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VEHICLE MILES TRAVELED STUDY
OAKCREST SPECIFIC PLAN
San Marcos, California
December 3, 2025

LLG Ref. 3-25-4059

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1.0 INTRODUCTION

Linscott, Law & Greenspan, Engineers (LLG) has prepared this Vehicle Miles Traveled (VMT) study to determine the potential VMT impacts for the proposed Oakcrest Specific Plan Project (proposed Project) located on the west side of North Twin Oaks Valley Road, north of Legacy Drive, and south of Deer Brook Drive in the City of San Marcos.

The VMT analysis presented in this report includes the following:

- Project Description & Trip Generation Calculations
- VMT Analysis Approach and Methodology
- Screening Criteria
- Analysis Metrics
- Significance Criteria
- Mitigation Measures and Strategies for VMT Reduction
- Project VMT Analysis
- Significant VMT Impacts and Conclusions

2.0 PROJECT DESCRIPTION & TRIP GENERATION CALCULATIONS

2.1 Project Description

The Project is proposing to construct 257 residential units (112 detached airspace condos and 145 single-family residential), 6.22 acres of public park and preserved open space on a 137-acre site. The Project site is located on the west side of North Twin Oaks Valley Road, north of Legacy Drive, and south of Deer Brook Drive in the City of San Marcos.

The Project proposes a Specific Plan, General Plan Amendment/Rezone, Tentative Subdivision Map, two Site Development Plans and a Conditional Use Permit.

The General Plan Amendment would change the designations from Rural Residential and Agricultural Residential (RR/AG) to Specific Plan Area (SPA). The rezone would change the Zoning from Residential Estate (R-1-20) and Agriculture-1 (A1) to Specific Plan Area (SPA). The Specific Plan has been prepared with the intent to provide a comprehensive plan to ensure the efficient development of a new residential community. The Specific Plan serves as both a policy document and a regulatory document for the systematic implementation of the policies and goals of the General Plan.

Access to the site is proposed via one driveway from North Twin Oaks Valley Road ("Street A"). The driveway is proposed to be signalized with a northbound left-turn lane into the site as a Project feature. An enhanced pedestrian landing in the median, designed to protect pedestrians and equestrians, is proposed. A second emergency-only access point to North Twin Oaks Valley Road would be provided to the south.

Figure 2-1 shows the Project vicinity. *Figure 2-2* shows a more detailed Project area map. *Figure 2-3* shows the Project site plan.

2.2 Trip Generation Calculations

Trip generation for the Project was estimated using trip rates from SANDAG's *(Not So) Brief Guide of Vehicular Traffic Generation Rates for the San Diego Region, April 2002*. The trip generation rates for "Condominium (or any multi-family units more than 6-20 DU/acre)", "Single Family Detached (average 3-6 DU/acre), and "Neighborhood Park" were used. The proposed park may generate trips above those of a typical park. Therefore, in order to be conservative, a 50% increase to the SANDAG "Neighborhood Park" rate was applied

Table 2-1 shows the Project trip generation calculations. As shown in *Table 2-1*, the proposed Project is calculated to generate a total of 2,393 ADT with 194 AM peak hour trips (52 inbound / 142 outbound) and 239 PM peak hour trips (167 inbound and 72 outbound).

**TABLE 2-1
PROJECT TRIP GENERATION**

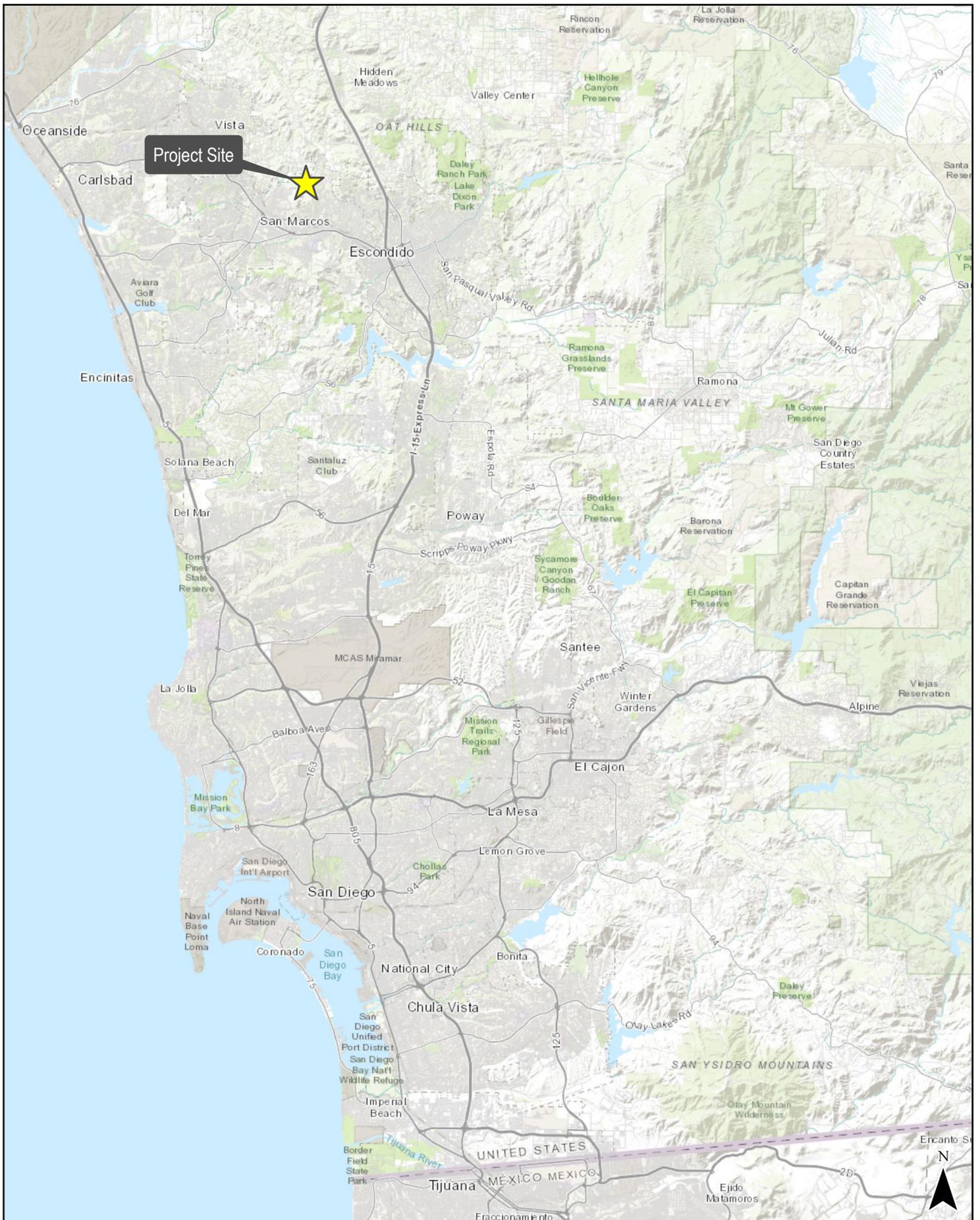
Land Use	Size	Daily Trip Ends (ADTs)		AM Peak Hour					PM Peak Hour				
		Rate ^a	ADT	Rate	In:Out Split	Volume			Rate	In:Out Split	Volume		
						In	Out	Total			In	Out	Total
Residential Component													
Condominium	112 DU	8 / DU	896	8%	20:80	14	58	72	10%	70:30	63	27	90
Single Family Residential	145 DU	10 / DU	1,450	8%	30:70	35	81	116	10%	70:30	102	43	145
<i>Residential Subtotal</i>			<i>2,346</i>			<i>49</i>	<i>139</i>	<i>188</i>			<i>165</i>	<i>70</i>	<i>235</i>
Park Component													
Neighborhood Park	6.2 Acres	5 / Acre	31	13%	50:50	2	2	4	9%	50:50	1	2	3
50% Park Trip Rate Increase			16			1	1	2			1	1	2
<i>Park Subtotal</i>			<i>47</i>			<i>3</i>	<i>3</i>	<i>6</i>			<i>2</i>	<i>3</i>	<i>5</i>
TOTAL			2,393			52	142	194			167	72	239

Footnotes:

- a. Trip generation rate from SANDAG's (*Not So*) *Brief Guide of Vehicular Traffic Generation Rates for the San Diego Region, April 2002* ("SANDAG Brief Guide").

General Note:

- DU = Dwelling Unit



N:10000:Figure
Date: 7/28/2025

SanGIS, Bureau of Land Management, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Figure 2-1
Vicinity Map

OAK CREST P

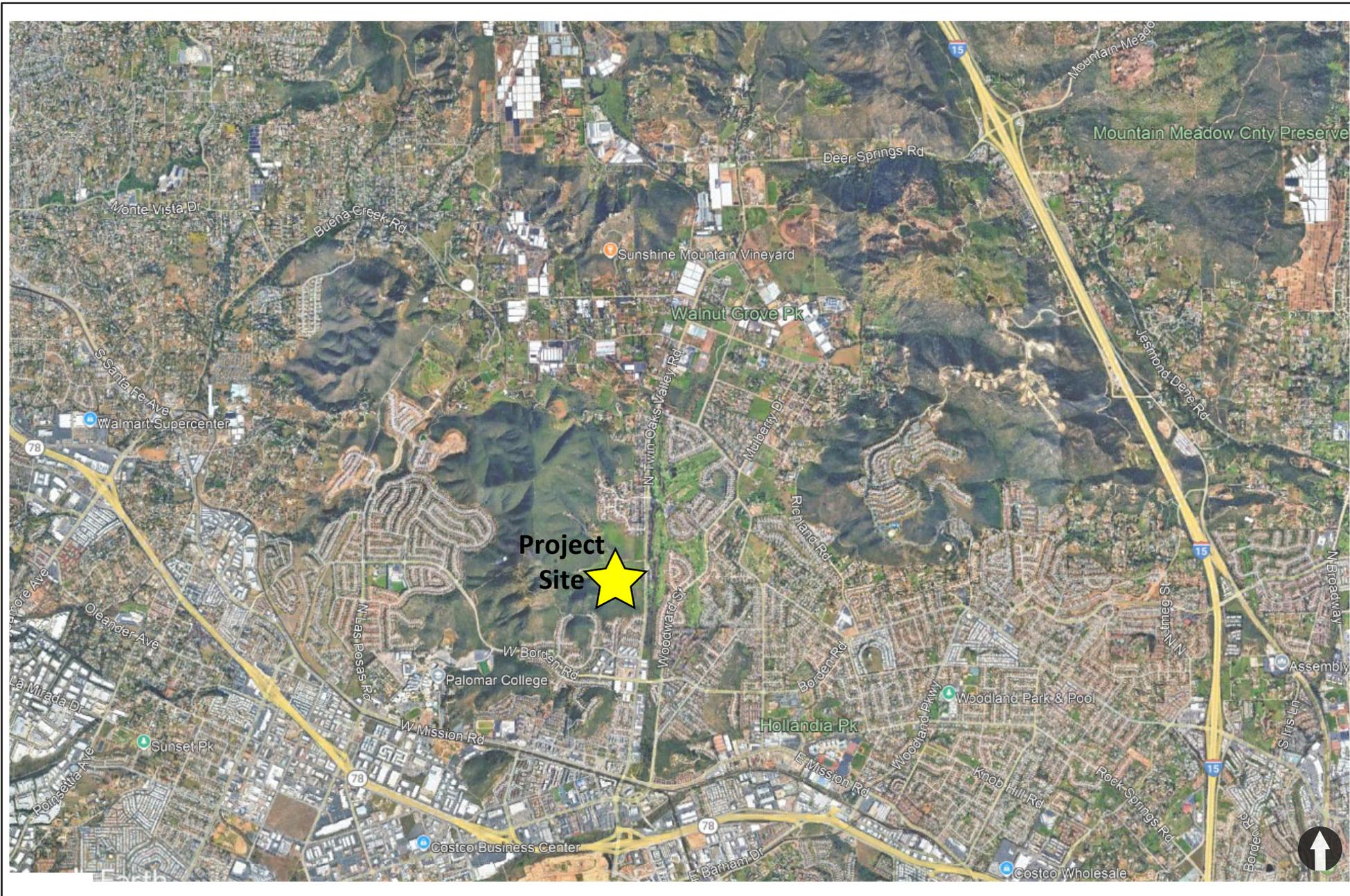


Figure 2-2
Project Area Map



N:\4059\Figures

Figure 2-3
Site Plan

3.0 VMT ANALYSIS APPROACH AND METHODOLOGY

Vehicles Miles Traveled (VMT) analysis required for CEQA was prepared based on the City of San Marcos *Transportation Impact Analysis Guidelines*, November 16, 2020. This section presents the applicable project screening criteria, VMT methodology, metrics, and significant impact thresholds per City guidelines.

3.1 Project Screening

The requirement to prepare a detailed transportation Vehicle Miles Traveled (VMT) analysis applies to all land development projects except for those that meet at least one of the provided screening criteria. A project that meets at least one of the screening criteria listed below would be considered to have a less significant impact due to the project or location characteristics.

1. Small Projects (less than 110 daily vehicle trips)
2. Affordable Housing (100% deed restricted)
3. Local Serving Retail and Public Facilities (50,000 square feet gross floor area or less)
4. Adjacency to High-Quality Transit
5. Map-Based Screening (projects located in VMT efficient areas; limited to projects generating fewer than 2,400 ADT)

Project screening was completed based on the Project parameters. Based on the Project site location, land use characteristics, and trip generation of the Project (see *Table 2-1*), screening criteria #5: *Map-Based Screening* is considered potentially applicable to the Project and assessed further as described below.

Table 3-1 summarizes the Project applicability of the TSM screening criteria. None of the City’s VMT screening criteria were ultimately determined to be applicable to the Project, and therefore, a VMT analysis is required.

**TABLE 3-1
VMT SCREENING CRITERIA – PROJECT APPLICABILITY**

Screening Criteria	Applicable to the Project?	Project Screens Out?
1. Small Project	No	–
2. Affordable Housing	No	–
3. Local-Serving Retail or Public Facility	No	–
4. Located in a High-Quality Transit Area	No	–
5. Located in Low VMT Area	Yes	No

General Notes:

1. Source: City of San Marcos TIA Guidelines, November 16, 2020.

3.1.1 Located in a Low VMT Area

Screening Criteria

Per the City's *Transportation Impact Analysis Guidelines*, residential projects that are proposed in areas that generate VMT below adopted City thresholds can be presumed to have a less-than-significant transportation impact and would not require a detailed VMT analysis. This determination must be made using SANDAG's online residential VMT maps, which show census tracts in the city where the VMT is below the regional average. Residential projects proposed in census tracts with residential VMT per capita below the City's threshold of exceeding 85 percent of the SANDAG regional average can be screened out using this approach.

Results

The Project is not located in a VMT efficient area (15% or more below the base year average household VMT/resident) based on the applicable location-based screening map produced by SANDAG. The San Diego average regional VMT/resident is 18.9 (and 15% below 18.9 would equate to 16.1 VMT/resident) per SANDAG Series 14 (Year 2016) data.

Using the SANDAG screening map for residential projects, shown in *Figure 3-1*, the Project is located in census tract 200.2 and would be expected to generate 18.5 VMT/resident. Therefore, this screening criteria is not applicable to the Project, and a VMT analysis is required, as presented in *Section 4.0*.

3.2 VMT Methodology, Metrics, and Significance Thresholds

For new land use development projects which do not meet any of the screening criteria outlined in *Section 3.1*, the following VMT metrics and thresholds, shown in *Table 3-2*, are used to determine a significant transportation impact.

The Project will use a VMT metric of VMT per resident, with a significance threshold of 15 percent below the existing countywide average (15% below 18.9 equates to 16.1 VMT/resident).

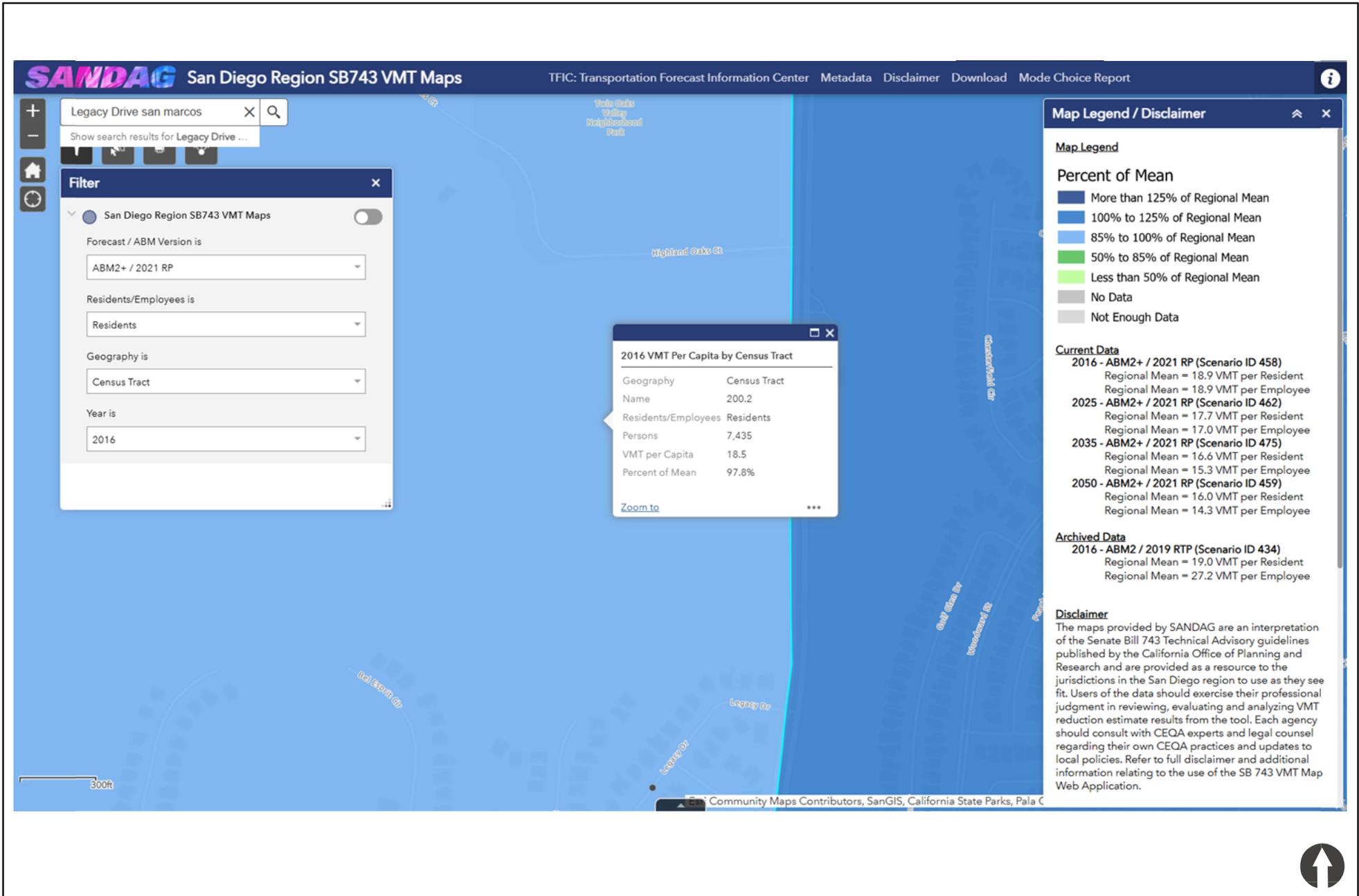
3.3 Mitigation Measures and Strategies for VMT Reduction

If a project would result in significant impacts, CEQA requires mitigation measures to be implemented to reduce or mitigate an impact. VMT reduction strategies from the City's TSM are included in *Appendix A*. VMT is reduced by implementing strategies that reduce the number of automobile trips generated by the project, shift more trips from automobile to non-automobile modes, and/or reduce the distances that people drive.

TABLE 3-2
VMT IMPACT THRESHOLDS BY LAND USE TYPE

Land Use Type	Impact Threshold
Residential Uses	A significant impact will occur if the project generates VMT per resident exceeding a level of 15 percent below the existing countywide average.
Employment Projects (including office and industrial)	A significant impact will occur if the project generates VMT per employee exceeding a level of 15 below the existing countywide average.
Retail Uses	A significant impact will occur if the project would result in a net increase in existing total citywide VMT.
Mixed-Use Projects	Evaluate each component of a mixed-use project independently and apply the significant threshold for each land use type, incorporating internalization reductions.
Redevelopment Projects (replaces existing uses)	If the project results in a net increase in VMT, apply the appropriate significance threshold for the project land use type(s).

Source: City of San Marcos *Transportation Impact Analysis Guidelines* (November 2020).



4.0 PROJECT VMT ANALYSIS

As described in the previous section, the Project does not meet any of the City’s screening criteria, and a detailed VMT analysis is required to evaluate the Project’s VMT per resident. This section presents the results of the VMT analysis based on the VMT per resident metric, with a significance threshold of 15 percent below the existing countywide average of 18.9 VMT per resident, which equates to 16.1 VMT/resident.

Using the SANDAG screening map for residential projects, the Project is located in census tract 200.2 and would be expected to generate 18.5 VMT/resident. This equates to 97.8% of the regional average VMT/resident.

Table 4–1 summarizes the VMT analysis results. As shown in *Table 4–1*, the Project is 12.8% over the City’s VMT threshold of 85% or less of the regional average. Therefore, the Project would have a significant VMT impact.

**TABLE 4–1
VMT ANALYSIS RESULTS**

VMT per Resident		
Geography	VMT per Resident	Exceeds Threshold?
San Diego Region	18.9	–
<i>Significance Threshold (85% of Regional Average VMT)</i>	16.1	–
Project Site		
Project Site	18.5 VMT (97.8% of regional average)	Yes
VMT Over / % Over	2.4 VMT / 12.8%	

Source: SANDAG San Diego Region SB743 VMT Maps

5.0 SIGNIFICANT VMT IMPACTS AND CONCLUSIONS

The Project will result in a significant VMT impact, and therefore, CEQA requires mitigation measures to be implemented to reduce or mitigate the impact. VMT is reduced by implementing strategies that reduce the number of automobile trips generated by the project, shift more trips from automobile to non-automobile modes, and/or reduce the distances that people drive. VMT reduction strategies from the City's *Transportation Impact Analysis Guidelines* are included in *Appendix A*.

Applicable VMT reduction strategies from the City's *Transportation Impact Analysis Guidelines* would not be enough to fully mitigate the significant VMT impact. The Project is 12.8% over the City's VMT threshold of 85% or less of the regional average and therefore must demonstrate a quantifiable reduction in Project related VMT of 12.8% or more. Applicable VMT reduction options provided in the City's *Transportation Impact Analysis Guidelines* do not total a VMT reduction of 12.8%.

VMT reduction strategies from the California Air Pollution Control Officers Association (CAPCOA) *Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity*, October 2024, were also reviewed. Measure T-14: *Provide Electric Vehicle Charging Infrastructure*; Measure T-18: *Provide Pedestrian Network Improvements*; and Measure T-23: *Provide Community Based Travel Planning* are applicable to the Project and were found to result in a *maximum* total VMT reduction of 12.67% based on the CAPCOA provided reduction formulas. A VMT reduction of 12.8% is required to fully mitigate the Project's significant VMT impact, and therefore the significant impact is not considered fully mitigated. VMT reduction strategies from the CAPCOA *Handbook* and Project specific VMT reduction calculations are included in *Appendix B*.

Since the Project cannot demonstrate a quantifiable reduction in Project related VMT of 12.8% or more, the Project would result in a significant unmitigated VMT impact. While a significant unmitigated VMT impact is identified, it's important to note that the Project will implement a variety of measures designed to enhance and encourage non-vehicular modes of travel thereby reducing VMT, including the following:

- ***Pedestrian Access with Internal and External Connections and Sidewalk Connections:*** the Project's pedestrian facilities will be designed to encourage walking by being well-lit, ADA accessible, and with features such as landscaping to improve the walking experience.

Project improvements include right of way dedication; signalization of the Project driveway including the provision of high visibility sidewalks and high visibility curb ramps with truncated domes; landscaped buffers between the sidewalk and vehicular traffic on Twin Oaks Valley Road; public park dedication; direct pedestrian public park access; pedestrian public trail access and traffic calming measures, as shown in *Appendix C*.

- ***Secure Bike Parking Spaces/Racks:*** the Project will provide bike parking as required by the City, as shown in *Appendix C*.

- ***Bike Repair stations:*** The Project will provide two (2) on-site bike repair stations, as shown in *Appendix C*.
- ***Off-Site Pedestrian Supportive Strategies: Sidewalk Connections:*** The Project will provide a public trail connection to Owens Peak (“P Mtn) from the fronting sidewalk, as shown in *Appendix C*.
- ***Off-Site Pedestrian Supportive Strategies: Bulbouts and Curb Extensions:*** The Project will provide bulbouts and curb extensions to facilitate traffic calming, as shown in *Appendix C*.
- ***Off-Site Bicycle Infrastructure:*** The Project will improve the existing multi-trail on the west side of Twin Oaks Valley Road to provide an improved 11’ wide Class I bike/pedestrian combo trail fronting the public park, connecting to the existing trail to the north and the Class II bike lanes to the south, as shown in *Appendix C*.
- ***Provision of a Public Park and Dedication of Right-of Way:*** The Project will provide an approximately 6.6-acre public park. The park will be available to residents of the Project as well as to the surrounding community, thereby reducing the need to drive to access similar land use types and reducing the number of vehicular trips made by residents of the Project, the surrounding neighborhood, and the City overall.
- ***Provision of an Enhanced Crossing:*** The Project will provide an enhanced crosswalk across Twin Oaks Valley Road at the Project’s proposed traffic signal. The enhanced crossing will include a protected landing within the median of the Project-provided crosswalk to serve pedestrians, bicyclists, equestrian users and any others crossing Twin Oaks Valley Road but unable to make it across in one crossing phase, as shown in *Appendix C*.
- ***On-Site TDM Coordinator:*** A TDM coordinator will be appointed by the homeowner’s association.
- ***Information Center for Transportation Alternatives:*** the Project will provide a web-based information center to promote and provide information for alternative mobility options.

Additional information on the Project’s VMT reducing measures is in the Project’s *Transportation Demand Management Plan*, prepared by LLG under separate cover.



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TECHNICAL APPENDICES TO THE VEHICLE MILES TRAVELED
OAK CREST SPECIFIC PLAN
San Marcos, California
December 2025

LLG Ref. 3-25-4059

APPENDICES

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- A. City of San Marcos VMT Mitigation
- B. CAPCOA '*Handbook*' Excerpts and VMT Reduction Calculations
- C. Project TDM and Traffic Calming Measures



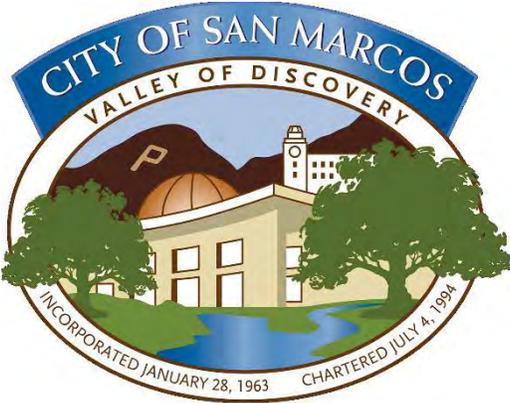
APPENDIX A

CITY OF SAN MARCOS VMT MITIGATION



TRANSPORTATION IMPACT ANALYSIS GUIDELINES

City of San Marcos, CA



November 16, 2020

Attachment C: VMT Mitigation

MEMORANDUM

Date: October 9, 2020

Project #24296

To: City of San Marcos

From: Michael Sahimi

Project: City of San Marcos SB 743 Implementation

Subject: VMT Mitigation Measures

With the passage of Senate Bill (SB) 743 in 2013, and the adoption of the City's updated transportation impact analysis guidelines in 2020, the basis for measuring significant transportation impacts for development projects under the California Environmental Quality Act (CEQA) has shifted from level of service (LOS) and automobile delay to vehicle miles traveled (VMT). This shift in focus from reducing impact to drivers to reducing the impact of driving better aligns with the State's goals to reduce greenhouse gas (GHG) emissions and encourage infill development and active transportation.

When projects under CEQA review are found to result in significant impacts to the environment, the lead agency must consider mitigation measures that would reduce the impact to below significant levels. With the shift away from LOS, delay, and vehicular capacity metrics and impact thresholds to VMT thresholds, mitigating significant impacts now requires focusing on measures to shorten vehicle trip distances or reduce single-occupancy vehicle trips (in favor of carpooling, taking public transit, bicycling, walking, and other modes), since VMT in essence is a function of the number of vehicle trips and their associated trip lengths. Whereas previous LOS-related mitigation measures focused on expanding roadway facilities primarily for vehicles, VMT-reducing mitigation measures can include modifying project characteristics, implementing on- or off-site improvements to transit, pedestrian and bicycle facilities, parking management strategies, and Transportation Demand Management (TDM) strategies to either reduce or shorten vehicular trips. In particular, TDM can reduce travel by single-occupancy vehicles by expanding traveler choices and encouraging ridesharing, carpooling, bicycling, walking, and riding transit. TDM strategies are among the most effective at reducing VMT impacts for land development projects at the project level.

This memorandum documents VMT mitigation strategies that Kittelson has determined can be applicable to projects in the City of San Marcos, based on a review of relevant literature and research. The selected strategies, as well as the applicable VMT reduction percentages and other attributes, are primarily based on a review of the guidance published by the California Air Pollution Control Officers Association (CAPCOA) in August 2010 (*Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures*). This resource forms the basis for much of the TDM and VMT mitigation research and policymaking in the state. The

recommendations in this memo are also based on more recent information, such as recent research published by the San Diego Association of Governments (SANDAG) in June 2019 (*Mobility Management Guidebook* and *Mobility Management VMT Reduction Calculator Tool – Design Document*), California Air Resources Board (CARB) in 2014, Western Riverside Council of Governments (WRCOG) in March 2019, and City of San Jose in February 2018.

VMT mitigation measures that can be applicable to projects in the City are provided in Table 1. Information provided in the table includes the following:

- **Tier:** Mitigation measures can fall within one of two categories – Project Tier (strategies that would be implemented at a project site) and City/Community Tier (strategies that would be implemented at a community or citywide scale).
- **Measure Category:** Measures consist of multiple categories including commute strategies (aimed at employee trips), parking policies and programs (can apply to multiple land use and trip types), transit improvements (can include networkwide service and/or fare changes), neighborhood enhancements (to improve multimodal connectivity), and land use and location strategies (involve project location and land use mix).
- **Description:** A detailed description is included for each measure, including requirements to successfully implement the measure. In addition, some measures may overlap and should not be analyzed together as part of a mitigation program; this information is also included.
- **Range of Reductions:** The maximum allowable reduction per each measure is provided.
- **Land Use Applicability:** The applicable land use for each measure (primarily consisting of residential, office/employment, and retail) is provided. It is important to note that some measures may not be applicable to all project types; for example, commute trip reduction measures cannot be applied to residential projects.
- **Implementation Body:** The appropriate implementation body or bodies are included for each measure. For example, some measures are under the purview of the City or local transit agencies such as NCTD. Physical on-site improvements are generally implemented by the site developer. Programs or other continuous measures would generally be implemented by tenants or other bodies (such as homeowners associations).
- **Source:** For each measure, the source for the appropriate methodology and VMT reduction formula is included.

It is important to note that reductions between multiple measures are not additive, and the sum of VMT reductions across measures must be dampened using the following formula per CAPCOA:

$$\text{Total VMT Reduction \%} = 1 - (1 - A) * (1 - B) * (1 - C) * \dots$$

Where A, B, and C represent the reduction percentages from individual strategies

This calculation should be applied within each category, and then across all five categories to obtain the total VMT reduction percentage for a project undergoing VMT mitigation. For example, if an applicant estimates reductions from four mitigation measures (5% from Land Use and Location: Increase Site

Density, 8% from Land Use and Location: Major Transit Center Accessibility, 10% from Parking Management Strategies: Parking Supply Limits, and 3% from Parking Management Strategies: Parking Pricing), then the calculations would be as follows:

$$\text{Total Land Use and Location Strategies Reduction \%} = 1 - (1 - 5\%) * (1 - 8\%) = 12.6\%$$

$$\text{Total Parking Management Strategies Reduction \%} = 1 - (1 - 10\%) * (1 - 3\%) = 12.7\%$$

$$\text{Total Global VMT Reduction \%} = 1 - (1 - 12.6\%) * (1 - 12.7\%) = \underline{\mathbf{23.7\%}}$$

In addition, it is important to note that this is a limit to the amount of VMT reduction that can be applied to a development project. Within the City of San Marcos, with its suburban land use and transportation context, CAPCOA indicates that the maximum feasible total reduction combining all measures is 15%. There are also maximum feasible reductions within and across the five mitigation categories; these are indicated in Table 2. Care should be taken that any calculated VMT reductions do not exceed these maximums. In the example above, in a suburban setting the Land Use and Location strategies reduction of 12.6% would be capped at 5%, and the total reduction would be capped at 15%.

At this time, several VMT-reducing measures are already required for new developments by the City's Municipal Code, which should be considered project features to be applied during a project's VMT impact assessment and should not be used as part of mitigation calculations:

- Chapter 20.340.050 requires trip reduction measures for all major non-residential development projects and the non-residential portions of mixed-use development projects that exceed 25,000 square feet of gross floor area. Requirements include preferential carpool/vanpool parking, passenger loading areas, and shower or locker facilities. Developments that provide more shower and storage locker facilities or secure bicycle parking than required may reduce their parking requirement.
- Chapter 20.340.090 requires bicycle parking spaces in compliance with the minimum requirements listed in the Municipal Code.

iCommute (www.icommutesd.com) is the transportation demand management program for San Diego County. It provides valuable resources and assistance that can be utilized by developers and tenants looking to implement TDM programs. iCommute has an employer services program which provides assistance and tools to help organizations design and implement commuter programs. In addition, iCommute provides the following items:

- information about carpool services and a carpool incentive pilot program
- subsidized vanpool program and transit passes
- regional support for biking
- the Guaranteed Ride Home program
- information about teleworking
- bike and pedestrian safety support for schools

Table 1: Applicable VMT Reduction Strategies

Tier and Category	Mitigation Measure	Description	Maximum VMT Reduction	Land Use Applicability	Implementation Body/Method	Source
Project Tier: Land Use and Location	Increase Site Density	This measure increases the density of households and employment per acre for the project site over what was used in the initial project VMT estimation. Density can be measured in terms of jobs, residents, employees, or dwelling units per unit area. Floor area ratio may be used as a proxy for employment, when employment is not known, or when considering non-office commercial developments.	Up to 30%	Residential, Office, Retail	Developer, City	CAPCOA (1.1)
	Increase Site Diversity	This measure involves improving the mix of uses and jobs/housing balance within a project or a planning area, incorporating a range of complementary land uses that provide a balanced development approach relative to the surrounding neighborhood and encourage shorter trips and transportation alternatives.	Up to 30%	Residential, Office, Retail	Developer, City	SANDAG (2B)
	Major Transit Center Accessibility	This measure locates a project within half a mile or a ten minute walk of a major transit center, defined as a rail transit station or a bus rapid transit station, but can be any transit stop with frequent service (5 to 15 minute headways) and significant transfer opportunities to other transit routes. Residential and commercial centers designed around rail and bus stations are known as Transit-Oriented Development and contain bike and pedestrian access.	Up to 14.4%	Residential, Office, Retail	Developer, City	SANDAG (2A)
	Integrate Affordable Housing	This measure incorporates a higher proportion of affordable housing within the residential portion of a project, subdivision, or a planning area. Income has a statistically significant effect on whether someone will drive a single-occupant vehicle to work or for other trip purposes.	Up to 32.5% of home VMT	Residential, Office, Retail	Developer, City	San Jose (PC-003)
Project Tier: Commute Demand Management Strategies	Voluntary Employer Commute Program	This measure consists of a variety of measures to reduce single-occupant vehicle commuting through an employer, such as carpool/vanpool programs, subsidized transit passes, preferential carpool parking, bicycle facilities, and flexible work schedules. Unlike a mandatory program, this strategy does not require monitoring, reporting, or performance standards. Note, this measure cannot be analyzed in combination with a mandatory employer commute program. In addition, separate commute demand management measures should not be analyzed if already included under this measure.	Up to 6.2% of work VMT	Office, Retail	Tenant	SANDAG (1A)

Tier and Category	Mitigation Measure	Description	Maximum VMT Reduction	Land Use Applicability	Implementation Body/Method	Source
	Mandatory Employer Commute Program	This measure consists of a variety of measures to reduce single-occupant vehicle commuting through an employer, such as carpool/vanpool programs, subsidized transit passes, preferential carpool parking, bicycle facilities, and flexible work schedules. Unlike a voluntary program, this strategy requires regular monitoring, reporting, and performance standards. Note, this measure cannot be analyzed in combination with a voluntary employer commute program. In addition, separate commute demand management measures should not be analyzed if already included under this measure.	Up to 26% of work VMT	Office, Retail	Tenant	SANDAG (1B)
	Employer Carpool/Vanpool Program	This measure consists of supporting ride sharing through more convenient pick up/drop off locations, parking locations during workdays, and subsidies. Employers can encourage vanpooling and carpooling by providing ride-matching assistance, priority parking for carpool/vanpool vehicles, incentives, and subsidies.	Up to 7.1% of work VMT	Office, Retail	Tenant (in partnership with City or other agencies)	SANDAG (1E)
	Employer Transit Subsidy	This measure consists of employer-provided subsidized or discounted daily or monthly transit passes to employees; the employer would pay for a portion or the entirety of an employee's transit costs.	Up to 10.9% of work VMT	Office, Retail	Tenant (in partnership with transit agencies)	SANDAG (1D)
	Employer Telecommute and Alternative Work Schedules	This measure involves encouraging and supporting employers and employees interested in telecommuting or working alternative work schedules. It involves marketing, equipment, and infrastructure to support telecommuting. A telework program enables employees to work from home or a remote location one or more days per week. Alternative work schedules are usually compressed work weeks that allow workers to reduce the number of commute trips they make.	Up to 5.5% of work VMT	Office	Tenant	CAPCOA (4.6)/San Jose (TP-008)
	School Bus Program/ School Pool Program	This measure consists of two types of programs: supporting expanded school bus programs, or organizing groups of volunteer parents to provide shared rides to school. Developers and the City can work with school districts to expand school bus services in the project area and local community; alternatively, school carpool programs can fill service gaps for school buses.	Up to 6.3% of school VMT (school bus); Up to 15.8% of school VMT (school pool)	Residential	Developer, City	CAPCOA (4.10/4.13)
Project Tier: Parking Management Strategies	Parking Cash Out	This measure consists of providing cash to employees for not parking a vehicle on site, if free parking is provided for employees and is paid for by the employer. The cash payment would consist of the cash value of the space in lieu of the space itself. This measure can be used where free parking is prevalent and it is not feasible to directly charge for parking.	Up to 7.7% of work VMT	Office, Retail	Property Manager, Tenant	CAPCOA (4.15)

Tier and Category	Mitigation Measure	Description	Maximum VMT Reduction	Land Use Applicability	Implementation Body/Method	Source
	Parking Pricing	This measure consists of charging drivers directly for parking. Parking pricing can be implemented on- or off-street. This measure can be implemented in several ways, including implementing residential parking permit programs, unbundling parking costs from rent or property costs, charging for on-street parking, and charging for workplace parking.	Up to 7.5%	Residential, Office, Retail	Property Manager, Tenant, City	SANDAG (3A)
	Parking Supply Limits	This measure sets the amount of available on-site and on-street parking available at some level below current peak demand. This measure can be implemented in several ways, including eliminating or reducing minimum parking requirements, establishing maximum parking requirements, requiring shared parking between different uses, limiting parking to residents with permits, and establishing parking time limits.	Up to 12.5%	Residential, Office, Retail	Developer, City	CAPCOA (3.1)
City/Community Tier: Transit Strategies	New Transit Service and Coverage	This measure involves expanding transit service in terms of areas and/or times of day being served, in order to better accommodate existing and future demand and encourage a shift away from driving. This can include creating new transit routes.	Up to 5.9%	Residential, Office, Retail	City, Transit Agencies	SANDAG (5A)
	Reduce fares	This measure consists of lowering transit fares in specific zones or across the transit system service area to make transit accessible to an increased number of users. Unlike the Employer Transit Subsidy, this measure is not limited to a single project site and reduces fares rather than providing discounts or subsidies.	Up to 1.2%	Residential, Office, Retail	City, Transit Agencies	SANDAG (5D)
	Increased Transit Service Frequency	This measure consists of measures to increase the frequency of service on transit routes to improve the viability of taking public transit as an alternative to driving. Measures can be implemented systemwide or on specific routes to reduce headways and increase ridership by reducing travel times.	Up to 8.2%	Residential, Office, Retail	City, Transit Agencies	SANDAG (5B)
	Increased Transit Speed and Reliability	This measure consists of roadway, traffic control, and other infrastructure improvements that expedite transit service and improve schedule adherence (reliability). Transit supportive treatments to increase transit vehicle speed and service reliability can include transit signal priority, bus-only signal phases, queue jumps, curb improvements to increase the speed of passenger loading, and dedicated bus lanes.	Up to 0.4%	Residential, Office, Retail	City, Transit Agencies	SANDAG (5C)

Tier and Category	Mitigation Measure	Description	Maximum VMT Reduction	Land Use Applicability	Implementation Body/Method	Source
	Microtransit NEV Shuttle	Microtransit services use real-time ride-hailing, mobile tracking, and app-based payment to provide demand-based services to user; this can include services utilizing Neighborhood Electric Vehicles (NEVs). Microtransit services are flexible and can consist of point-to-point shuttles or first/last-mile shuttles connecting with major transit hubs to provide an alternative to short vehicle trips.	Up to 0.1%	Residential, Office, Retail	Property Manager, Tenant, City, Transit Agencies	SANDAG (5E)
City/Community Tier: Neighborhood Circulation Enhancements	Improved Street Connectivity	This measure consists of strategies to improve street connectivity by increasing the density of publicly accessible streets, resulting in shorter block lengths between intersections to shorten trip lengths to increase the comfort and connectivity of pedestrians and bicyclists.	Up to 6%	Residential, Office, Retail	Developer, City	SANDAG (4A)/San Jose (MI-003)
	Pedestrian and Bicycle Facility and Network Improvements	This strategy improves the accessibility, convenience, and perceived safety of sidewalks, bicycle lanes, and pedestrian/bicycle paths. Improvements to the pedestrian/bicycle network include removing physical barriers, adding crossing infrastructure, widening sidewalks and bike lanes, and creating network links. This consists of three types of improvements: <ul style="list-style-type: none"> • Pedestrian facility improvements (enhancing the existing streetscape and adding crossing improvements) • Bikeway network expansion (increasing the existing network of on- or off-street bikeways) • Bike facility improvements (implementing new bikeways) 	Up to 1.4% (pedestrian facility improvements); Up to 5.0% (bikeway network expansion); Up to 0.3% (individual bike facility improvement)	Residential, Office, Retail	Developer, City	SANDAG (4B/4C/4D)
	Support Bike Share	This measure consists of supporting bike sharing through parking facilities and subsidies. This can include partnering with docked and dockless bicycle, e-bike, and scooter share companies to provide on-demand active transportation options to residents and employees. Employers and cities can support these programs by providing bicycle parking, marketing bike share services, and subsidizing user cost.	Up to 0.1%	Residential, Office, Retail	Property Manager/HOA, Tenant, Developer, City	SANDAG (4E)
	Car Share	This measure consists of supporting car sharing through priority parking facilities and membership discounts and subsidies. This measure can help reduce automobile ownership. Types of carshare programs can include one-way (free-floating) programs that allow users to leave their vehicle at their final destination (without returning it to the origin) while roundtrip programs require users to return the vehicle to a designated location.	Up to 0.7%	Residential, Office, Retail	Property Manager/HOA, Tenant, Developer, City	SANDAG (4F)

Tier and Category	Mitigation Measure	Description	Maximum VMT Reduction	Land Use Applicability	Implementation Body/Method	Source
	Traffic Calming	<p>This measure consists of strategies to reduce the speeds of vehicle traffic on the street and improve the lateral separation between bicyclists, pedestrians, and motor vehicles; such strategies increase bicyclist and pedestrian comfort and can encourage a shift away from driving for shorter trips. Traffic calming strategies can include:</p> <ul style="list-style-type: none"> • Narrowing roadways • Vertical deflection such as speed bumps, humps, or tables • Horizontal deflection • Enforcement and education • Lowering speed limits 	Up to 1%	Residential, Office, Retail	Developer, City	CAPCOA (2.2)
	Community-Based Travel Planning	<p>This measure consists of an agency- or HOA-sponsored TDM program; unlike the Voluntary Employer Commute Program and Mandatory Employer Commute Program, this measure is focused on residents. The organization responsible for operating the TDM program utilizes advisors to engage residents and provide information, incentives, and support to encourage residents and visitors to use alternative modes of travel. It may or may not be monitored with reduction targets.</p>	Up to 2%	Residential	Property Manager/HOA, Tenant, Developer, City	SANDAG (4G)
	NEV Network	<p>This measure consists of establishing a neighborhood electric vehicle (NEV) network. NEVs are low speed vehicles which are electric powered, offering an alternative to traditional vehicle trips and can legally be used on roadways with speed limits of 35 MPH or less (unless specifically restricted). Creating an NEV network requires implementing the necessary infrastructure, including NEV parking, charging facilities, striping, signage, and educational tools.</p>	Up to 13%	Residential	Property Manager/HOA, Tenant, Developer, City	CAPCOA (2.3)
	Cordon Pricing	<p>This strategy consists of levying a toll on motor vehicles seeking to enter a specific area, such as a downtown area. The cordon pricing system would be set up to cover all entry points to the area, with funds potentially being utilized to improve multimodal facilities in the area.</p>	Up to 22%	Residential, Office, Retail	City	CAPCOA (6.1)

Table 2: Maximum VMT Reductions (Suburban Areas)

Max Category Reductions			Max Cross-Category Reductions	Global Max Reduction
Project Tier	Commute Demand Management Strategies (including Parking Cash Out)	25% (work VMT)	15% overall; 25% work VMT; 65% school VMT 10% without NEV; 15% with NEV (all VMT)	15% without NEV; 20% with NEV (all VMT)
	Parking Management Strategies (excluding Parking Cash Out)	20%		
	Land Use and Location	5%		
City/Community Tier	Transit Strategies	10%		
	Neighborhood Circulation Enhancements (excluding Cordon Pricing)	5% without NEV; 15% with NEV		
	Cordon Pricing	22%		

Source: California Air Pollution Control Officers Association (CAPCOA) *Quantifying Greenhouse Gas Mitigation Measures: A Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures* (August 2010)

Note: NEV signifies the Neighborhood Electric Vehicle network mitigation measure, which is within the Neighborhood Circulation Enhancements category.



APPENDIX B

CAPCOA 'HANDBOOK' EXCERPTS AND VMT REDUCTION CALCULATIONS

Maximum VMT Reduction Calculations: CAPCOA

- T-18: Provide Pedestrian network improvements (*up to 6.4%*)
- T-14: Provide Electric Vehicle Charging Infrastructure (*4.5%*)
- T-23: Provide Community Based Travel Planning (*up to 2.3%*)
- **Total VMT reduction if max of the above is obtained = $1-(1-0.064)*(1-0.045)*(1-0.023) = 12.67\%$**

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

Designed for Local Governments, Communities, and Project Developers



T-14. Provide Electric Vehicle Charging Infrastructure



GHG Mitigation Potential



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 ₂ e 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 ₂ e per megawatt hour (MWh)	CA Utilities 2021
J	Average emission factor of non-electric vehicles accessing the site	307.5	g CO ₂ e 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).



- (F) – A review of EV user surveys and analytics included in the CARB’s *Advanced Clean Cars Mid-Term Report* suggest that PHEV owners can reach 80 percent eVMT with access to adequate supportive charging infrastructure (CARB 2017).
- (G) – As described for (J), the average GHG emission factor for gasoline vehicles is 307.5 grams of CO_{2e} per mile.
- The fuel efficiency of a PHEV in gasoline mode is calculated as 66.7 percent of the fuel consumption rate of a gasoline vehicle, based on the assumption that a gasoline hybrid vehicle has 50 percent higher fuel economy (miles per gal [mpg]) than a comparable gasoline vehicle, based on a comparison of the gasoline and hybrid Toyota Camry and Corolla models (U.S. DOE 2021). This percentage is applied to the average GHG emission factor for gasoline vehicles to determine the average emission factor for PHEVs in gasoline mode as (66.7%×307.5 g CO_{2e} per mile). If the user can provide a project-specific value by running EMFAC based on the future year of a project, they should replace the default in the GHG reduction formula.
- (H) – Scaled from a light-duty automobile gasoline equivalent fuel economy 30.3 mpg (CARB 2020a), an energy efficiency ratio (EER) of 2.5 (CARB 2020b), and an assumption of 33.7 kWh electricity per gallon of gasoline (U.S. DOE 2021).
- (I) – GHG intensity factors for major California electricity providers are provided in Tables E-4.3 and E-4.4 in Appendix C. If the project study area is not serviced by a listed electricity provider, or the user is able to provide a project-specific value (i.e., for the future year not referenced in Appendix C), the user should replace the default in the GHG calculation formula. If the electricity provider is not known, the user may elect to use the statewide grid average carbon intensity.
- (J) – The average GHG emission factor for non-electric vehicles accessing the site was calculated in terms of CO_{2e} per mile using EMFAC2017 (v1.0.3). The model was run for a 2020 statewide average of LDA, LDT1, and LDT2 vehicles using diesel and gasoline fuel. The running emission factors for CO₂, CH₄, and N₂O (CARB 2020a) were multiplied by the corresponding 100-year GWP values from the IPCC’s Fourth Assessment Report (IPCC 2007). If the user can provide a project-specific value (i.e., for a future year and project location), the user should run EMFAC to replace the default in the GHG reduction formula.

GHG Calculation Caps or Maximums

Measure Maximum

(A_{max}) The percent reduction in GHG emissions (A) is capped at 11.9 percent, which is based on the following assumptions used to generate a maximum scenario:

- (B) – number of chargers installed = 20. CALGreen provides a non-residential voluntary Tier 2 measure that requires projects with 201 or more parking spaces to allocate 10 percent of total parking spaces for “EV Capable” parking spaces (or 20 parking spaces) (CBSC 2019). Note that EV Capable parking spaces do not actually have EV chargers installed, though they do have electrical panel capacity, a dedicated branch circuit, and a raceway to the EV parking spot to support future installation of charging stations. Therefore, using the number of EV Capable parking spaces as a proxy for EV chargers as a high-end estimate is conservative.



- (C) – total vehicles accessing the site = 200. Per the CALGreen voluntary measure, the number of total parking spaces that correspond with 20 “EV Capable” parking spaces is 201.
- (D) – PHEVs served per day per charger installed = 7. This value is the max (D_{max}). This assumes that all PHEV drivers would coordinate sharing of the limited number of chargers at the site. Value is based on data from the National Renewable Energy Laboratory (CARB 2019).
- (I) – carbon intensity of local electricity provider = 0 lb CO_{2e} per MWh. This assumes that the local electricity provider is powered 100 percent by renewables and thus has a carbon intensity of zero.

Subsector Maximum

($\sum A_{max_{T-14 \text{ through } T-16}} \leq 35\%$) This measure is in the Parking or Road Pricing/Management subsector. This subcategory includes Measures T-14 through T-16. The VMT reduction from the combined implementation of all measures within this subsector is capped at 35 percent.

Example GHG Reduction Quantification

The user will install electric vehicle chargers at their proposed office or multifamily housing development, which will enable employees or residents with PHEVs to drive a larger share of miles in electric mode, as opposed to gasoline-powered mode, thereby displacing GHG emissions from gasoline consumption with a lesser amount of indirect emissions from indirect electricity. In this example, 20 chargers (B) will be installed at a workplace with 200 daily employee vehicles accessing the site (C). The electricity provider for the project area is the Sacramento Municipal Utility District (SMUD) and the analysis year is 2022. The carbon intensity of electricity is therefore 344 lb CO_{2e} per MWh (I). The GHG impact is calculated as a 3.4 percent reduction from the total emissions from vehicles accessing the site.

A =

$$\frac{20 \times 2 \frac{\text{PHEVs}}{\text{charger} \cdot \text{day}} \times (80\% - 46\%) \times (205.1 \frac{\text{g CO}_2\text{e}}{\text{miles}} - (0.327 \frac{\text{kWh}}{\text{mile}} \times 344 \frac{\text{lb CO}_2\text{e}}{\text{MWh}} \times 454 \frac{\text{g}}{\text{lb}} \times 0.001 \frac{\text{MWh}}{\text{kWh}}))}{-200 \text{ vehicles} \times 307.5 \frac{\text{g CO}_2\text{e}}{\text{miles}}} = 3.4\%$$

Quantified Co-Benefits

While the measure will achieve fuel savings, it will also increase electricity consumption. This section defines the methods for quantifying Improved Local Air Quality and fuel savings, as well as increased electricity consumption.



Improved Local Air Quality

Local criteria pollutants will be reduced by the reduction in fossil fuel combustion. The percent reduction in criteria pollutants can be calculated using the GHG reduction formula. Electricity supplied by statewide fossil-fueled or bioenergy power plants will generate criteria pollutants. However, because these power plants are located throughout the state, electricity consumption from vehicles charging will not generate localized criteria pollutant emissions. Consequently, for the quantification



of criteria pollutant emission reductions, either the electricity portion of the equation can be removed, or the electricity intensity (I) can be set to zero.



Fuel Savings (Increased Electricity)

The percent reduction in vehicle fuel consumption would be the same as the percent reduction in criteria pollutant emissions. The percent increase in electricity use (M) from this measure can be calculated as follows.

Electricity Use Increase Formula

$$M = \frac{B \times D \times (F - E) \times J \times N \times O}{-C \times P}$$

Electricity Use Increase Calculation Variables

ID	Variable	Value	Unit	Source
Output				
M	Increase in electricity from PHEVs	[]	%	calculated
User Inputs				
N	Existing electricity consumption of project/site	[]	kWh per year	user input
O	Days per year with vehicles accessing the site	260–365	days per year	user input
P	Average annual VMT of vehicles accessing the site	[]	miles per day per vehicle	user input
Constants, Assumptions, and Available Defaults				
None				

Further explanation of key variables:

- (N) – The user should take care to properly quantify building electricity using accepted methodologies (such as CalEEMod).
- (O) – If the proposed development is a workplace in which employees access the site an average of 5 days per week, the user should input 260 workdays. If the development is multifamily dwelling, the user should input 365 days.
- Please refer to the GHG Calculation Variables table above for definitions of variables that have been previously defined.

Sources

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T-18. Provide Pedestrian Network Improvement



GHG Mitigation Potential



Up to 6.4% of GHG emissions from vehicle travel in the plan/community

Co-Benefits (icon key on pg. 34)



Climate Resilience

Improving pedestrian networks increases accessibility of outdoor spaces, which can provide health benefits and thus improve community resilience. This can also improve connectivity between residents and resources that may be needed in an extreme weather event.

Health and Equity Considerations

Ensure that the improvements also include accessibility features to allow for people of all abilities to use the network safely and conveniently. Ensure that sidewalks connect to nearby community assets, such as schools, retail, and healthcare.

Measure Description

This measure will increase the sidewalk coverage to improve pedestrian access. Providing sidewalks and an enhanced pedestrian network encourages people to walk instead of drive. This mode shift results in a reduction in VMT and GHG emissions.

Subsector

Neighborhood Design

Locational Context

Urban, suburban, rural

Scale of Application

Plan/Community

Implementation Requirements

The GHG reduction of this measure is based on the VMT reduction associated with expansion of sidewalk coverage expansion, which includes not only building of new sidewalks but also improving degraded or substandard sidewalk (e.g., damaged from street tree roots). However, pedestrian network enhancements with non-quantifiable GHG reductions are encouraged to be implemented, as discussed under *Expanded Mitigation Options*.

Cost Considerations

Depending on the improvement, capital and infrastructure costs may be high. However, improvements to the pedestrian network will increase pedestrian activity, which can increase businesses patronage and provide a local economic benefit. The local municipality may achieve cost savings through a reduction of cars on the road leading to lower infrastructure and roadway maintenance costs.

Expanded Mitigation Options

When improving sidewalks, a best practice is to ensure they are contiguous and link externally with existing and planned pedestrian facilities. Barriers to pedestrian access and interconnectivity, such as walls, landscaping buffers, slopes, and unprotected crossings should be minimized. Other best practice features could include high-visibility crosswalks, pedestrian hybrid beacons, and other pedestrian signals, mid-block crossing walks, pedestrian refuge islands, speed tables, bulb-outs (curb extensions), curb ramps, signage, pavement markings, pedestrian-only connections and districts, landscaping, and other improvements to pedestrian safety (see Measure T-35, *Provide Traffic Calming Measures*).





GHG Reduction Formula

$$A = \left(\frac{C}{B} - 1 \right) \times D$$

GHG Calculation Variables

ID	Variable	Value	Unit	Source
Output				
A	Percent reduction in GHG emissions from household vehicle travel in plan/community	0–6.4	%	calculated
User Inputs				
B	Existing sidewalk length in study area	[]	miles	user input
C	Sidewalk length in study area with measure	[]	miles	user input
Constants, Assumptions, and Available Defaults				
D	Elasticity of household VMT with respect to the ratio of sidewalks-to-streets	-0.05	unitless	Frank et al. 2011

Further explanation of key variables:

- (B and C) – Sidewalk length should be measured on both sides of the street. For example, if one 0.5-mile-long street has full sidewalk coverage, the sidewalk length would be 1.0 mile. If there is only sidewalk on one side of the street, the sidewalk length would be 0.5 mile. The recommended study area is 0.6 mile around the pedestrian network improvement. This represents a 6- to 10-minute walking time.
- (D) – A study found that a 0.05 percent decrease in household vehicle travel occurs for every 1 percent increase in the sidewalk-to-street ratio (Frank et al. 2011; Handy et al. 2014).

GHG Calculation Caps or Maximums

Measure Maximum

(A_{\max}) The percent reduction in GHG emissions (A) is capped at 3.4 percent, which is based on the following assumptions:

- 35.2 percent of vehicle trips are short trips (2 mile or less, average of 1.29 miles) and thus could easily shift to walking (FHWA 2019).
- 64.8 percent of vehicle trips are longer trips that are unlikely to shift to walking (2 miles or more, average of 10.93 miles) (FHWA 2019).
- So $A_{\max} = \frac{35.2\% \times 1.29 \text{ miles}}{64.8\% \times 10.93 \text{ miles}} = 6.4\%$



Subsector Maximum

($\sum A_{\text{maxT-18 through T-22-D}} \leq 10\%$) This measure is in the Neighborhood Design subsector. This subcategory includes Measures T-18 through T-22-D. The VMT reduction from the combined implementation of all measures within this subsector is capped at 10 percent.

Example GHG Reduction Quantification

The user reduces household VMT by improving the pedestrian network in the study area. In this example, the existing sidewalk length (B) is 9 miles, and the sidewalk length with the measure (C) would be 10 miles. With these conditions, the user would reduce GHG emissions from household VMT within the study area by 0.6 percent.

$$A = \left(\frac{10 \text{ miles}}{9 \text{ miles}} - 1 \right) \times -0.05 = -0.6\%$$

Quantified Co-Benefits



Improved Local Air Quality

The percent reduction in GHG emissions (A) would be the same as the percent reduction in NO_x, CO, NO₂, SO₂, and PM. Reductions in ROG emissions can be calculated by multiplying the percent reduction in GHG emissions (A) by an adjustment factor of 87 percent. See *Adjusting VMT Reductions to Emission Reductions* above for further discussion.



Energy and Fuel Savings

The percent reduction in vehicle fuel consumption would be the same as the percent reduction in GHG emissions (A).



VMT Reductions

The percent reduction in household VMT would be the same as the percent reduction in GHG emissions (A).



Improved Public Health

Users are directed to the Integrated Transport and Health Impact Model (ITHIM) (CARB et al. 2020). The ITHIM can quantify the annual change in health outcomes associated with active transportation, including deaths, years of life lost, years of living with disability, and incidence of community and individual disease.

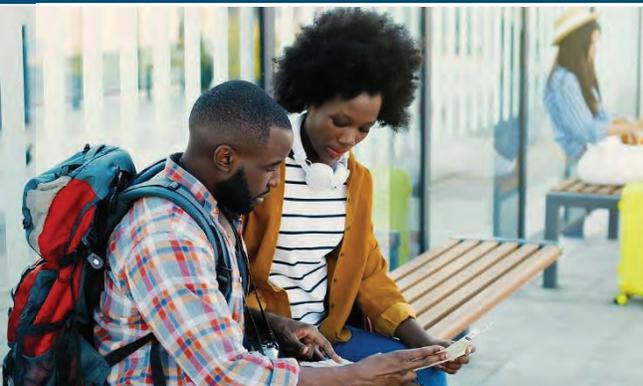
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T-23. Provide Community-Based Travel Planning



GHG Mitigation Potential



Up to 2.3% of GHG emissions from vehicle travel in the plan/community

Co-Benefits (icon key on pg. 34)



Climate Resilience

CBTP can decrease vehicle use and thus improve air quality, resulting in health impacts that may increase the resilience of communities near freeways and roads. This can also increase the adaptive capacity of communities by informing them of travel alternatives if certain modes become disrupted due to extreme events.

Health and Equity Considerations

Outreach materials may need to be in multiple languages to address diverse linguistic communities.

Measure Description

This measure will target residences in the plan/community with community-based travel planning (CBTP). CBTP is a residential-based approach to outreach that provides households with customized information, incentives, and support to encourage the use of transportation alternatives in place of single occupancy vehicles, thereby reducing household VMT and associated GHG emissions.

Subsector

Trip Reduction Programs

Locational Context

Urban, suburban

Scale of Application

Plan/Community

Implementation Requirements

CBTP involves teams of trained travel advisors visiting all households within a targeted geographic area, having tailored conversations about residents' travel needs, and educating residents about the various transportation options available to them. Due to the personalized outreach method, communities are typically targeted in phases.

Cost Considerations

The main cost consideration for CBTP is labor costs for program managers and resident outreach staff plus material costs for development of educational material. The beneficiaries are the commuters who may be able to reduce vehicle usage or ownership. The local municipality may achieve cost savings through a reduction of cars on the road leading to lower infrastructure and roadway maintenance costs.

Expanded Mitigation Options

Pair with any of the Measures from T-17 through T-22-D to ensure that residents that are targeted by CBTP who want to use alternative transportation have the infrastructure and technology to do so.





GHG Reduction Formula

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

GHG Calculation Variables

ID	Variable	Value	Unit	Source
Output				
A	Percent reduction in GHG emissions from household vehicle travel in plan/community	0–2.3	%	calculated
User Inputs				
B	Residences in plan/community	[]	residences	user input
C	Residences in plan/community targeted with CBTP	[]	residences	user input
Constants, Assumptions, and Available Defaults				
D	Percent of targeted residences that participate	19	%	MTC 2021
E	Percent vehicle trip reduction by participating residences	12	%	MTC 2021
F	Adjustment factor from vehicle trips to VMT	1	unitless	assumed

Further explanation of key variables:

- (D) – Results from program evaluations of CBTP in several counties in Washington and Oregon across multiple years indicate that an average of 19 percent of residences targeted will participate (MTC 2021).
- (E) – Results from program evaluations of CBTP in several counties in Washington and Oregon across multiple years indicate that a 12 percent vehicle trip reduction will occur among participating residences (MTC 2021).
- (F) – The adjustment factor from vehicle trips to VMT is 1. This assumes that all vehicle trips will average out to typical trip length (“assumes all trip lengths are equal”). Thus, it can be assumed that a percentage reduction in vehicle trips will equal the same percentage reduction in VMT.

GHG Calculation Caps or Maximums

Measure Maximum

(A_{max}) The maximum percent reduction in GHG emissions (A) is 2.3 percent. This maximum scenario is presented in the below example quantification.

Subsector Maximum

Same as (A_{max}). Measure T-23 is the only measure at the Plan/Community scale within the Trip Reduction Programs subsector.



Example GHG Reduction Quantification

The user reduces household VMT by having residences in the plan/community participate in CBTP. In this example, all of the residences in a city of 5,000 are targeted (B and C), which would reduce GHG emissions from citywide household VMT by 2.3 percent.

$$A = \left(\frac{5,000 \text{ residences}}{5,000 \text{ residences}} \right) \times 19\% \times -12\% \times 1 = -2.3\%$$

Quantified Co-Benefits



Improved Local Air Quality

The percent reduction in GHG emissions (A) would be the same as the percent reduction in NO_x, CO, NO₂, SO₂, and PM. Reductions in ROG emissions can be calculated by multiplying the percent reduction in GHG emissions (A) by an adjustment factor of 87 percent. See *Adjusting VMT Reductions to Emission Reductions* above for further discussion.



Energy and Fuel Savings

The percent reduction in vehicle fuel consumption would be the same as the percent reduction in GHG emissions (A).



VMT Reductions

The percent reduction in household VMT would be the same as the percent reduction in GHG emissions (A).

Sources

- Metropolitan Transportation Commission (MTC). October 2021. *Plan Bay Area 2050, Forecasting and Modeling Report*. Available: https://www.planbayarea.org/sites/default/files/documents/Plan_Bay_Area_2050_Forecasting_Modeling_Report_October_2021.pdf. Accessed: November 2021.

Maximum VMT Reduction Calculations: CAPCOA

- T-18: Provide Pedestrian network improvements (*up to 6.4%*)
- T-14: Provide Electric Vehicle Charging Infrastructure (*4.5%*)
- T-23: Provide Community Based Travel Planning (*up to 2.3%*)
- **Total VMT reduction if max of the above is obtained = $1-(1-0.064)*(1-0.045)*(1-0.023) = 12.67\%$**



APPENDIX C

PROJECT TDM AND TRAFFIC CALMING MEASURES

TENTATIVE MAP FOR OAKCREST SUBDIVISION

CITY OF SAN MARCOS, CA

MAP PREPARED BY:
EXCEL ENGINEERING
440 STATE PLACE
ESCONDIDO, CA 92029
PHONE (760) 945-8189
FAX (760) 745-1890



ENGINEER OF WORK
EXCEL ENGINEERING
440 STATE PLACE
ESCONDIDO, CA 92029
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FAX (760) 745-1890



OWNER'S CERTIFICATE
WE HEREBY CERTIFY THAT WE ARE THE RECORD OWNER OF THE PROPERTIES SHOWN ON THIS TENTATIVE SUBDIVISION MAP AND THAT SAID MAP SHOWS OUR ENTIRE CONTIGUOUS OWNERSHIP. WE UNDERSTAND THAT THE PROPERTY IS CONSIDERED CONTIGUOUS EVEN IF IT IS SEPARATED BY ROADS, STREETS, UTILITY EASEMENTS OR RAILROAD RIGHTS-OF-WAY.

BY: GOTH, GEORGE & BARBARA FAMILY TRUST 07-05-89
COSTANZO FAMILY TRUST 02-07-81
ROBERT G. LINDS AND CHRISTINE G. LINDS LIVING REVOCABLE TRUST AGREEMENT DATED JUNE 21, 1990
COSTANZO FAMILY TRUST DATED FEBRUARY 1, 1991
TERESA L. DELLAMARY GOTH 2007 TRUST DATED JUNE 13, 2007

DEVELOPER
MERITAGE HOMES OF CALIFORNIA, INC.
BY: JOHANNA CROOKER, VICE-PRESIDENT DATE:

DEVELOPER ADDRESS
5 PETERS CANYON, SUITE 310
IRVINE, CA 92606
TELEPHONE (949) 299-3824

SOURCE OF TOPOGRAPHY
THE EXISTING TOPOGRAPHY SHOWN HEREON IS BASED ON AN AERIAL TOPOGRAPHY DONE BY AEROSPACE MAPPING, INC. IN CLONING ON MARCH 24, 2002 & SUPPLEMENTED BY CONVENTIONAL FIELD SURVEY BY EXCEL ENGINEERING IN MAY 2024.

BASIS OF BEARINGS
THE BASIS OF BEARINGS FOR THIS SURVEY IS THE N.A.D. 83 ZONE 6 BEARINGS BETWEEN STATIONS 10+00 AND 10+00.00, AS SAID STATIONS ARE SHOWN ON PG. 23/31. N: (NORTH 12° 28' 00" EAST)

PROJECT BENCHMARK
THE BENCHMARK FOR THIS SURVEY IS CITY OF SAN MARCOS SURVEY CONTROL MONUMENT "CP-009", LOCATED IN THE TOP OF CURB ON THE NORTHWEST SIDE OF CHESAPEAKE COURT 04-06-SAC, 8 FEET SOUTHWEST OF A FIRE HYDRANT, AS SAID STATIONS ARE SHOWN ON PG. 23/31. ELEVATION: 675.65 DATUM: NAVD83

LEGAL DESCRIPTION
PORTIONS OF THE FRACTIONAL SECTION 2, TOWNSHIP 12 NORTH, RANGE 3 WEST, SAN BERNARDINO MERIDIAN, TOGETHER WITH PORTIONS OF BLOCKS 43, 44 AND 49 OF MAP OF HANCOCK LOS VALLEJITOS DE SAN MARCOS, MAP NO. 808, ALL LOCATED IN THE CITY OF SAN MARCOS, COUNTY OF SAN DIEGO, STATE OF CALIFORNIA.

GENERAL NOTES
1. POLICE PROTECTION PROVIDED BY THE COUNTY OF SAN DIEGO SHERIFF'S DEPARTMENT.
2. SETBACKS TO CONFORM TO ZONE REGULATIONS:
SINGLE FAMILY RESIDENTIAL
FRONT YARD=15', GARAGE=20', SIDEYARD=5', REAR=15'
DETACHED CONDOMINIUMS
PER SPECIFIC PLAN

PUBLIC UTILITIES & DISTRICTS
SEWER - VALLEJITOS WATER DISTRICT
WATER - VALLEJITOS WATER DISTRICT
GAS & ELECTRIC - SAN DIEGO GAS & ELECTRIC
TELEPHONE - PACIFIC BELL TELEPHONE COMPANY
FIRE - SAN MARCOS FIRE PROTECTION DISTRICT
SCHOOLS - SAN MARCOS HIGH SCHOOL DISTRICT

EASEMENT NOTE
SEE SHEET 2 - EXISTING CONDITION
EASEMENTS OF RECORD NOT SHOWN HEREON SHALL BE HONORED, ABANDONED AND / OR RELOCATED TO THE SATISFACTION OF ALL INTERESTED PARTIES. PUBLIC UTILITY EASEMENTS NECESSARY TO SERVE THIS PROJECT WILL BE COORDINATED WITH THE SERVING UTILITY COMPANY.

ASSESSOR'S PARCEL NUMBERS
218-110-03, 218-110-04, 218-300-26, 218-300-28, 218-300-29, 218-300-30, 218-300-31, 218-300-32, 218-300-33, 218-300-34, 218-300-35, 218-300-36, 218-300-37, 218-300-38, 218-300-39, 218-300-40, 218-300-41, 218-300-42, 218-300-43, 218-300-44, 218-300-45, 218-300-46, 218-300-47, 218-300-48, 218-300-49, 218-300-50, 218-300-51, 218-300-52, 218-300-53, 218-300-54, 218-300-55, 218-300-56, 218-300-57, 218-300-58, 218-300-59, 218-300-60, 218-300-61, 218-300-62, 218-300-63, 218-300-64, 218-300-65, 218-300-66, 218-300-67, 218-300-68, 218-300-69, 218-300-70, 218-300-71, 218-300-72, 218-300-73, 218-300-74, 218-300-75, 218-300-76, 218-300-77, 218-300-78, 218-300-79, 218-300-80, 218-300-81, 218-300-82, 218-300-83, 218-300-84, 218-300-85, 218-300-86, 218-300-87, 218-300-88, 218-300-89, 218-300-90, 218-300-91, 218-300-92, 218-300-93, 218-300-94, 218-300-95, 218-300-96, 218-300-97, 218-300-98, 218-300-99, 218-300-100, 218-300-101, 218-300-102, 218-300-103, 218-300-104, 218-300-105, 218-300-106, 218-300-107, 218-300-108, 218-300-109, 218-300-110, 218-300-111, 218-300-112, 218-300-113, 218-300-114, 218-300-115, 218-300-116, 218-300-117, 218-300-118, 218-300-119, 218-300-120, 218-300-121, 218-300-122, 218-300-123, 218-300-124, 218-300-125, 218-300-126, 218-300-127, 218-300-128, 218-300-129, 218-300-130, 218-300-131, 218-300-132, 218-300-133, 218-300-134, 218-300-135, 218-300-136, 218-300-137, 218-300-138, 218-300-139, 218-300-140, 218-300-141, 218-300-142, 218-300-143, 218-300-144, 218-300-145, 218-300-146, 218-300-147, 218-300-148, 218-300-149, 218-300-150, 218-300-151, 218-300-152, 218-300-153, 218-300-154, 218-300-155, 218-300-156, 218-300-157, 218-300-158, 218-300-159, 218-300-160, 218-300-161, 218-300-162, 218-300-163, 218-300-164, 218-300-165, 218-300-166, 218-300-167, 218-300-168, 218-300-169, 218-300-170, 218-300-171, 218-300-172, 218-300-173, 218-300-174, 218-300-175, 218-300-176, 218-300-177, 218-300-178, 218-300-179, 218-300-180, 218-300-181, 218-300-182, 218-300-183, 218-300-184, 218-300-185, 218-300-186, 218-300-187, 218-300-188, 218-300-189, 218-300-190, 218-300-191, 218-300-192, 218-300-193, 218-300-194, 218-300-195, 218-300-196, 218-300-197, 218-300-198, 218-300-199, 218-300-200, 218-300-201, 218-300-202, 218-300-203, 218-300-204, 218-300-205, 218-300-206, 218-300-207, 218-300-208, 218-300-209, 218-300-210, 218-300-211, 218-300-212, 218-300-213, 218-300-214, 218-300-215, 218-300-216, 218-300-217, 218-300-218, 218-300-219, 218-300-220, 218-300-221, 218-300-222, 218-300-223, 218-300-224, 218-300-225, 218-300-226, 218-300-227, 218-300-228, 218-300-229, 218-300-230, 218-300-231, 218-300-232, 218-300-233, 218-300-234, 218-300-235, 218-300-236, 218-300-237, 218-300-238, 218-300-239, 218-300-240, 218-300-241, 218-300-242, 218-300-243, 218-300-244, 218-300-245, 218-300-246, 218-300-247, 218-300-248, 218-300-249, 218-300-250, 218-300-251, 218-300-252, 218-300-253, 218-300-254, 218-300-255, 218-300-256, 218-300-257, 218-300-258, 218-300-259, 218-300-260, 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218-300-338, 218-300-339, 218-300-340, 218-300-341, 218-300-342, 218-300-343, 218-300-344, 218-300-345, 218-300-346, 218-300-347, 218-300-348, 218-300-349, 218-300-350, 218-300-351, 218-300-352, 218-300-353, 218-300-354, 218-300-355, 218-300-356, 218-300-357, 218-300-358, 218-300-359, 218-300-360, 218-300-361, 218-300-362, 218-300-363, 218-300-364, 218-300-365, 218-300-366, 218-300-367, 218-300-368, 218-300-369, 218-300-370, 218-300-371, 218-300-372, 218-300-373, 218-300-374, 218-300-375, 218-300-376, 218-300-377, 218-300-378, 218-300-379, 218-300-380, 218-300-381, 218-300-382, 218-300-383, 218-300-384, 218-300-385, 218-300-386, 218-300-387, 218-300-388, 218-300-389, 218-300-390, 218-300-391, 218-300-392, 218-300-393, 218-300-394, 218-300-395, 218-300-396, 218-300-397, 218-300-398, 218-300-399, 218-300-400, 218-300-401, 218-300-402, 218-300-403, 218-300-404, 218-300-405, 218-300-406, 218-300-407, 218-300-408, 218-300-409, 218-300-410, 218-300-411, 218-300-412, 218-300-413, 218-300-414, 218-300-415, 218-300-416, 218-300-417, 218-300-418, 218-300-419, 218-300-420, 218-300-421, 218-300-422, 218-300-423, 218-300-424, 218-300-425, 218-300-426, 218-300-427, 218-300-428, 218-300-429, 218-300-430, 218-300-431, 218-300-432, 218-300-433, 218-300-434, 218-300-435, 218-300-436, 218-300-437, 218-300-438, 218-300-439, 218-300-440, 218-300-441, 218-300-442, 218-300-443, 218-300-444, 218-300-445, 218-300-446, 218-300-447, 218-300-448, 218-300-449, 218-300-450, 218-300-451, 218-300-452, 218-300-453, 218-300-454, 218-300-455, 218-300-456, 218-300-457, 218-300-458, 218-300-459, 218-300-460, 218-300-461, 218-300-462, 218-300-463, 218-300-464, 218-300-465, 218-300-466, 218-300-467, 218-300-468, 218-300-469, 218-300-470, 218-300-471, 218-300-472, 218-300-473, 218-300-474, 218-300-475, 218-300-476, 218-300-477, 218-300-478, 218-300-479, 218-300-480, 218-300-481, 218-300-482, 218-300-483, 218-300-484, 218-300-485, 218-300-486, 218-300-487, 218-300-488, 218-300-489, 218-300-490, 218-300-491, 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218-300-723, 218-300-724, 218-300-725, 218-300-726, 218-300-727, 218-300-728, 218-300-729, 218-300-730, 218-300-731, 218-300-732, 218-300-733, 218-300-734, 218-300-735, 218-300-736, 218-300-737, 218-300-738, 218-300-739, 218-300-740, 218-300-741, 218-300-742, 218-300-743, 218-300-744, 218-300-745, 218-300-746, 218-300-747, 218-300-748, 218-300-749, 218-300-750, 218-300-751, 218-300-752, 218-300-753, 218-300-754, 218-300-755, 218-300-756, 218-300-757, 218-300-758, 218-300-759, 218-300-760, 218-300-761, 218-300-762, 218-300-763, 218-300-764, 218-300-765, 218-300-766, 218-300-767, 218-300-768, 218-300-769, 218-300-770, 218-300-771, 218-300-772, 218-300-773, 218-300-774, 218-300-775, 218-300-776, 218-300-777, 218-300-778, 218-300-779, 218-300-780, 218-300-781, 218-300-782, 218-300-783, 218-300-784, 218-300-785, 218-300-786, 218-300-787, 218-300-788, 218-300-789, 218-300-790, 218-300-791, 218-300-792, 218-300-793, 218-300-794, 218-300-795, 218-300-796, 218-300-797, 218-300-798, 218-300-799, 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TDM Plan View

Figure 1 Bike Racks & Repair Station in Public Park

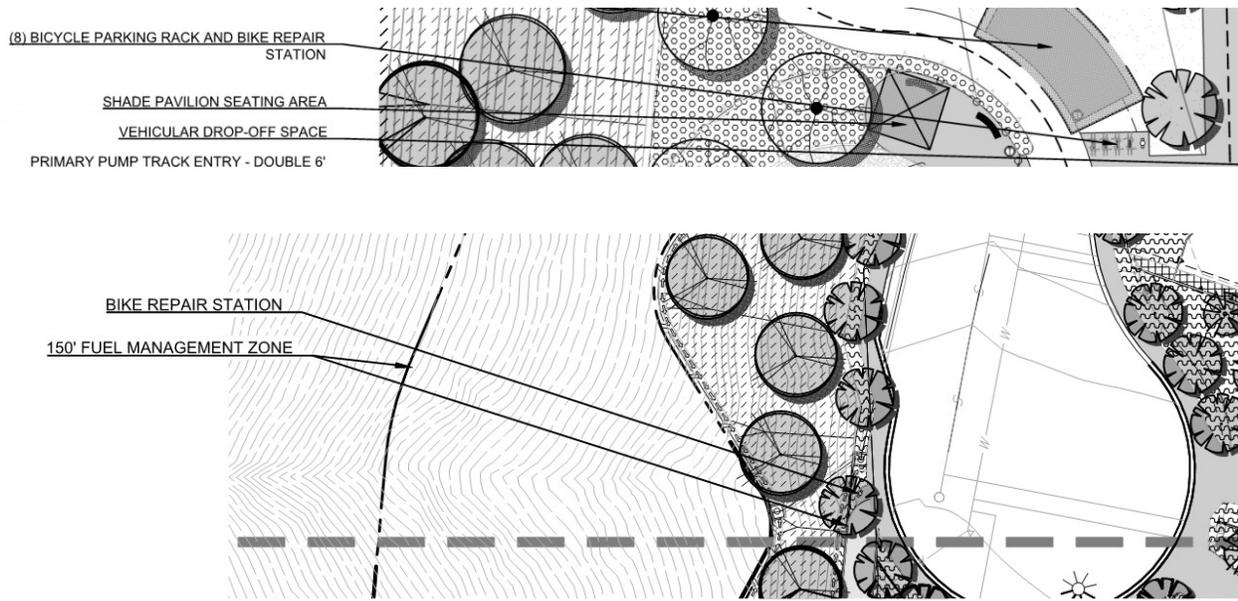
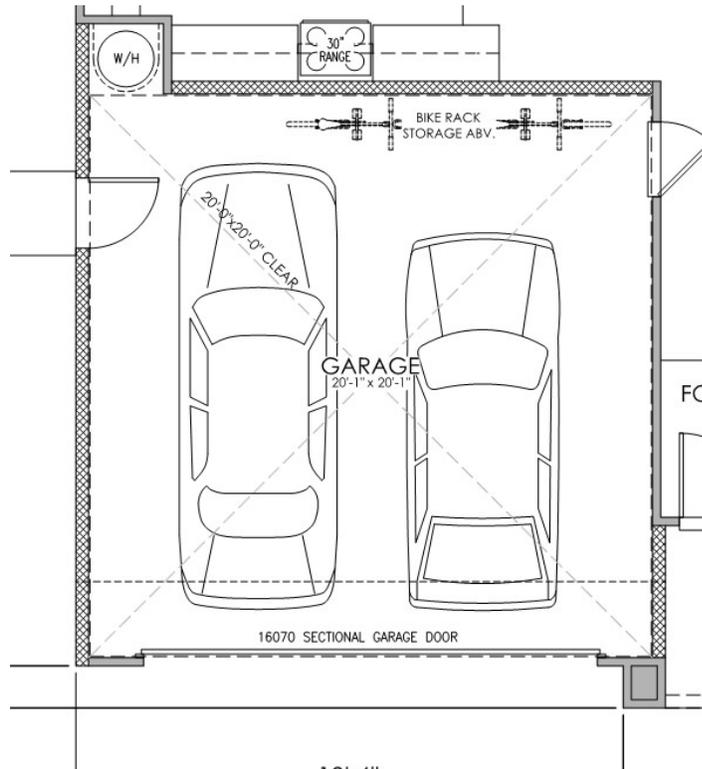
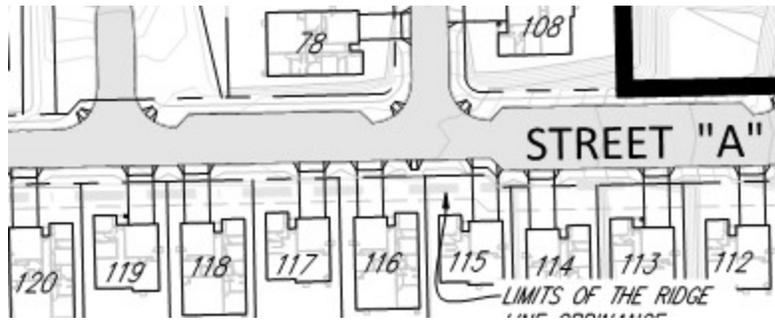


Figure 2 Bike Racks Provided for Each Garage



TDM Plan View

Figure 3 Traffic Calming Bulb Outs



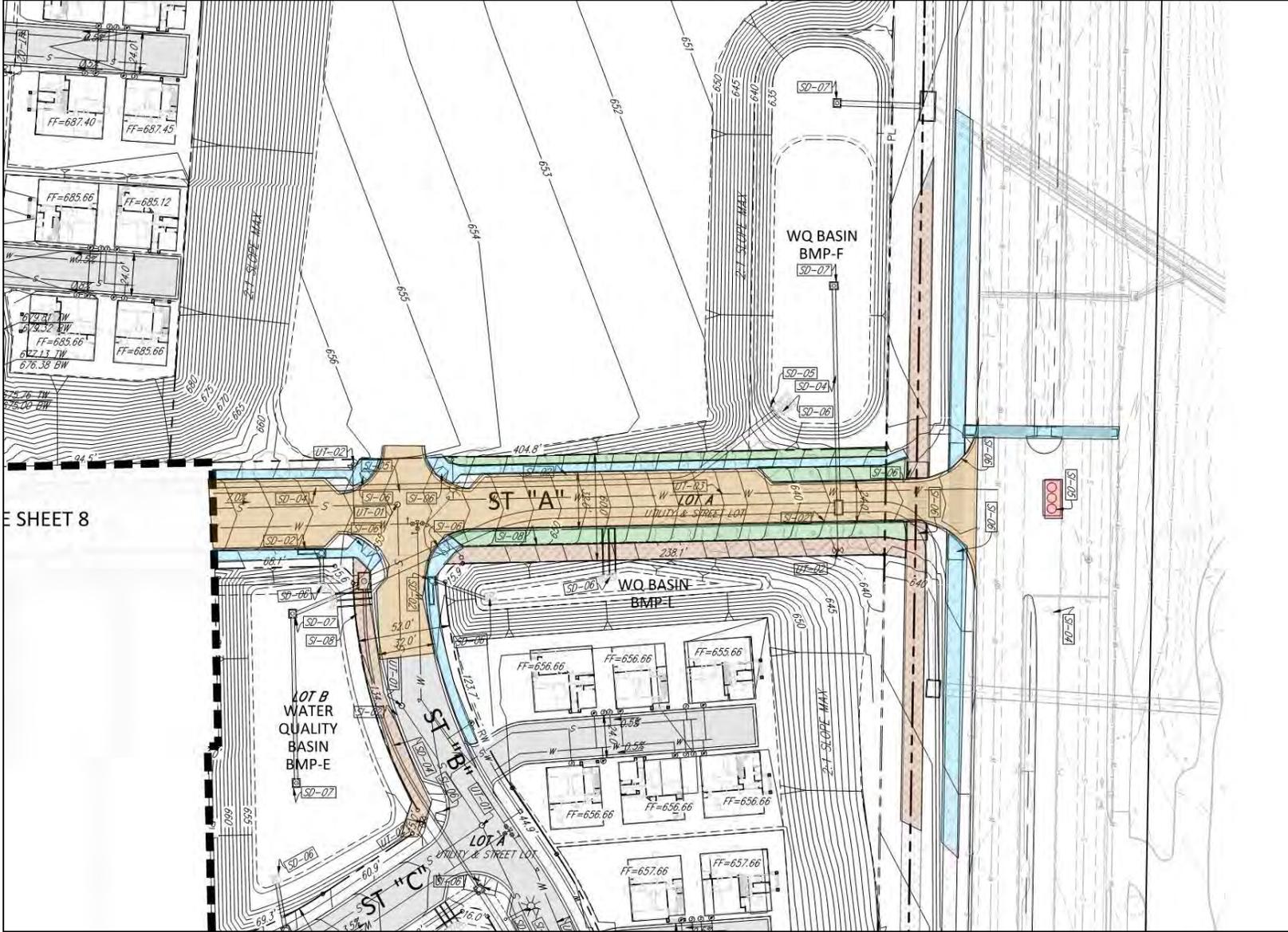
Traffic Calming Measures

The Oakcrest project is providing the following pedestrian and bike enhancements to Twin Oaks Valley Road and internal streets

- Bulbed intersection treatment
- Protected bike line crossing
- Protected pedestrian crossings
- Fully traffic calmed intersection into the public park
- Landscape buffers to trails
- 10 public trails on one side of the street.
- Protected bike lane and ped path on Twin Oaks Valley Road
- Signal with ped crossing and centerline staggering location tying to the existing trail on the East side of Twin Oaks

See a highlighted portion of the plan below to help clarify the enhancements.

Exhibit A





END OF APPENDICES