		A=	-1.29%			

T-14. Provide Electric Vehicle Charging Infrastructure

GHG Mitigation Potential

11.9%

Up to 11.9% of GHG emissions from vehicles accessing the commercial or multifamily housing building

Co-Benefits (icon key on pg. 34)

Climate Resilience

Providing electric vehicle charging infrastructure increases fuel redundancy for electric vehicles even if an extreme weather event disrupts other fuel sources. Electric vehicles could also provide benefits to buildings and the grid, such as emergency backup, energy reserves, and demand response.

Health and Equity Considerations

Differential costs of PHEVs compared to conventional vehicles are decreasing over time, but at present are more expensive, which means this measure could disproportionately benefit those of greater economic means. As costs come into parity over time, this will be less of an issue. Employer, electricity provider, and state incentives for PHEV purchase could help address near-term disparities.

Measure Description

Install onsite electric vehicle chargers in an amount beyond what is required by the 2019 California Green Building Standards (CALGreen) at buildings with designated parking areas (e.g., commercial, educational, retail, multifamily). This will enable drivers of PHEVs to drive a larger share of miles in electric mode (eVMT), as opposed to gasoline-powered mode, thereby displacing GHG emissions from gasoline consumption with a lesser amount of indirect emissions from electricity. Most PHEVs owners charge their vehicles at home overnight. When making trips during the day, the vehicle will switch to gasoline mode if/when it reaches its maximum all-electric range.

Subsector

Parking or Road Pricing/Management

Locational Context

Urban, suburban, rural

Scale of Application

Project/Site

Implementation Requirements

Parking at the chargers must be limited to electric vehicles.

Cost Considerations

The primary costs associated with electric vehicle charging infrastructure include the capital costs of purchasing and installing charging stations, electricity costs from use of stations, and maintenance costs of keeping the charging stations in working order. Costs initially fall to the station owners, either municipalities or private owners, but can be passed along to station users with usage fees. Depending on station placement and charging times required for PHEVs, businesses near charging stations can derive benefits from patronage of station users.

Expanded Mitigation Options

In addition to increasing the percentage of electric miles for PHEVs, the increased availability of chargers from implementation of this measure could mitigate consumer "range anxiety" concerns and increase the adoption and use of battery electric vehicles (BEVs), but this potential effect is not included in the calculations as a conservative assumption. Expanded mitigation could include quantification of the effect of this measure on BEV use.

GHG Reduction Formula

$$A = \frac{B \times D \times (F - E) \times (G - (H \times I \times K \times L))}{-C \times J}$$

GHG Calculation Variables

ID	Variable	Value	Unit	Source
Output				
A	Percent reduction in GHG emissions from vehicles accessing the office building or housing	0–11.9	%	calculated
User Inputs				
B	Number of chargers installed at site	[ ]	integer	user input
C	Total vehicles accessing the site per day	[ ]	integer	user input
Constants, Assumptions, and Available Defaults				
D	Average number of PHEVs served per day per charger installed	2	integer	CARB 2019
E	Percent of PHEV miles in electric mode without measure	46	%	CARB 2020a
F	Percent of PHEV miles in electric mode with measure	80	%	CARB 2017
G	Average emission factor of PHEV in gasoline mode	205.1	g CO_2e per mile	CARB 2020a; U.S. DOE 2021
H	Energy efficiency of PHEV in electric mode	0.327	kilowatt hours (kWh) per mile	CARB 2020b; U.S. DOE 2021
I	Carbon intensity of local electricity provider	Tables E-4.3 and E-4.4	lb CO_2e per megawatt hour (MWh)	CA Utilities 2021
J	Average emission factor of non-electric vehicles accessing the site	307.5	g CO_2e per mile	CARB 2020a
K	conversion from lb to g	454	g per lb	conversion
L	Conversion from kWh to MWh	0.001	MWh per kWh	conversion

Further explanation of key variables:

- (D) – The average number of PHEVs served per day per charger installed is 2 vehicles (CARB 2019). If the user can provide a project-specific value, they should replace the default in the GHG reduction formula.
- (E) - Based on the EMFAC2017 model (v1.0.3), 46 percent of miles traveled by PHEVs in California are eVMT, and 54 percent are in gasoline mode (CARB 2020a).

T-5. Implement Commute Trip Reduction Program (Voluntary)

GHG Mitigation Potential

Up to 4.0% of GHG emissions from project/site employee commute VMT

Co-Benefits (icon key on pg. 34)

Climate Resilience

CTR programs could result in less traffic, potentially reducing congestion or delays on major roads during peak AM and PM traffic periods. When this reduction occurs during extreme weather events, it better allows emergency responders to access a hazard site. Lower transportation costs would also increase community resilience by freeing up resources for other purposes.

Health and Equity Considerations

Design of CTR programs need to ensure equitable access and benefits to all employees are provided considering disparate existing mobility options in diverse communities.

Measure Description

This measure will implement a voluntary commute trip reduction (CTR) program with employers. CTR programs discourage single-occupancy vehicle trips and encourage alternative modes of transportation such as carpooling, taking transit, walking, and biking, thereby reducing VMT and GHG emissions. Voluntary implementation elements are described in this measure.

Subsector

Trip Reduction Programs

Locational Context

Urban, suburban

Scale of Application

Project/Site

Implementation Requirements

Voluntary CTR programs must include the following elements to apply the VMT reductions reported in literature.

- Employer-provided services, infrastructure, and incentives for alternative modes such as ridesharing (Measure T-8), discounted transit (Measure T-9), bicycling (Measure T-10), vanpool (Measure T-11), and guaranteed ride home.
- Information, coordination, and marketing for said services, infrastructure, and incentives (Measure T-7).

Cost Considerations

Employer costs may include recurring costs for transit subsidies, capital and maintenance costs for the alternative transportation infrastructure, and labor costs for staff to manage the program. Where the local municipality has a VMT reduction ordinance, costs may include the labor costs for government staff to track the efficacy of the program.

Expanded Mitigation Options

Other strategies may also be included as part of a voluntary CTR program, though they are not included in the VMT reductions reported by literature and thus are not incorporated in the VMT reductions for this measure.

This program typically serves as a complement to the more effective workplace CTR measures such as pricing workplace parking (Measure T-12) or implementing employee parking "cash-out" (Measure T-13).

GHG Reduction Formula

$A = B \times C$

GHG Calculation Variables

ID	Variable	Value	Unit	Source
Output				
A	Percent reduction in GHG emissions from project/site employee commute VMT	0–4.0	%	calculated
User Inputs				
B	Percent of employees eligible for program	0–100	%	user input
Constants, Assumptions, and Available Defaults				
C	Percent reduction in commute VMT from eligible employees	-4	%	Boarnet et al. 2014

Further explanation of key variables:

- (B) – This refers to the percent of employees that would be able to participate in the program. Employees who might not be able to participate could include those who work nighttime hours when transit and rideshare services are not available or employees who are required to drive to work as part of their job duties. This input does not refer to the percent of employees who participate in the program.
- (C) – A policy brief summarizing the results of employer-based trip reduction studies concluded that these programs reduce total commute VMT for employees at participating work sites by 4 to 6 percent (Boarnet et al. 2014). To be conservative, the low end of the range is cited.

GHG Calculation Caps or Maximums

Measure Maximum

(A_{max}) The maximum GHG reduction from this measure is 4 percent. This maximum scenario is presented in the below example quantification.

Subsector Maximum

($\sum A_{max_{T\text{-}5 \text{ through } T\text{-}13}} \leq 45\%$) This measure is in the Trip Reduction Programs subsector. This subcategory includes Measures T-5 through T-13. The employee commute VMT reduction from the combined implementation of all measures within this subsector is capped at 45 percent.

Mutually Exclusive Measures

If this measure is selected, the user may not also take credit for Measure T-6, which represents the same implementation activities as Measure T-5, except that the CTR program would be mandatory. Users should select either Measure T-5 or T-6.

T-10. Provide End-of-Trip Bicycle Facilities

GHG Mitigation Potential

Up to 4.4% of GHG emissions from project/site employee commute VMT

Co-Benefits (icon key on pg. 34)

Climate Resilience

End-of-trip bicycle facilities could take more cars off the road, resulting in less traffic and better allowing emergency responders to access a hazard site during an extreme weather event. They could also make it easier for bicycle users to access resources in an extreme weather event.

Health and Equity Considerations

Facilities should be inclusive of all gender identities and expressions. Consider including gender-neutral, single-occupancy options to allow for additional privacy for those who want it.

Measure Description

This measure will install and maintain end-of-trip facilities for employee use. End-of-trip facilities include bike parking, bike lockers, showers, and personal lockers. The provision and maintenance of secure bike parking and related facilities encourages commuting by bicycle, thereby reducing VMT and GHG emissions.

Subsector

Trip Reduction Programs

Locational Context

Urban, suburban

Scale of Application

Project/Site

Implementation Requirements

End-of-trip facilities should be installed at a size proportional to the number of commuting bicyclists and regularly maintained.

Cost Considerations

Employer costs include capital and maintenance costs for construction and maintenance of facilities and potentially labor and materials costs for staff to monitor facilities and provide marketing to encourage use of new facilities. The beneficiaries include the program participants saving on commuting cost, the employer reducing onsite parking expenses, and the municipality reducing cars on the road, which leads to lower infrastructure and roadway maintenance costs.

Expanded Mitigation Options

Best practice is to include an onsite bicycle repair station and post signage on or near secure parking and personal lockers with information about how to reserve or obtain access to these amenities.

This measure could be paired with any combination of the other commute trip reduction strategies (Measures T-7 through T-13) for increased reductions.

GHG Reduction Formula

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

GHG Calculation Variables

ID	Variable	Value	Unit	Source
Output				
A	Percent reduction in GHG emissions from employee project/site commute VMT	0.1–4.4	%	calculated
User Inputs				
	None			
Constants, Assumptions, and Available Defaults				
B	Bike mode adjustment factor	1.78 or 4.86	unitless	Buehler 2012
C	Existing bicycle trip length for all trips in region	Table T-10.1	miles	FHWA 2017a
D	Existing vehicle trip length for all trips in region	Table T-10.1	miles	FHWA 2017a
E	Existing bicycle mode share for work trips in region	Table T-10.2	%	FHWA 2017b
F	Existing vehicle mode share for work trips in region	Table T-10.2	%	FHWA 2017b

Further explanation of key variables:

- (B) – The bike mode adjustment factor should be provided by the user based on type of bike facility. A study found that commuters with showers, lockers, and bike parking at work are associated with 4.86 times greater likelihood to commute by bicycle when compared to individuals without any bicycle facilities at work. Individuals with bike parking, but no showers and lockers at the workplace, are associated with 1.78 times greater likelihood to cycle to work than those without trip-end facilities (Buehler 2012).
- (C and D) – Ideally, the user will calculate bicycle and auto trip length for a Project/Site at a scale no larger than a census tract. Potential data sources include the U.S. Census, California Household Travel Survey (preferred), or local survey efforts. If the user is not able to provide a project-specific value using one of these data sources, they have the option to input the trip lengths for bicycles and vehicles for one of the six most populated CBSAs in California, as presented in Table T-10.1 in Appendix C (FHWA 2017a). Trip lengths are likely to be longer for areas not covered by the listed CBSAs, which represent the denser areas of the state.
- (E and F) – Ideally, the user will calculate bicycle and auto mode share for work trips for a Project/Site at a scale no larger than a census tract. Potential data sources include the U.S. Census, California Household Travel Survey (preferred), or local survey efforts. If the user is not able to provide a project-specific value using one of these data sources, they have the option to input the regional average mode shares for bicycle and vehicle

Table E-4.3. Greenhouse Gas Intensity Factor by California Electricity Provider by Year (2017–2031)[1]

	Intensity Factor per Total Energy Delivered (lb CO_2e per MWh)												
Electricity Provider	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Alameda Municipal Power	455	0[2]	0	0	0	0	0	0	0	0	0	0	0
Apple Valley Choice Energy	655	655	655	595	595	595	595	526	526	526	526	334	334
Bear Valley Electric Service	914	914	914	567	567	567	567	483	483	483	483	435	435
Burbank Water & Power	1,132	1,008	932	902	884	669	398	224	221	216	218	236	236
Baldwin Park Resident Owned Utility District	—[3]	585	585	598	598	598	598	526	526	526	526	336	336
Central Coast Community Energy	12	137	509	542	528	448	388	313	235	159	83	8	8
City of Anaheim Public Utilities Department	1,037	965	982	1001	985	937	756	568	469	311	304	276	271
City of Commerce	—[4]	—[4]	—[4]	600	600	600	600	518	518	518	518	331	331
City of Palo Alto Utilities Department	0	0	0	0	0	0	0	0	0	0	25	75	75
City of Riverside	875	788	792	791	789	789	602	451	441	432	415	398	398
City of Vernon Municipal Light Department	707	713	567	545	504	508	456	416	420	426	321	326	326
CleanPowerSF	46	19	132	122	108	94	80	9	9	9	9	0	0
Clean Energy Alliance	—[3]	964	964	545	544	544	544	449	449	449	449	431	431
Clean Power Alliance	361	474	474	432	432	432	431	416	416	416	416	332	332
Desert Community Energy	534	47	85	85	81	76	72	68	65	62	60	58	58
Glendale Water and Power	1027	948	951	785	790	693	550	346	357	370	285	304	304
Imperial Irrigation District	459	183	192	189	219	223	225	264	268	277	251	249	249
Lancaster Choice Energy	618	618	618	600	600	600	600	516	516	516	516	333	333
Los Angeles Department of Water & Power	694	694	694	694	694	694	694	694	694	694	694	694	694
MCE	190	292	292	151	151	150	150	184	184	184	184	247	247
Merced Irrigation District	455	293	293	403	403	403	403	405	405	405	405	391	391
Modesto Irrigation District	480	503	455	467	474	481	490	394	408	385	368	373	373
Pacific Gas and Electric Company	206[6]	206	206	206	206	206	206	206	206	206	206	206	206
PacifiCorp	1,501	1,292	1,188	1,228	1,254	1029	978	967	930	808	784	724	722
Pasadena Water and Power	1,030	869	875	869	869	465	82	71	68	68	71	64	64
Peninsula Clean Energy	102	102	0	0	0	0	0	0	0	0	0	0	0
Pico Rivera Innovative Municipal Energy	687	687	686	595	594	594	594	527	527	527	527	335	335
Pioneer Community Energy	767	767	767	624	623	623	623	482	482	482	482	391	391
Pomona Choice Energy	—[3]	618	618	598	598	598	598	517	517	517	517	333	332
Rancho Mirage Energy Authority	648	648	647	591	591	591	591	526	526	526	526	328	328
Redding Electric Utility	377	374	339	339	337	341	350	161	166	173	175	181	181
Redwood Coast Energy Authority	64	317	408	231	181	226	226	200	200	200	200	244	244
Roseville Electric	530	532	474	473	473	448	394	377	360	343	325	309	309
Sacramento Municipal Utility District	376	375	360	344	329	314	297	280	269	254	239	224	210
San Diego Community Power	—[4]	—[4]	—[4]	583	583	582	582	486	486	486	486	324	324
San Diego Gas & Electric	591	542	542	542	542	542	541	47	47	46	46	171	171
San Francisco Public Utilities Commission	0	0	0	0	0	0	0	0	0	0	0	0	0
San Jacinto Power	583	643	643	583	583	582	582	486	486	486	486	324	324
San Jose Clean Energy	811	811	810	390	390	390	390	363	363	363	363	311	311
Silicon Valley Clean Energy	2	2	2	6	5	5	5	5	4	4	4	3	3

Table E-4.4. Greenhouse Gas Intensity Factor by California Electricity Provider by Year (2032–2045)[1]

Provider	Intensity Factor per Total Energy Delivered (CO_2e per MWh)													
	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Alameda Municipal Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apple Valley Choice Energy	333	333	333	333	333	333	333	333	333	333	333	333	333	332
Bear Valley Electric Service	435	435	435	435	435	435	435	434	434	434	434	434	434	434
Burbank Water & Power	236	236	236	236	236	236	236	236	236	236	236	236	236	236
Baldwin Park Resident Owned Utility District	336	336	335	335	335	335	335	335	335	335	335	335	335	335
Central Coast Community Energy	8	8	7	7	7	7	7	7	7	7	7	7	7	7
City of Anaheim Public Utilities Department	267	267	267	267	267	267	267	267	267	267	267	267	267	267
City of Commerce	331	331	331	331	331	330	330	330	330	330	330	330	330	330
City of Palo Alto Utilities Department	7	7	7	7	7	7	7	7	7	7	7	7	7	7
City of Riverside	398	398	398	398	398	398	398	398	398	398	398	398	398	398
City of Vernon Municipal Light Department	326	326	326	326	326	326	326	326	326	326	326	326	326	326
CleanPowerSF	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clean Energy Alliance	431	431	431	430	430	430	430	430	430	430	430	430	430	430
Clean Power Alliance	332	332	332	331	331	331	331	331	331	331	331	331	331	331
Desert Community Energy	58	58	58	58	58	58	57	57	57	57	57	57	57	57
Glendale Water and Power	304	304	304	304	304	304	304	304	304	304	304	304	304	304
Imperial Irrigation District	249	249	249	249	249	249	249	249	249	249	249	249	249	249
Lancaster Choice Energy	333	333	333	333	333	333	333	333	332	332	332	332	332	332
Los Angeles Department of Water & Power	694	694	694	694	694	694	694	694	694	694	694	694	694	694
MCE	247	247	247	247	247	247	247	247	247	247	246	246	246	246
Merced Irrigation District	391	391	391	391	391	391	391	391	391	391	390	390	390	390
Modesto Irrigation District	373	373	373	373	373	373	373	373	373	373	373	373	373	373
Pacific Gas and Electric Company	206	206	206	206	206	206	206	206	206	206	206	206	206	206
PacifiCorp	711	706	704	684	686	616	536	499	463	483	479	331	304	304
Pasadena Water and Power	64	64	64	64	64	64	62	62	62	62	62	62	62	62
Peninsula Clean Energy	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pico Rivera Innovative Municipal Energy	335	335	335	335	335	335	335	335	335	335	335	334	334	334
Pioneer Community Energy	391	391	391	391	391	391	391	391	391	391	390	390	390	390

Table T-9.1. Average Transit Mode Share of Work Trips by California Core-Based Statistical Area

Core-Based Statistical Area	Transit Mode Share of Work Trips
Los Angeles-Long Beach-Anaheim	5.39%
Riverside-San Bernardino-Ontario	1.12%
Sacramento-Roseville-Arden-Arcade	5.44%
San Diego-Carlsbad	4.74%
San Francisco-Oakland-Hayward	25.60%
San Jose-Sunnyvale-Santa Clara	6.11%

Source: Federal Highway Administration. 2017. National Household Travel Survey – 2017 Table Designer. WRKTRANS by HH_CBSA. Available: https://nhts.ornl.gov/. Accessed: January 2021.

Table T-10.1. Average One-Way Bicycle and Vehicle Trip Length of All Trips by California Core-Based Statistical Area

	Trip Length (miles)	
Core-Based Statistical Area	Bicycle	Vehicle
Los Angeles-Long Beach-Anaheim	1.7	9.7
Riverside-San Bernardino-Ontario	2.2	11.7
Sacramento-Roseville-Arden-Arcade	2.9	10.9
San Diego-Carlsbad	2.0	19.1
San Francisco-Oakland-Hayward	2.1	12.4
San Jose-Sunnyvale-Santa Clara	2.8	11.5

Source: Federal Highway Administration. 2017. National Household Travel Survey – 2017 Table Designer. Travel Day PT by TRPTRANS by HH_CBSA. Available: https://nhts.ornl.gov/. Accessed: January 2021.

Table T-10.2. Average Bicycle and Vehicle Mode Share of Work Trips by California Core-Based Statistical Area

	Mode Share	
Core-Based Statistical Area	Bicycle	Vehicle
Los Angeles-Long Beach-Anaheim	1.0%	90.7%
Riverside-San Bernardino-Ontario	0.4%	95.3%
Sacramento-Roseville-Arden-Arcade	2.2%	89.5%
San Diego-Carlsbad	1.3%	91.8%
San Francisco-Oakland-Hayward	2.8%	67.1%
San Jose-Sunnyvale-Santa Clara	4.1%	86.6%

Source: Federal Highway Administration. 2017. National Household Travel Survey – 2017 Table Designer. Workers by WRKTRANS by HH_CBSA. Available: https://nhts.ornl.gov/. Accessed: January 2021.