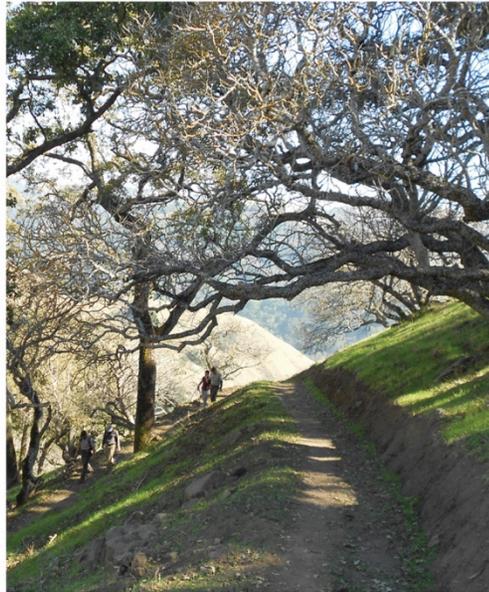


Silicon Valley Trail Loop

Greenhouse Gas Emissions Reduction Demonstration Project



Recommendations and Strategies
for Effective Mode Shift Programs
& User-Friendly Transit Development

PREPARED FOR:
Bay Area RidgeTrail Council
and San Francisco Bay Trail
Project

PREPARED BY:
EcoShift Consulting, LLC



JULY 2016



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*A total of 20 employer responses were received
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which represent 74,910 employees in the region.*

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Abbreviations and Acronyms

AB	Assembly Bill
ABAG	Association of Bay Area Governments
AHSC	Affordable Housing and Sustainable Communities
AREF	Auto Running Emission Factor in grams/mile from EMFAC2011
ATSEF	Auto Trip Start Emission Factor in grams/trip from EMFAC2011
BART	Bay Area Rapid Transit
BREF	Bus Running Emission Factor in grams/mile from EMFAC2011
CAPCOA	California Air Pollution Officers Association
CARB	California Air Resources Board
CEQA	California Environmental Quality Act
CMP	Congestion Management Plan
EMFAC	Emissions Factor: CARB's tool used to calculate current and future inventories of motor vehicle emissions as the state, county, air district, air basin or air basin within the county level
GHG	Greenhouse gas
ICP	Integrated Connectivity Projects
LTR	Light Rail
MTC	Metropolitan Transit Commission
MT CO ₂ e	Metric Tons Carbon Dioxide equivalent
SB	Senate Bill
SGC	Strategic Growth Council
SOV	Single Occupancy Vehicle
US EPA	US Environmental Protection Agency
TAC	Transit and Connectivity
TAZ	Traffic Analysis Zones
TCM	Traffic Congestion Management
TDM	Transportation Demand Management
TOD	Transit Oriented Development
VMT	Vehicle Miles Traveled
VTA	Santa Clara Valley Transportation Authority

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1.0 Executive Summary

The Bay Area Ridge Trail Council and the San Francisco Bay Trail Project initiated the *Silicon Valley Trail Loop Study*.

The goal was to explore, test, and document the potential of a robust trail system (and trails in combination with transit) - in the heart of the Silicon Valley - to facilitate a shift from auto trips to trail and transit, and thereby reduce Greenhouse Gas (GHG) emissions.

Specifically, the study sought to forecast emissions reductions under current and future scenarios, as infrastructure develops. The study also reviewed the effectiveness of various programs, policies and incentives to facilitate and support trail and transit use.

Overarching goals were to learn more about GHG emission reduction opportunities, to support trail and transit connectivity, to inform policy and funding decisions, and ultimately, to promote environmental, community, and health benefits associated with active and alternative transportation.

In and around San José, an intersection of existing and planned regional trails and transit (including existing light rail and future BART), interwoven with neighborhoods, job sites, urban centers, developed parks and nearby wild natural areas, formed a compelling study area.

The home-work commute, supported by specific models, was a significant focus of the study; however, non-commute trips were included where possible. In addition to commuting, the network can offer a convenient alternative to get around town, to school, or out into nature (there are world-class opportunities in the surrounding shoreline and hills!).

Related objectives were to **learn how to better incentivize trail and transit use**, and to **better understand the challenges or barriers to using trails and transit** (such as concern for safety, schedule, or lack of pedestrian and bicycle amenities/infrastructure).

The study has two main components:

1. **Forecast greenhouse gas (GHG) emissions reductions under various scenarios:** Employ two quantification methods that factor in current status; a completed trail system; additional transit options that are integrated with trails; and the effect of programs and incentives that help decrease single-occupancy vehicle (SOV) use, particularly during commute times.
2. **Understand effective strategies, programs, and incentives that encourage a voluntary mode shift to trails and transit:** Programs and incentives may include such things as reduced travel costs, convenience, improved infrastructure, and a more pleasant commute, and the shift is important no matter how frequent (i.e., a few days a week or month to regular and consistent use).

In addition, **an interactive trip-planning map for the greater study area—that calculates carbon and cost savings—was developed as a pilot tool** to facilitate trail and transit use:

svtrailfinder.ridgetrail.org.

The intent is that study results will:

- **Inform planning, policy and funding decisions with quantified, supportable data;**
- Help extend and complete trails, and ensure trail and transit connectivity to where people live, work, and play;
- Help develop and enhance programs or tools that support voluntary mode shift to trails and transit;
- Support active transportation and sustainable communities;
- Serve as a case-study for other communities.

The study was led by a Planning Team that in addition to the Ridge Trail and Bay Trail includes the State Coastal Conservancy¹, the City of San José, the Santa Clara Valley Transportation Authority, Santa Clara County Parks, the Rails-to-Trails Conservancy, and the National Park Service, Rivers Trails & Conservation Assistance program. GHG emissions forecasting expertise and research assistance comes from EcoShift Consulting, LLC and the AmeriCorps Civic Spark program.

Regional stakeholders and experts from the policy, bicycle and pedestrian advocacy, transportation, government, academic, community, and business sectors—who may be interested in using the results to support and further their respective work—were invited to provide input directly and via surveys. Regional stakeholders included representative from study partner agencies and employer transportation coordinators, with both groups being separately surveyed.

¹ Partial funding from a State Coastal Conservancy “Climate Ready” grant (<http://scc.ca.gov/category/climate-change/>).

The Silicon Valley Trail Loop brings together sections of interconnected local and regional trail systems, including both developed and planned (see Figure 2.0-1):

- the San Francisco Bay Trail (including Highway 237 Bikeway) hugging the shoreline;
- the Bay Area Ridge Trail (including the Penitencia Creek section) circling the ridges, but also looping into the downtown San José area; and
- local trail systems that are part of the City of San José Trail Network (including Guadalupe River Trail, Coyote Creek Trail, Highway 237 Bikeway, and Three Creeks Trail) forming connecting spokes.

The greater area linked by the Silicon Valley Trail Loop stretches from the Baylands of East Palo Alto around to Fremont and to downtown San José and the surrounding ridge lines. A section of the Ridge Trail will pass through the Berryessa BART station (planned to open in 2017), and stations planned for “Phase II” (Alum Rock, Downtown San José, Diridon, Santa Clara) will also intersect or be very near the loop alignment. Figures 3.1-1 and 3.1-2 depict 2015 and 2025 SVTL and transit infrastructure, respectively.

1.1 Forecasting GHG Emissions Reduction Potential Under Study Scenarios

The study forecasted GHG [greenhouse gas] emissions reductions using two methods:

1. A set of calculations set forth in the Strategic Growth Council’s (SGC) Affordable Housing and Sustainable Communities program

guidelines (and adjusted by EcoShift as appropriate for this particular study):

- It was developed to be applied to projects such as bicycle and pedestrian facilities;
- It is provided by the California Air Resources Board, the agency charged with providing the quantification methodology to estimate GHG emission reductions from projects receiving monies from the Greenhouse Gas Reduction Fund, an account established to receive Cap-and-Trade proceeds.

2. The Santa Clara Valley Transportation Authority’s (VTA’s) Countywide Travel Demand Model:

- It has been specifically developed for the study region;
- The model provides enhanced metrics that improve insight into other aspects of active and transit transportation in the SVTL geographic area.

Use of both the SGC method and VTA model to forecast emissions reduction potential met the Planning Team’s intent to use methods that were recognized as comprehensive, robust, replicable, and verifiable, and that considered local conditions. These methodologies also provided the following benefits:

- The SGC method was provided by the California Air Resources Board (CARB), the agency charged with providing the quantification methodology to estimate GHG emission reductions from projects receiving monies from the Greenhouse Gas Reduction Fund, an account established to receive Cap-and-Trade proceeds;
- The VTA model was specifically developed for the region in which the study area is located;

- The SGC method enabled determination of emissions reductions per component (infrastructure improvement or TDM program/incentive);
- The SGC method was able to directly analyze the effect of TDM programs;
- The VTA model was able to capture synergistic and “diminished return” effects because its results are calibrated with real-world counts of traffic, ridership and trail use;
- The VTA model was able to isolate the trail contribution, both how the SVTL and its feeder trails impact emissions reduction potential in combined trail and transit trips (the added reduction from walking or biking to transit stops/stations), and how the SVTL (by itself) enables increased and quicker access to jobs in 2025. In contrast, the SGC method cannot account for the additional reduction from taking the trail to/from transit; it treats each trip as either “trail only” or “transit only.”

Table 1.1-1 presents GHG emissions reduction potential forecasts under each of these two methods. Results are presented in metric tons of carbon dioxide equivalent (MT CO₂e).

Table 1.1-1. Forecasted emissions reduction potential by scenario and method²

STUDY SCENARIOS	SGC EMISSIONS REDUCTION POTENTIAL (MT CO2e)	VTA EMISSIONS REDUCTION POTENTIAL (MT CO2e)
(1) 2015 Conditions: 2015 trails, transit, and TDM programs	2,493	3,616 ³
(2) Scenario 1, plus 2025 Trail: 2015 transit and TDM programs, plus fully built and connected Silicon Valley Trail Loop	4,511	5,458
(3) 2025 Trail and Transit: Scenario 2, plus 2025 transit network	6,303	28,195
(4) 2025 Trail, Transit, and TDM programs: Scenario 3, plus 2025 TDM programs	7,063	NA

The results indicate:

- **The effect of trails alone—a fully built and connected trail loop, independent of additional transit—almost doubles the emissions reduction compared with existing conditions, a partially-built trail network** (note the difference between Scenario 2 and Scenario 1);
- **A fully completed trail loop will result in a substantial increase in the number of jobs that can be reached within**

² The forecast emissions reductions are compared to having no trails, transit, or TDM programs.

³ Because TDM programs are not modeled separately in the VTA model, it is not possible to determine their separate impact in Scenarios 1 and 4.

just 15 minutes via bicycle—in some zones, up to 42,300 additional jobs (see Figure 5.3.2-1);

- **Combining use of transit with trails yield up to eight times the amount of emissions reductions compared with existing conditions** (note the difference between Scenario 3 and Scenario 1);
- **A fully-completed trail loop** ranked as the #1 factor that would result in the greatest mode shift to trail-and-transit commutes;
- **Even low-cost, simple measures to promote bicycling to work have a significant impact**, such as policies enabling bicycles in the building, “social” measures such as active commute contests, and educational/safety seminars.

For Scenarios 1 and 2, the two methods correlate well in terms of estimated magnitude of emissions reductions. However, the VTA model estimates emissions reduction potential to be higher in all scenarios than the SGC method, and in Scenario 3 its estimate is over four times that of the SGC method.

The following factors may account for these differences in results:

- Although the SGC method uses output from the VTA model (such as average traffic and transit use), it uses static calculations and a limited set of factors to discount the VMTs [vehicle miles traveled]; the VTA model considers a greater number of factors dynamically and synergistically.
- The VTA model captures “**synergistic effects,**” i.e., it is able to consider the multiplier effect of **the combined use of trail and transit systems on reducing auto trips** (the SGC method considers trail use separately from transit use).

The Planning Team sought to further explore synergistic effects by determining emissions reductions from **taking the trail to and from transit**. Using data from VTA model runs, the technical team was able to estimate that **potentially 524 MT CO₂e of emissions could be reduced annually by walking or biking to and from transit under Scenario 3, the 2025 combined trail and transit scenario**. The SGC method, in contrast, is not designed to address trips that use both trail and transit, and treats those trips as “transit-only.”

See Section 5.0 for a break-out of forecasted emissions reduction potential for commute versus non-commute trips using each method.

1.2 Additional Modeling Results – The Power of Trails

Another key finding of the study is the **substantial increase in number of jobs that are accessible within 15 minutes via the SVTL by bicycle under a “fully completed SVTL and transit” scenario**. The majority of the increases occur where the Penitencia Creek trail intersects the Coyote Creek trail, with about 9,000 to 42,300 additional jobs made accessible within 15 minutes. See Figure 5.3.2-1, which provides ranges for the number of additional jobs that can be reached at various locations along the trail network. **This is a powerful finding that visually illustrates the significance of trail completion to active transportation.**

1.3. Understanding What Prompts a Mode Shift to Trails and Transit

Through surveys of nearby employers and study partners working in the area, the Planning Team sought to understand and document

effective strategies, programs, and incentives that encourage a voluntary mode shift to trails and transit, no matter how frequent (i.e., a few days a week or month to regular and consistent daily use). A related objective was to understand the challenges or barriers to using trails and transit, such as concern for safety, schedule, or lack of bike amenities/infrastructure. Understanding the challenges could help in future planning, development and operations of trails.

1.3.1 Trail-related Recommendations

Employer transportation coordinators and study partners indicated that the trail amenities resulting in the greatest mode shift from Single Occupancy Vehicle (SOV) trips to trail and trail-transit commutes (in order of importance) include:

- **A fully connected trail network,**
- Paved trails,
- On-street connection signs to trails (with distance noted),
- Warning signs (pedestrian crossing, curve, etc.) and advisory signs (nearest restrooms, food/water, etc.), and
- Integration of social activities as part of alternative transportation planning and promotion (e.g. more events like Bike to Work Day), and dedicated “bike cars” on BART and Caltrain during peak commuter hours.

1.3.2 Transit-related Recommendations

Employer transportation coordinators and study partners expressed the following suggestions to improve transit, some of which align with regional transit agencies’ planning and programming:

- Install signage that directs and connects transit users to trails and vice versa,
- Improve travel time between stations (e.g., decrease wait time between trains or buses),
- Improve safety on transit.

Employer transportation coordinators and study partners also indicated that the transit amenities resulting in the greatest mode shift from SOV trips to trail and trail-transit commutes are (in order of importance):

- New transit stations,
- On-street connection signs to trails with distance,
- Dedicated bike cars on BART during peak commuter hours,
- Integration of social activities as part of alternative transportation planning and promotion (e.g. more events like Bike to Work Day), and dedicated bike cars on BART during peak commuter hours.

*One employer transportation coordinator also offered a comment that **increasing transit use requires regional agencies working together to “shift the norm” away from SOV travel.***

1.3.3 Transportation Demand Management Program (TDM) Implementation Recommendations

Transportation demand management (TDM) programs were evaluated using three factors: cost, ease of implementation, and potential to

reduce GHG emissions. Although their prioritization order changes under different weighting schemes (see Section 6.3), the following recommendations were selected:⁴

- **policy enabling “bikes in the building,”**
- **provision of secure bike lockers, showers, and/or changing facilities,**
- **limited parking,**
- **a pre-tax deduction benefit,**
- **employer-provided subsidy,**
- **rewards and recognition.**

1.4 Conclusion Highlights

Putting Results in Context

It is helpful to put the emissions reduction estimates into context with other tangible emissions quantities. The following table compares emissions reductions under the study scenarios with other quantified estimates.

⁴ TDM programs were filtered to exclude those that do not involve a switch to active transportation.

Table 1.4-1. Annual GHG emissions estimates at various scales

GHG EMISSIONS ESTIMATES	ANNUAL MT CO2e
Global Carbon Footprint per person ⁵	4
US Carbon Footprint per person	20
Silicon Valley BART Extension Estimated Emissions Reduced when completed	3,400
Reduction range from Study Scenario 1 (2015 Trails, Transit, and TDM Programs)	2,493 – 3,616
Reduction range from Scenario 3 (Baseline TDM Programs, plus 2025 Trail and Transit)	6,303 – 28,195
Santa Clara County Community Transportation Emissions ⁶ (2007)	423,000
San José Transportation Emissions ⁷ (2014)	4 Million
Bay Area Transportation Emissions ⁸ (2007)	35 Million
California’s Transportation Sector Emissions (2013)	170 Million

Note that the contribution of “baseline” trail, transit, and TDM programs is comparable to the effect of the BART extension, and the 2025 future combined scenarios may have up to eight times the reduction potential of the BART extension alone.

⁵ Average global and US carbon footprints from www.coolclimate.org

⁶ <http://www.santaclaraca.gov/home/showdocument?id=10170>

⁷ <https://www.sanjoseca.gov/DocumentCenter/View/55505>

⁸ http://www.baaqmd.gov/~media/Files/Planning%20and%20Research/Emission%20Inventory/regionalinventory2007_2_10.ashx

See section 7.0 to (Figure 7.1-1⁹) to see how the SVTL trail and transit use in 2025 compares to other equivalent emissions activities such as:

- carbon sequestered from seedlings grown over 10 years,
- the combustion of gallons of gasoline, and
- the number of utility scale wind turbines installed to avoid emissions an equivalent amount.

Study Objectives

Through this study, the Planning Team was able to achieve the following objectives established at the outset of the study:

- Provide useful information to planners, policy- and decision-makers;
- Test and document the potential of a connected trail and trail-transit network in and around San José to reduce GHG emissions;
- Highlight factors that support trail and trail-transit use as preferable options;
- Demonstrate that a connected trail and transit network can provide easier access to transit and thousands of Silicon Valley jobs, as well as schools, parks and other destinations;
- Pilot an interactive trip-planning mapping tool for the Silicon Valley Trail Loop area that calculates carbon and cost savings: **svtrailfinder.ridgetrail.org**;
- Offer a case study for other communities.

⁹ <http://www2.epa.gov/energy/greenhouse-gas-equivalencies-calculator>

The Planning Team members, agencies, and other stakeholders may use the findings of the study to:

- Encourage allocation of, and more competitively compete for, funding for GHG reducing trail projects (i.e., show trails are a viable part of the solution);
- Develop effective programs or incentives to increase mode shift to trail and trail-transit use.

2.0 Introduction and Study Purpose

2.1 Study Purpose and Scope

The Bay Area Ridge Trail Council and the San Francisco Bay Trail Project initiated the *Silicon Valley Trail Loop Study*.

The goal was to explore, test, and document the potential of a robust trail system (and trails in combination with transit) - in the heart of the Silicon Valley - to facilitate a shift from auto trips to trail and transit, and thereby reduce Greenhouse Gas (GHG) emissions.

Specifically, the study sought to forecast emissions reductions under current and future scenarios, as infrastructure develops. The study also reviewed the effectiveness of various programs, policies and incentives to facilitate and support trail and transit use.

Overarching goals were to learn more about GHG emission reduction opportunities, to support trail and transit connectivity, to inform policy and funding decisions, and ultimately, to promote environmental, community, and health benefits associated with active and alternative transportation.

In and around San José, an intersection of existing and planned regional trails and transit (including existing light rail and future BART), interwoven with neighborhoods, job sites, urban centers, developed parks and nearby wild natural areas, formed a compelling study area.

The home-work commute, supported by specific models, was a significant focus of the study; however, non-commute trips were included where possible. In addition to commuting, the network can offer a convenient alternative to get around town, to school, or out

into nature (there are world-class opportunities in the surrounding shoreline and hills!).

Related objectives were to **learn how to better incentivize trail and transit use**, and to **better understand the challenges or barriers to using trails and transit** (such as concern for safety, schedule, or lack of pedestrian and bicycle amenities/infrastructure).

The study has two main components:

1. **Forecast greenhouse gas (GHG) emissions reductions under various scenarios:** Employ two quantification methods that factor in current status; a completed trail system; additional transit options that are integrated with trails; and the effect of programs and incentives that help decrease single-occupancy vehicle (SOV) use, particularly during commute times.
2. **Understand effective strategies, programs, and incentives that encourage a voluntary mode shift to trails and transit:** Programs and incentives may include such things as reduced travel costs, convenience, improved infrastructure, and a more pleasant commute, and the shift is important no matter how frequent (i.e., a few days a week or month to regular and consistent use).

In addition, **an interactive trip-planning map for the greater study area—that calculates carbon and cost savings—was developed as a pilot tool** to facilitate trail and transit use:
svtrailfinder.ridgetrail.org.

The intent is that study results will:

- **Inform planning, policy and funding decisions with quantified, supportable data;**
- Help extend and complete trails, and ensure trail and transit connectivity to where people live, work, and play;
- Help develop and enhance programs or tools that support voluntary mode shift to trails and transit;
- Support active transportation and sustainable communities;
- Serve as a case-study for other communities.

The Silicon Valley Trail Loop brings together sections of interconnected local and regional trail systems, sections of which are both developed and planned (see Figure 2.1-1):

- the San Francisco Bay Trail (including Highway 237 Bikeway) hugging the shoreline;
- the Bay Area Ridge Trail (including the Penitencia Creek section) circling the ridges, but also looping into the downtown San José area; and
- local trail systems that are part of the City of San José Trail Network (including Guadalupe River Trail, Coyote Creek Trail, Highway 237 Bikeway, and Three Creeks Trail) forming connecting spokes.

The greater area linked by the Silicon Valley Trail Loop stretches from the Baylands of East Palo Alto around to Fremont and to downtown San José and the surrounding ridge lines. A section of the Ridge Trail will pass through the Berryessa BART station (planned to open in 2017), and stations planned for “Phase II” (Alum Rock, Downtown San José, Diridon, Santa Clara) will also intersect or be very near the loop

alignment. Figures 3.1-1 and 3.1-2 depict 2015 and 2025 SVTL and transit infrastructure, respectively.

2.2 Role of Local Organizations and Stakeholders

The study was led by a Planning Team that, along with the Bay Area Ridge Trail Council and the San Francisco Bay Trail Project, included the State Coastal Conservancy¹⁰, the City of San José, the Santa Clara Valley Transportation Authority, Santa Clara County Parks, the Rails-to-Trails Conservancy, and the National Park Service, Rivers Trails & Conservation Assistance Program. In a highly collaborative process with the Planning Team and Study Partners, EcoShift Consulting, LLC, with assistance from the AmeriCorps Civic Spark program, conducted background research and determined the GHG emissions reduction potential of trail and trail/transit use. The study is possible in part because of long-standing arrangements with agencies like the Santa Clara Valley Water District that permits public trail access to its properties via joint trail agreements with local agencies.

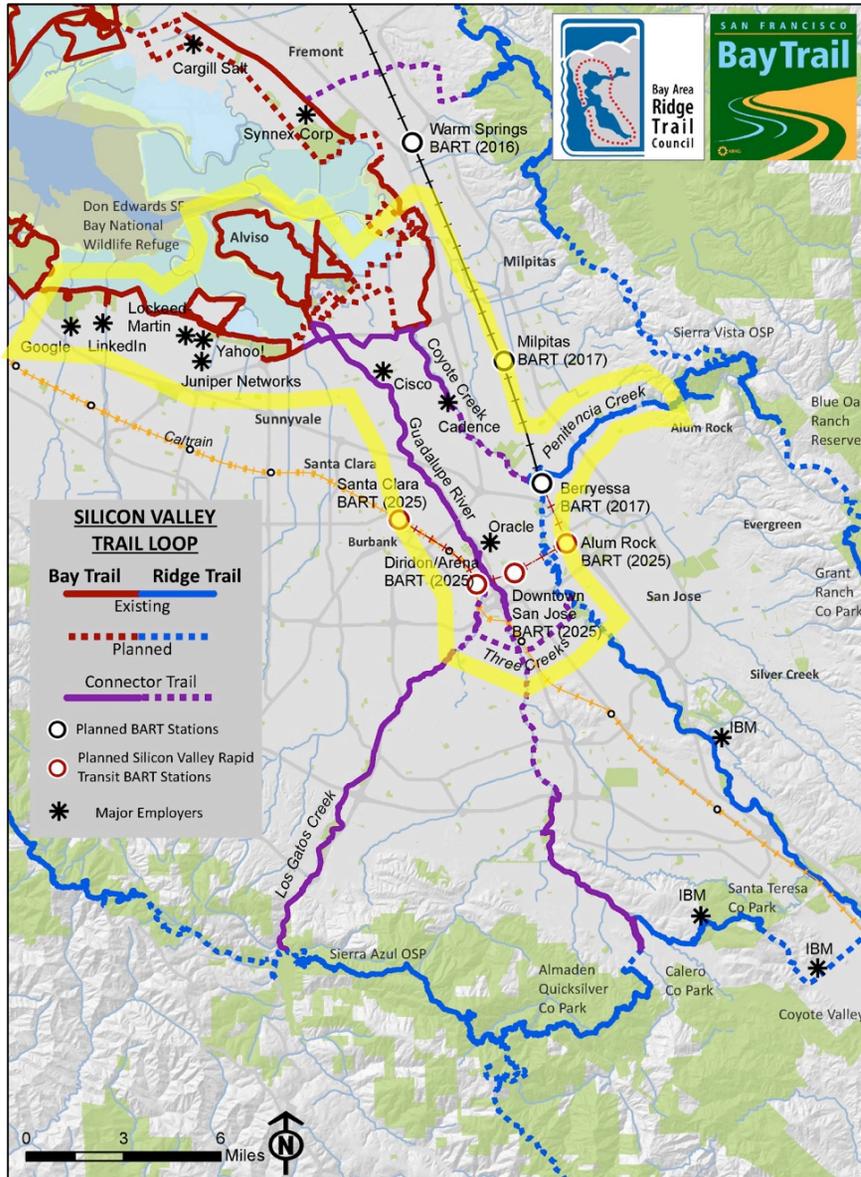
The study Planning Team also sought to engage others who may be interested in using the results to support and further their respective work—experts from the policy, bicycle and pedestrian advocacy, transportation, government, academic, community, and business sectors—by inviting input directly and via surveys. The results contained herein will provide additional data and momentum to spark actions:

- Use quantifiable, supportable data to effect policy and funding decisions;

¹⁰ Partial funding from a State Coastal Conservancy “Climate Ready” grant (<http://scc.ca.gov/category/climate-change/>).

- Complete and extend trails, and ensure connections to where people live, work, and play;
- Develop or enhance programs or tools that support voluntary mode shift to trails and transit;
- Support active transportation and sustainable community efforts;
- Use as a case-study for other communities.

Figure 2.1-1. Map of Study Area Context



SILICON VALLEY TRAIL LOOP CONNECTING THE BAY AND RIDGE TRAILS TO SAN JOSÉ'S URBAN CORE

The Silicon Valley Trail Loop brings together sections of interconnected regional trails: the Bay Trail hugs the shoreline; the Ridge Trail (including the Penitencia Creek section) circles the ridges, but also loops into downtown San José; and the regional riparian trails (including Guadalupe River and Coyote Creek) forming connecting spokes. The greater area linked by the Silicon Valley Trail Loop stretches from the Baylands of East Palo Alto around to Fremont and to downtown San José and the surrounding ridge lines. A section of the Ridge Trail will pass through the planned Berryessa BART station, and “Phase II” stations (Alum Rock, Downtown San José, Diridon, Santa Clara) will also intersect or be very near the loop alignment.

2.3 Climate Change and Transportation Sector Pollution in California

GHG emissions associated with climate change present significant risks to California's economic, ecological and social systems. Overall, while there is uncertainty on the scale, timing and duration of long-term climate change effects, research suggests that California will experience sea level rise, extreme weather events, rising temperatures, severe droughts and significant disruptions to native plant communities and wildlife migrations¹¹. The changes in these ecological systems will cause three major impacts to the study area¹²:

- Increased severity and frequency of flood events for a significant number of residential, commercial and industrial structures situated on the San Francisco Bay's shorelines and low-lying areas — not to mention many miles of freeways, airports, port facilities and other transportation infrastructure adjacent to the Bay¹³
- Increased intensity of and potential for wildfires will result in property damage and loss of life; and

¹¹ <http://scc.ca.gov/climate-change/>

¹² <http://www.pmcworld.com/client/sunnyvale/documents/final-ClimateActionPlan.pdf>

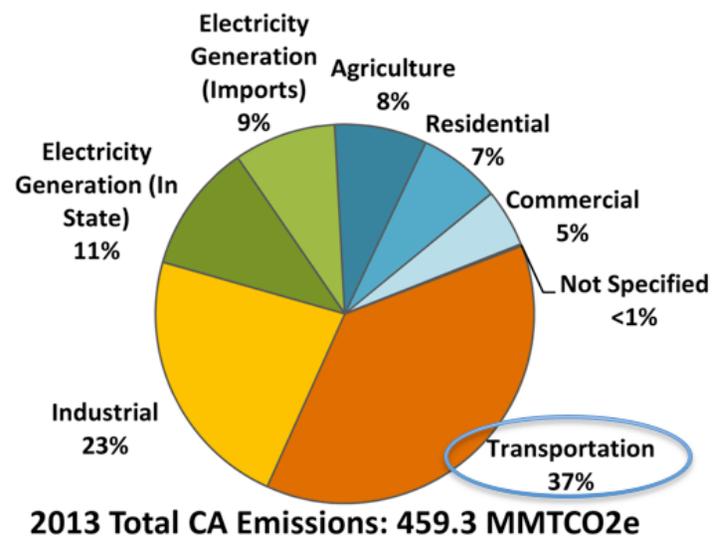
¹³ http://files.mtc.ca.gov/pdf/Plan_Bay_Area_FINAL/Plan_Bay_Area.pdf;
<http://www.santaclaraca.gov/home/showdocument?id=13934>;
<http://www.energy.ca.gov/2012publications/CEC-500-2012-014/CEC-500-2012-014.pdf>

- Increased public health risks from heat waves, mosquito-borne diseases and increased ozone concentrations.

In 2013, California's transportation sector accounted for 37% of the state's GHG emissions and personal passenger vehicles constitute the majority of those emissions. Of those transportation emissions, over 90% are attributable to on-road and rail activities (with the rest attributable to aviation, off road and water activities). Measures for reducing GHG emissions related to transportation include improving vehicle fuel economy and technology toward low or no carbon driving and reducing the overall miles traveled, particularly from SOVs. It is the latter strategy upon which this study focuses.

By using active transportation options like bicycling and walking, combined with transit use, transportation related GHG emissions may be substantially reduced. Health improvement from active transportation is considered a key co-benefit to reduced GHG emissions. Together, high emissions reduction potential and increased community health (and other) co-benefits are likely to attract public and policy-maker attention and action toward simultaneously achieving mode shift targets and GHG emission reduction goals.

Figure 2.3-1. California’s sectoral attribution of GHG emissions (CARB, 2013)



2.4 Policy Context for the Study¹⁴

State-, regional- and local-level policies provided the framework under which the study purposes were developed and location chosen. California has led the way with setting an overall direction for addressing GHG emissions. The landmark 2006 *Global Warming Solutions Act* (AB 32) requires that GHG emissions be reduced to 1990 levels by 2020. One mechanism to reach this goal is use of market-based regulations, such as the “Cap and Trade” program - proceeds from which are used to invest in GHG-reducing measures such as alternative transportation infrastructure. It is anticipated that study results will be used to help build the case (particularly, by adding

¹⁴ Appendix A contains an expanded description of relevant guiding policy.

quantitative data) for a fully complete and connected trail network as part of a suite of transportation options.

The regional context for the study is underpinned by *Plan Bay Area*, the long-range integrated transportation and land-use/housing strategy for the San Francisco Bay Area. This plan allocates \$4.6 billion to bicycle and pedestrian improvements funded by state Transportation Development Act and local sales tax funds. In addition, the One Bay Area Grant program will invest \$14.6 billion (over the life of the plan) in complete streets projects that include stand-alone bicycle and pedestrian paths, bicycle lanes, pedestrian bulb-outs, lighting, new sidewalks, and Safe Routes to Transit and Safe Routes to Schools projects that will improve bicycle and pedestrian safety and travel.

At the county level, *Valley Transportation Plan 2040* describes the bicycle network as an “essential component of a fully integrated, multimodal, countywide transportation system.” The plan includes a section on Multimodal Transportation Investments as well as a Bicycle Expenditure Plan, both of which specifically target improvements to the cycling transportation network. The plan also details improvements to the transit system, such as construction of the Berryessa BART station.

Finally, the City of San José General Plan and *Green Vision Plan* contain goals and policies to reduce “vehicle miles traveled” (VMTs); expand facilities for walking and bicycling, particularly to connect with and ensure access to transit and to provide a safe and complete alternative transportation network that facilitates non-automobile trips; and develop an interconnected trail network, including both on-street bikeways and systems that follow creeks, rivers, utility corridors and former railways.

3.0 Existing and Future Conditions

3.1 Study Scenarios

The study considers the SVTL trails, nearby transit, and TDM programs in place in both 2015 and those planned for 2025, as depicted in Figures 3.1-1 and 3.1-2, respectively. Several combinations of trail, transit and TDM programs were considered to define scenarios to be assessed for potential mode shift away from SOVs and reduction in GHG emissions. Scenarios were developed and selected based on two criteria considered by the Planning Team (1) whether the scenario reasonably and accurately represents current and future planned conditions and (2) whether the current/future planned conditions represented by the scenario are achievable within a 10-year time horizon. Considering these criteria, the following “emissions reduction” scenarios were identified for analysis:

SCENARIO 1 – 2015 TRAIL, TRANSIT, AND TDM PROGRAMS:

- 2015 pedestrian and bicycle facilities and use (including the SVTL at 2015 level of completion);
- 2015 bus and rail (light rail and regional rail/Caltrain) service and ridership; and
- TDM programs and participation rates in effect in 2015, as indicated by employer surveys (for SGC method only).

SCENARIO 2 — SCENARIO 1, PLUS 2025 TRAIL (FULLY-COMPLETED AND CONNECTED SILICON VALLEY TRAIL LOOP):

- Projected 2025 SVTL pedestrian and bicycle facilities use; and
- 2015 conditions for transit and TDM programs (same as Scenario 1).

SCENARIO 3—SCENARIO 2, PLUS 2025 TRANSIT NETWORK:

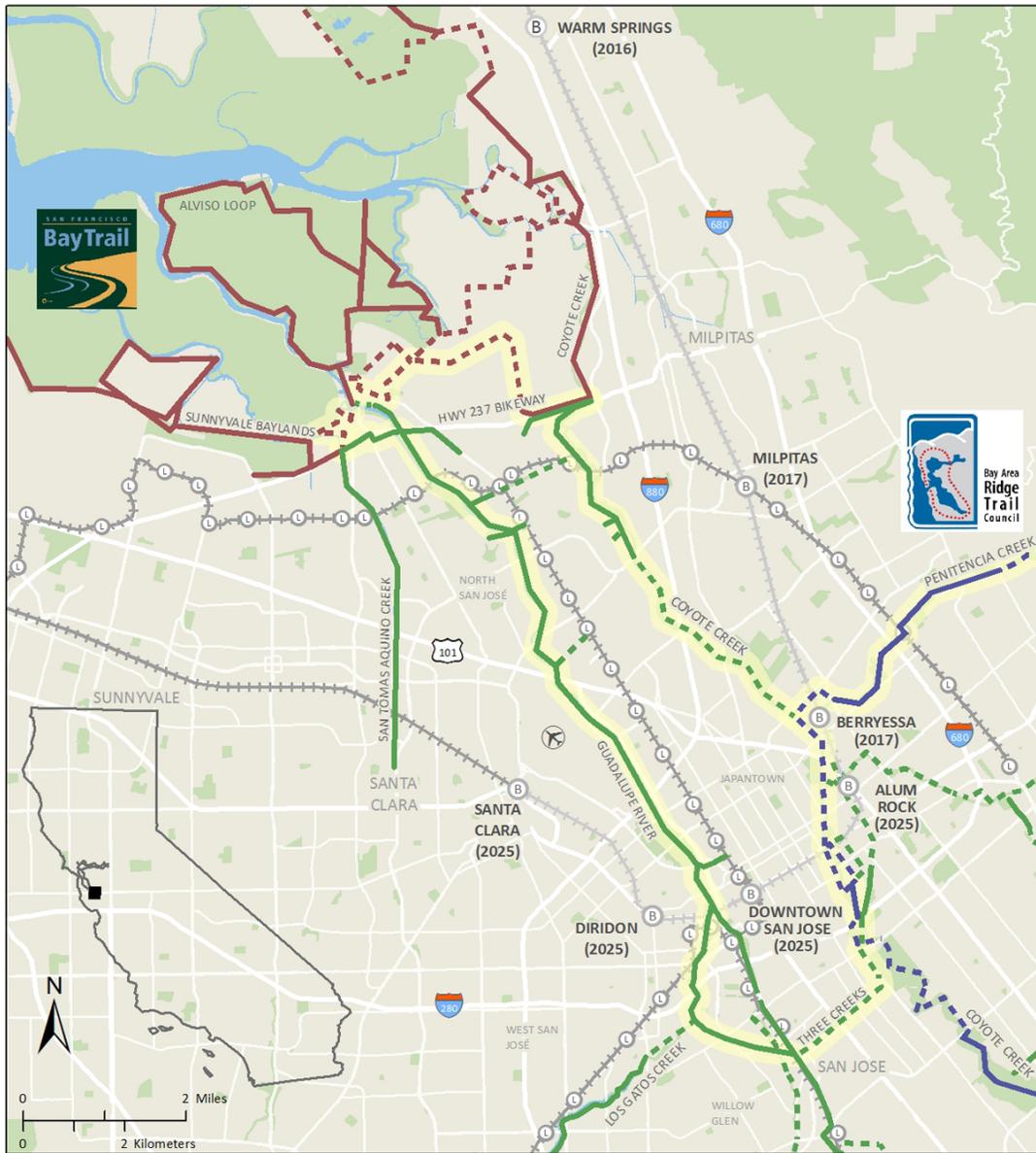
- Projected 2025 bus, rail, and BART service and ridership;
- Projected 2025 SVTL pedestrian and bicycle facilities and use; and
- 2015 TDM programs and participation.

SCENARIO 4—SCENARIO 3, PLUS 2025 TDM PROGRAMS:

- Expanded TDM programs (for SGC method only; applies 2015 participation rates to anticipated 2025 programs);
- Projected 2025 pedestrian and bicycle facilities and use,
- Projected 2025 bus, rail, and BART service and ridership.

Note that an additional scenario, “**2015 Transit, plus 2025 Trail and TDM Programs,**” was initially included as well. As information that fed into this scenario was gathered, however, questions arose as to whether the resulting emissions reduction forecasts would be meaningful, and the Planning Team ultimately decided not to include the results (see Section 5.0 for a full explanation).

Figure 3.1-1. Map of Silicon Valley Trail Loop – Planned Trails + Transit in 2015



Silicon Valley Trail Loop

Existing Trail and Transit System 2015

Ridge Trail

- Existing
- - - Planned

Bay Trail

- Existing
- - - Planned

Riparian/Connector Trails

- Existing
- - - Planned

Rails

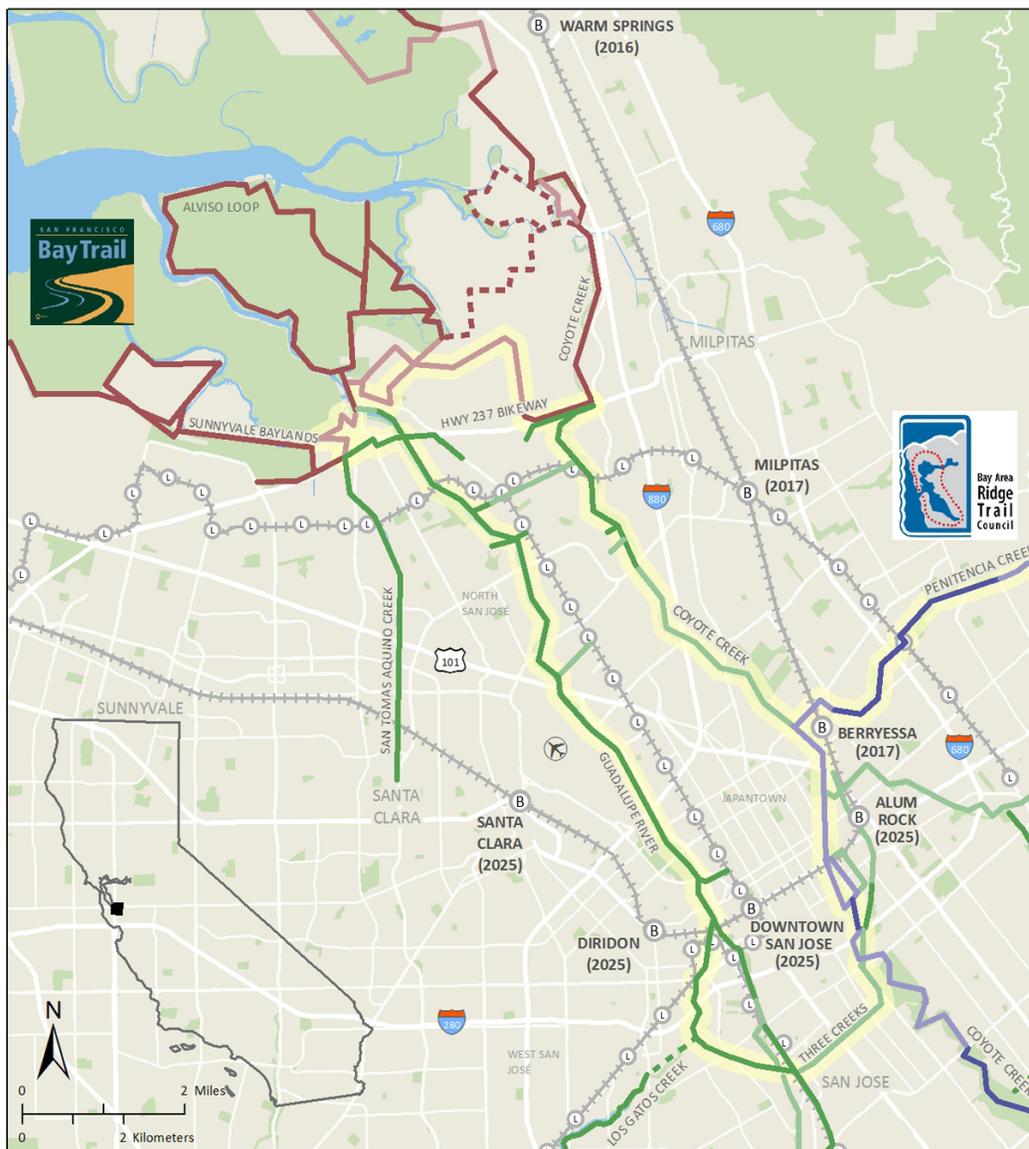
- Existing LRT Rails
- Planned BART Rails

Other Features

- L Light Rail Stops
- B BART Stations
- Core Loop Trails



Figure 3.1-2. Map of Silicon Valley Trail Loop – Planned Trails + Transit in 2025



Silicon Valley Trail Loop

Fully Built & Connected Trail Loop with Transit System 2025

Ridge Trail

- Existing in 2015
- Complete by 2025

Bay Trail

- Existing in 2015
- Complete by 2025
- - - Future Trail

Riparian/Connector Trails

- Existing in 2015
- Complete by 2025
- - - Future On-Street Bikeway

Rails

- + + + + BART Rails
- + + + + LRT Rails

Other Features

- B BART Stations
- L Light Rail Stops
- Core Loop Trails

Development of trail facilities dependent upon local and grant resources may not yet be confirmed and/or available within this time frame.



3.2 Trail Infrastructure

The trails described in this section (see Table 3.1.1) and featured in Figures 3.0.1 and 3.0.2 comprise the majority of the SVTL:

- The **Coyote Creek Trail**, currently 19 miles long, will be one of the network's longest trails when complete, extending south from the Bay shoreline (and south of Highway 237 as part of the SVTL) to Morgan Hill (a distance of about 25 miles).
- The **Penitencia Creek Trail** (part of the Ridge Trail network) will be extended to meet the SVTL's future southern extension of the Coyote Creek Trail at the Berryessa BART station planned to be operational in 2017, near the northeast side of San José's Japantown neighborhood.
- The Ridge Trail will continue south, connecting the future Coyote Creek Trail to the future **Three Creeks Trail** on the south side of downtown San José. The existing mile-long Three Creeks Trail travels through the Willow Glen neighborhood of San José and will connect to the Guadalupe River Trail's south end.
- The **Guadalupe River Trail**, currently 11 miles long, links San Francisco Bay to downtown San José; when complete, the 20-mile trail will continue the connection to south San José.
- The **Highway 237 Bikeway**, five miles long and serving mostly as a commuter trail, runs parallel to Highway 237 and links Milpitas and Sunnyvale.

Although the trails that compose the SVTL were the primary subject of this study, interconnectivity of trails and their linkage to communities result in the other trails having great value in supporting active transportation and accessibility to open space, employment centers

and schools. Trails leading to the SVTL include the Alviso Trail Loop, the Five Wounds Trail, the Lower Silver Creek Trail, the Highway 87 Bikeway, the Los Gatos Creek Trail, the San Tomas Aquino Creek Trail, and the Mountain View-Moffett-Sunnyvale Trail:

- The **Alviso Trail Loop**, part of the Bay Trail network and managed by the Santa Clara County Parks Department, is nine miles long, rich with San Francisco Bay wildlife, and serves mostly as a recreational trail.
- The **Five Wounds Trail**, about two miles long, follows a former railroad alignment that, when complete, will travel through eastern downtown San José.
- The **Lower Silver Creek Trail**, 6.5 miles once completed, will connect the Coyote Creek Trail to Lake Cunningham Park in East San José.
- The **Highway 87 Bikeway**, approximately four miles long, heads south from Downtown San José until the West Valley Freeway in Blossom Valley.
- The **Los Gatos Creek Trail**, currently 11 miles long, will connect the southern section of the core loop in Downtown San José to an extension into Campbell and Los Gatos.
- The **San Tomas Aquino Creek Trail**, approximately five miles long, connects both the Mountain View-Moffett-Sunnyvale Trail and the Highway 237 Bikeway, and extends south into Santa Clara.
- The **Mountain View-Moffett-Sunnyvale Trail**, four miles long, runs along San Francisco Bay, connecting various coastal employers such as Lockheed Martin, Yahoo! Corporation, and the NASA Ames Research Center.

The City of San José is pursuing a well-funded and citywide work plan to develop and extend each of these trail systems. Near the downtown and SVTL, work is underway to extend Los Gatos Creek Trail, enhance Highway 87 Bikeway, extend Guadalupe River Trail, and extend and close gaps along Coyote Creek trail. The San José trails within the SVTL are all categorized as Core Systems within San José's urban trail network because of their joint function as recreational and commuter routes. According to the City of San José Trail Manager, the City's trails are developed to Caltrans Class I standards to support multi-use, and include amenities such as decorative gateways, warning and advisory signs, and bridges and under-crossings when possible to avoid at-grade crossings. Trail users are also directed to amenities like public

restrooms in parks adjacent to the trails via directional signage. Table 3.2-1 includes more detail on each trail's location, length, condition, and installation status.

The Santa Clara Valley Water District is a significant partner in the City of San José's trail operational efforts. The Guadalupe River Trail and Coyote Creek Trail are only possible because of the District's willingness to permit recreational access to its maintenance roads under joint trail agreements with the City. The District is also a funding partner for development of the Three Creeks Trail.

Table 3.2-1. SVTL core and feeder trails

TRAIL NAME	DESCRIPTION	LENGTH TO DATE (MILES)	STATUS
Alviso Loop	The Alviso Trail Loop, part of the Bay Trail and rich with San Francisco Bay wildlife, serves mostly as a recreational trail.	9.0	Unpaved - Complete
Highway 237 Bikeway	The Highway 237 Bikeway, serving mostly as a commuter trail, runs parallel to Hwy. 237 and links Milpitas and Sunnyvale.	5.0	Paved – Complete
Coyote Creek	The Coyote Creek Trail, when complete, will be one of the network’s longest trails, extending southward from Hwy. 237 to Morgan Hill. South of the confluence with Penitencia Creek, this is part of the primary Ridge Trail route.	18.7	Paved/ Gravel – Incomplete
Penitencia Creek	The Penitencia Creek Trail will extend approximately 5 miles from its confluence with Coyote Creek, through the upcoming Berryessa BART station and Berryessa and Alum Rock neighborhoods to historic Alum Rock Park (with a trail connection to Sierra Vista Open Space Preserve). It is entirely part of the primary Ridge Trail route.	3.5	Paved – Incomplete
Three Creeks	The Three Creeks Trail currently travels through the Willow Glen neighborhood of San José between Los Gatos Creek and Guadalupe River. Efforts are underway to link to Highway 87 Bikeway and Coyote Creek trails.	0.9	Paved – Incomplete
Guadalupe River	The Guadalupe River Trail is a core system of San José’s trail network. When complete, the 20 mile trail will connect the San Francisco Bay to south San José, and to other trails and the Santa Cruz mountains.	11.4	Paved/ Gravel – Incomplete
Mountain View – Moffett - Sunnyvale	This part of the Bay Trail runs along the edge of San Francisco Bay through Mountain View and Sunnyvale, connecting various coastal employers such as Lockheed Martin, Yahoo! Corporation, and the NASA Ames Research Center.	4.0	Paved/unpaved - Complete

3.3 Transit Infrastructure

In the study area, as depicted in the maps contained in Figures 3.1-1 and 3.1-2, there are several transit options available currently (in 2015) and in the future (in 2025): VTA Light Rail, CalTrain and other regional rail, Bay Area Rapid Transit (BART), and bus service provided by VTA.

The study considers any transit within a half-mile of the SVTL.

3.3.1 VTA Light Rail

VTA's 42.2-mile, 62-stop light rail line is one of the longest to be built in the US in 50 years. Service started on the line in December 1987 and currently serves the residential areas of South San José, Downtown San José, San José Civic Center, North First Street high-tech area, Great America theme park, Tasman Drive high-tech and residential areas, Downtown Campbell, Lockheed Martin, Middlefield Road industrial areas, and Downtown Mountain View. VTA light rail service is offered seven-days a week, 365 days a year. Light rail operates on 15-, 30- and 60-minute frequencies depending on time of day, from 4:30 a.m. to 1:30 a.m. on the Alum Rock–Santa Teresa Line and 5 a.m. to 12 midnight on the Mountain View–Winchester Line. Light rail service connects with VTA buses at most stations. Light rail also connects with Caltrain at the Tamien, Diridon, and Downtown Mountain View stations. Light rail connects to Altamont Commuter Express and Capitol Corridor Intercity Rail Service at Lick Mill and Diridon stations. VTA currently operates 99 light rail vehicles and four historic trolleys. There are 62 stations with free lighted parking for 6,471 cars at 21 Park & Ride lots along the light rail line¹⁵.

¹⁵ VTA Light Rail Fact Sheet

The VTA light rail runs nearly parallel to the north-south running Guadalupe Trail on the west side of the SVTL, starting at Tasman Station and running south along First Street to the Convention Center station near Interstate 280. From there, the VTA light rail extends south along Highway 87 and outside of the study's geographic area. Picking up at Tasman Station on the north side of the study area, VTA light rail travels east roughly along Highway 237, outside of the study area and over to Highway 680 at Milpitas.

Light rail vehicles are equipped with bike racks in the center section of each car. Every vehicle can accommodate up to four bicycles, with a maximum number of six. Up to four bicycles can be accommodated in the racks provided, with two additional bicycles allowed to stand on the floor in the center section (turntable area) of the vehicle. **Light Rail ridership is considered in the study for the 2015 baseline scenario and for the 2025 future scenarios that include transit.**

3.3.2 Caltrain + Other Regional Rail

Caltrain provides commuter rail service along the San Francisco Peninsula, through the South Bay to San José and Gilroy. The San Francisco and San José Railroad Company began passenger rail service on the Peninsula in 1863; the system we know today as Caltrain began in 1992. CalTrain operates the 4th and King (San Francisco)-Tamien line (San José) running in a northwest to southeast fashion (and vice versa) within 2 miles of the study's geographic area. Other regional rail service, namely the Capitol Corridor line and the Altamont Commuter Express, runs roughly north to south (and vice versa) with a portion of the two lines within two miles of the study area.

Caltrain operates two types of train equipment: Bombardier and Gallery. While each train has two bike cars, the number of bike spaces on the two types of equipment differs. Bombardier trains can

accommodate 48 bikes, while Gallery sets carry a maximum of 80 bikes¹⁶. **Regional rail ridership is considered in the 2015 baseline scenario and the 2025 future scenario that includes transit.**

3.3.3 Bay Area Rapid Transit (BART)

With 104 miles of track, currently BART operates 44 stations and five lines throughout the Bay Area. Service extends north as far as Richmond and Pittsburg/Bay Point and running south, splits in Oakland, and continues southwest through San Francisco to Millbrae and southeast through Oakland to Fremont. The BART district was established in 1957 by the California State Legislature. It has 33 stations with parking for a total of 46,385 parking spaces and 5,383 bike parking facilities (lockers, racks and bike stations). There are 669 total fleet vehicles and maximum of 10 cars per train. Notably, 78% of operating costs are paid by passenger fares, parking, advertising and other sources of revenue¹⁷.

No BART service extends currently into the study area (for 2015 scenarios). However, **five extension and connector projects are planned for expansion of the BART system and several are considered in one 2025 future scenario that includes transit.** The Berryessa Extension is the 10-mile, two-station, first phase of BART Silicon Valley and is schedule to commence passenger service in 2017. This extension of the BART system will begin south of the future Warm Springs station in Fremont, proceed through Milpitas and end in the Berryessa area of north San José. The two stations feature parking structures, bus transit centers, bicycle and pedestrian connections and access to the BART and VTA transit systems. The extension will be within a half-mile walk

for nearly 30,000 local residents, less than a 12-minute bike ride for 260,000 people, and just 15 minutes via public transit or automobiles for more than 1,007,000 local residents¹⁸. The Ridge Trail (Penitencia Creek Trail) will connect directly to the Berryessa Station.

Phase II of VTA's BART Silicon Valley Extension will include a five-mile-long subway tunnel through downtown San José, will extend the BART system from the planned Berryessa Extension terminus for approximately six miles, ending at-grade in Santa Clara near the Caltrain Station. Four new stations are also planned including Alum Rock, Downtown San José, Diridon, and Santa Clara. Construction of Phase II is anticipated to begin as additional funding is secured in 2019 and is anticipated to commence passenger service by 2025. **All new service and six new stations constructed during Phases I and II are within the study's geographic area and are considered in the 2025 future scenario that includes transit.**

3.3.4 VTA Bus Service

VTA's bus services began January 1, 1973 and now consist of 426 active buses, zero-emission buses, smaller community buses and three bus divisions with maintenance and overhaul capabilities. VTA operates an extensive network of local bus routes serving the urbanized portions of Santa Clara County. These routes serve main arterial streets, neighborhoods and residential areas, shopping, schools, employment areas and other businesses. Approximately 80% of Santa Clara County residents are within a quarter mile of a transit route¹⁹. There are a number of local bus, community bus, limited stop bus and express bus routes within the study's geographic area. VTA has equipped all buses

¹⁶<http://www.caltrain.com/riderinfo/Bicycles/BikesOnBombardiers.html>

¹⁷ BART 2014 Fact Sheet

¹⁸ <http://www.vta.org/bart/stations>

¹⁹ <http://www.vta.org/getting-around/schedules/bus-rail>

with exterior bike racks that can accommodate up to two bicycles. When the racks are filled, up to two bicycles are allowed inside the bus subject to the driver's discretion when passenger loads are light. **Bus ridership is considered in the study for the 2015 baseline scenario and for one 2025 future scenario that includes transit.**

In addition to the current bus system in place, VTA will be upgrading several service lines to Bus Rapid Transit Technology: Santa Clara-Alum Rock with 11 new stations (2017), El Camino Real (2018), and Stevens Creek (2018). The Santa Clara/Alum Rock Bus Rapid Transit Study will provide approximately seven miles of limited-stop rapid transit service from the Eastridge Transit Center to the Arena Station in downtown San José using Capitol Expressway, Alum Rock Avenue and Santa Clara Street. The El Camino Real Bus Rapid Transit Study will upgrade the 522 Rapid Bus Route on El Camino Real to Bus Rapid Transit status and as the 522 Rapid Bus does today, the 522 BRT route would travel from the Palo Alto Transit Center to the Eastridge Transit Center, traveling through Downtown San José. Around 26 BRT stations would be served along the way. The Stevens Creek Bus Rapid Transit Study will provide a rapid transit service for 8.5 miles from De Anza College to the Transit Mall in downtown San José using San Carlos Avenue and Stevens Creek Boulevard²⁰. **Anticipated ridership on the new bus rapid transit lines is considered in the study for one 2025 future scenario that includes transit.**

3.4 Current and Future Mode Share

Current mode share and planned (future) mode share/mode shift programs were identified through research of regional agencies and

²⁰ <http://www.vta.org/projects-and-programs/transit/bus-rapid-transit-program>

city planning departments as well as by conducting surveys with major employers and study partners working in this area.

Surveys to be completed by transportation coordinators (or those assuming the responsibilities of such a position) of major employers and project partners were developed in collaboration with the SVTL Planning Team and tested by representatives from both groups (employers and the study partners). Facilitated by groups like 511 and the Planning Team, surveys were completed between August 4 and August 24, 2015. A total of 22 responses were included in the analysis, 15 from major employers²¹ and seven from study partners. The data set with responses from all survey respondents to all survey questions is available for any interested study partner. A summary of all responses to all questions is included in Appendix B.

Surveys requested that respondents:

1. Estimate the mode share of employees and program participants commuting to and from home and work; and
2. Indicate the desired mode share from employees or program participants in 2025.

Results, including those from the City of San José and the VTA, are presented in Table 3.4-1.

²¹ Twenty “major employer” responses were received, 15 of which were included in the study. Of the five excluded, one was a duplicate response, two were from outside the study area, and two provided only the number of employees or average commute distance and no responses for any of the qualitative questions.

Table 3.4-1. Comparison of various mode share estimates

	TELE-COMMUTER	CAR-POOLER	BIKE COMMUTER	TRANSIT COMMUTER	PEDESTRIAN COMMUTER
EMPLOYERS SURVEYED	8.3%	4.5%	4.7%	19.4%	4.6%
PROJECT PARTNERS SURVEYED	20.0%	11.0%	23.3%	30.0%	5.0%
SAN JOSE (2008) ⁱ	5.8%	9.2%	1.2%	4.1%	1.8%
SAN JOSE (2040)	NA	>10%	>15%	>20%	>15%
VTA (2015)	NA	11.4%	1.8%	3.9%	3.3%
VTA (2025)	NA	11.6%	2.5%	5.7%	3.5%

According to the VTA, SOV trips account for 79.6% of mode share in 2015 and an estimated 76.6% of mode share in 2025.

Employers’ transportation coordinators responded that all modes of transit, active transportation options, and shuttles or vanpools (the only non-public, motorized form of transportation indicated) are the preferred commute options for employees in 2025. The Study Partners responded that all modes of transit and active transportation were the preferred modes of transportation. They also cited a preference for carpools (the only non-public, motorized form of transportation indicated). One study partner responded with quantitative mode share targets of a maximum of 40% drive alone, at least 20% use transit, 15% bicycle and 15% walk (source: City of San José respondent).

3.5 Transportation Demand Management Programs

Employers, housing developments, advocacy groups and local government agencies are designing and implementing Transportation Demand Management (TDM) programs²² within the study area to reduce reliance on SOVs [single-occupancy vehicles].

3.5.1 Level of Participation in TDM Programs and Incentives – Current and Anticipated

Survey responses shed light onto which TDM programs and incentives are (1) currently in place, and (2) planned to be implemented by 2025. Table 3.5.1-1 displays the 2015 levels in which employees participate in TDM programs as reported by employers. Table 3.5.1-2 displays whether employers’ and study partners’ currently (in 2015) and plan to (in 2025) implement each TDM program.

²² The term "demand" refers to the amount of street/road use during a given time period. Transportation Demand Management programs focus on changing or reducing travel demand, particularly from SOVs and at peak commute hours, instead of increasing roadway supply.

Table 3.5.1-1. 2015 TDM program participation by employees

Employer-provided transit (e.g. company van or bus)	13.6%
Telework and flexible work scheduling	13.1%
Free or reduced price transit passes	7.6%
Provision of secure bike lockers, showers, and/or changing facilities	5.7%
Guaranteed ride home	4.7%
Bicycle loan program for home-to-work commute	4.3%
Rideshare matching services (i.e. providing employees with tools to find carpools)	4.3%
Educational seminars on bicycle safety and/or route planning	4.2%
Installed on-site infrastructure that facilitates the use of trails or transit	3.9%
Pre-tax deduction benefit	3.6%
On-site transit information and/or pass sales	3.5%

Table 3.5.1-2. Current and anticipated TDM programs – Years 2015 and 2025

TDM PROGRAM OR INCENTIVE	2015		2025	
	EMPLOYERS	STUDY PARTNERS	EMPLOYERS	STUDY PARTNERS
Provision of secure bike lockers, showers, etc.	✓	✓	✓	✓
Installed on-site infrastructure to trails/transit (e.g., paths from buildings/campus to trail or transit, protected transit waiting areas, etc.	✓	✓	✓	
On-site transit information and/or pass sales	✓	✓	✓	
Policy enabling "bikes in the building"	✓	✓	✓	
Bicycle loan program for work commute	✓	✓		✓
*Employer-provided transit (e.g., company van or bus)	✓		✓	
*Rideshare matching services (i.e., providing employees with tools to find carpools)	✓	✓	✓	✓
Guaranteed ride home (e.g., standby car or van service for those that miss their normal transit ride or are not prepared to bike in inclement weather)	✓	✓	✓	✓
*Telework and flexible work scheduling (by working at home, SOV trips are avoided; flexible schedules enable avoidance of traffic congestion during peak commute hours)	✓	✓	✓	✓
Free or reduced price transit passes	✓	✓	✓	✓
Educational seminars on bicycle safety and/or route planning	✓	✓	✓	✓
Limited parking supply	✓	✓	✓	
Pre-tax deduction benefit (e.g., an incentive employers offer to facilitate purchase of transit passes from employees pre-tax compensation)	✓	✓	✓	✓
Employer-provided subsidy (e.g., where employers subsidize a portion or all of the cost of a transit pass or purchase of a commute bike)	✓	✓	✓	✓
Rewards and recognition for using alternative transportation	✓	✓	✓	✓
Cash benefits, such as a parking cash out (e.g., receive cash in lieu of a parking pass)	✓		✓	✓
Parking fees or elimination of subsidized parking	✓		✓	✓

**This study only factors into the analysis the programs and incentives that encourage active transportation and filters out those that shift mode to another form of motorized transportation, or that eliminate the trip entirely. In Table 3.4.2, a checkmark denotes that at least one respondent indicated that the TDM program was currently or planned to be implemented. For analysis, it is assumed that any program in place in 2015 will continue to be implemented in 2025.*

This study focuses on programs and incentives that encourage active transportation (and so filters from the analysis those that shift the mode to another form of motorized transportation, or that eliminate the commute trip altogether). Thus, **the three programs that involve active transportation and had the most participation in 2015** (according to survey responses) are:

- free or reduced-price transit passes,
- provision of secure bike lockers, showers, and/or changing facilities, and
- bicycle loan programs for the home-to-work commute.

“Level of participation” is factored into the selection of TDM programs to be included in the emissions reduction forecasts for the 2015 baseline scenario (Scenario 1) and 2025 future scenario that includes TDM programs (Scenario 4). See Section 3.4.3 for explanation of the TDM programs selection process.

3.5.2 Effectiveness of TDM Programs and Incentives

In addition to indicating mode share, participation rates, and implementation of new programs and incentives, the surveys probed for perceived effectiveness of each program or incentive. Effectiveness is defined as the degree to which a program or incentive will reduce SOVs and, in turn, GHG emissions. The study used two measures of effectiveness: one based on the study’s survey responses and another based on empirical literature (to help address any inherent bias from survey responses).

Along with “level of participation,” “effectiveness” is also factored into the selection of TDM programs to be included in the emissions reduction forecasts for the 2015 baseline scenario (Scenario 1) and

2025 future scenario that includes TDM programs (Scenario 4). See Section 3.4.3 for explanation of the TDM programs selection process.

Effectiveness Based on Surveys

Effectiveness is quantified for each mode shift program or incentive as the average of transportation coordinators’ responses to the question “to what degree each is making a difference in mode shift?” The following are the questions used to determine effectiveness and a summary of responses for each respondent group and each scenario year.

For each of the incentives or programs your company (or participants) already implement(s), rate to what degree you think each is making a difference in mode shift from single occupancy vehicle trips to trail and trail-transit commutes (where 5 is large difference and 1 is no difference).

From the menu of choices, **employer transportation coordinator respondents indicated that the TDM incentives and programs currently making the highest degree of difference in shifting employees from SOV trips to trail and trail-transit commutes include:**

- policy enabling bikes in the building
- rewards and recognition
- free or reduced price transit passes
- limited parking
- pre-tax deduction benefit
- on-site transit information and/or pass sales, an
- education seminars on bicycle safety.

From the menu of choices, *study partner respondents indicated that the TDM incentives and programs currently making the highest degree of difference in shifting employees from SOV trips to trail and trail-transit commutes include:*

- active commute contests (an “other” response)
- policy enabling bikes in the building
- free or reduced price transit passes
- rewards and recognition
- provision of secure bike lockers, showers and/or changing facilities
- on-site transit information and/or pass sales
- limited parking
- employer-provided subsidy, and
- installed on-site infrastructure that facilitates the use of trails or transit (the last four programs/incentives were tied).

Because respondents were not specifically asked to anticipate the effectiveness of the TDM incentives or programs in year 2025 (only specify for 2015/current year), effectiveness as quantified from the surveys is assumed to be the same in 2025 as in 2015.

Effectiveness based on Empirical Literature

Effectiveness as reported in the literature was also used to rank each program or incentive evaluated. Various sources were consulted, including the California Air Pollution Control Officers Association’s (CAPCOA’s) *Quantifying Greenhouse Gas Mitigation Measures* guidance

document,²³ which underlies one of the study’s GHG forecasting methods.

The top 50% of those TDM incentives and programs that are most effective in shifting from SOV to trail and transit user includes (in descending order):

- Employer-provided subsidy and pre-tax deduction benefit
- bicycle loan program
- free or reduced price transit passes
- parking fees/elimination of subsidized parking, limited parking
- employer provided transit
- cash benefits (e.g., parking cashout)

These effectiveness measures are used in both the 2015 and 2025 scenarios.

3.5.3 TDM Programs and Incentives Recommended for Emissions Reduction Potential Analysis

To determine the mode shift programs recommended for emissions reduction analysis, TDM programs and incentives were filtered by three criteria: “active transportation or transit,” “ease of implementation” and “effectiveness.”

Criterion 1 - Active Transportation or Transit: This study and its analysis focused on mode shift from SOV to use of trail and transit. We therefore distinguished between TDM programs and incentives that simply shift SOV use to another motorized form of transportation (such as a carpool or vanpool, private shuttles or transit) or eliminate a trip

²³ See Appendix E for each TDM measure’s effectiveness per CAPCOA.

(e.g., telecommuting) versus those that shift the mode to active transportation. The distinction is important because policies and programs aimed at decreasing SOVs from the roads do not proportionately increase bike and walk mode share.

Criterion 1 therefore filters the list of TDM policies, programs, and incentives to include only those that promote mode shift to active transportation on trails and transit.

Criterion 2 - High Degree of Implementation: Criterion 2 filters the list of TDM policies, programs and incentives to include only those that **both** sets of survey respondents (“employers” and “project partners”) indicated had the most participation (the top 50%) in 2015. (And because the survey did not ask for projected 2025 participation rates, the same list was used for the 2025 study scenario).

Criterion 3 - Effectiveness: The list of TDM policies, programs and incentives was filtered to capture both “regional effectiveness” as indicated by the survey results, and “statewide effectiveness” as indicated in the empirical literature discussed above

Criterion 3 filters the list of TDM policies, programs, and incentives to include only those that :

- **both sets** of survey respondents (“employers” and “project partners”) indicated were the most effective (the top 50%) in shifting SOV trips to trail and trail-transit commutes (strong regional indication); **or**
- **one set** of survey respondents **and** the empirical literature indicated were the most effective (the top 50%) in shifting SOV trips to trail and trail-transit commutes (both regional and state indication).

Selection Results - Applying these three criteria (see tables in Appendix C) resulted in the following TDM policies, programs, and incentives being selected for inclusion in the “emissions reduction potential” analysis (for both Year 2015 and Year 2025 scenarios): ***on-site transit information and/or sales pass, free or reduced price transit passes, limited parking, and a pre-tax deduction benefit.***

4.0 Methods to Determine Emissions Reduction Potential

4.1 Quantification Methodology Selection

Several methodologies exist to determine emissions reduction potential from trail, transit and TDM program implementation. Few, however, are comprehensive enough to compute VMTs and emissions reductions for each component of the study focus: trails, transit, and TDM programs²⁴. A number of agencies are using best available methods to quantify GHG emissions; others are developing new methods and tools. The robustness and technical complexity of methods employed varies substantially. In some states, agencies are required—or may soon be required—to quantify transportation-related GHG emissions attributable to new development as part of the development’s environmental review process.

It was the intent of the Planning Team to use methods that were recognized as comprehensive, robust, replicable, and verifiable, and, to the extent possible, considered local conditions. It was agreed that emissions reductions determinations would be made using two parallel methodologies: one that was recognized by the state and one that had

been specifically developed for the region in which the study area is located.

1. The Strategic Growth Council’s (SGC) Affordable Housing and Sustainable Communities (AHSC) program guidelines. This methodology is essentially a set of calculations, and was chosen because:
 - It was developed to be applied to “transit and connectivity” projects, e.g., bicycle and pedestrian facilities (called “Integrated Connectivity Projects” in the AHSC grant round);
 - It is provided by the California Air Resources Board (CARB), the agency charged with providing the quantification methodology to estimate GHG emission reductions from projects receiving monies from the Greenhouse Gas Reduction Fund, an account established to receive Cap-and-Trade proceeds.

EcoShift computed emissions reduction potential for each scenario under the SGC AHSC program guidelines.

2. The Santa Clara Valley Transportation Authority’s (VTA’s) Countywide Travel Demand Model. This methodology is an actual model, and was chosen because:
 - It has been specifically developed for the study region;

²⁴ For example, the Transportation Research Board’s Transit Cooperative Research Program (TCRP) Report 176: Quantifying Transit’s Impact on GHG Emissions and Energy Use—The Land Use Component examines interrelationships between transit and land use patterns to understand their contribution to compact development and the potential GHG reduction benefits.

- Model provides enhanced metrics that improve insight into other aspects of active and transit transportation in the SVTL geographic area.

Modelers from the VTA determined VMTs [vehicle miles traveled] for combinations of trail and trail/transit use in 2015 and 2025 for the entire County. VMT, transit, bicycle, and pedestrian volumes were developed from the VTA models to use in the SGC method. For both methods, EcoShift applied CARB emission factors for each year to VMTs reduced to determine the metric tons of emissions reduced for each scenario.

4.2 Core Study Assumptions

A core set of assumptions was required to create parameters for which scenarios would be analyzed for their emissions reduction potential. Under both methodologies, key assumptions include:

- One focus is on home - work commutes²⁵ in order to best utilize survey information from employers.
- Current and future trail and transit infrastructure is known for the study area as described in Section 3.0.
- In 2025, all planned trails will be built and access to them from roadways and transit stations provided.
- In 2025, all planned BART stations will be built and able to be accessed.

²⁵ It is significant to note that 75% of trips on the SVTL are non-commute (e.g., recreation, etc.) and presents results for both commute and non-commute trips for each scenario in Section 6.

- The SGC method uses estimated traffic and transit use volumes from the VTA model (as summarized in Appendix F). Because the VTA model considers future land use and density variations in its output, both methods have accounted for those variables consistently. The SGC method does not, however, rely strictly on VMTs from the VTA model to estimate emissions reduction potential, but conservatively discounts VMTs based on a variety of factors (e.g., adjustment for transit dependency, distance to activity centers, adjustments based on population and average daily traffic, etc.).
- Neither method considers the impact of trip chaining in combination with commute trips²⁶.
- Although the surveys included questions about trail comfort, perceived safety and infrastructure quality, the VTA model ignores those variables in its computations and the SGC method provides no calculations to consider these variables. Thus, they are excluded from consideration in the modeling, but are discussed in the recommendations section.
- Under the SGC method, the emissions reduction potential for each scenario is computed for each contributing component or source (e.g, bike and pedestrian paths, transit use, mode shift programs).
- For both scenario years, mode shift policies, programs and incentives recommended for inclusion in the emissions reductions analysis under the SGC method were identified as

²⁶ The Federal Highway Administration developed an operational definition of a “trip chain” as a sequence of trips bounded by stops of 30 minutes or less (2003). The two methods used in this study to forecast emissions reductions only factor in the commute trip “leg” of a trip chain.

on-site transit information and/or sales pass, free or reduced price transit passes, limited parking, and a pre-tax deduction benefit.

4.3 Strategic Growth Council Affordable Housing and Sustainable Communities Method

The SGC AHSC program funds “Transit-Oriented Development,” which focuses on affordable housing and transportation-related infrastructure, and “Integrated Connectivity Projects,” which focus on transit and connectivity (e.g., bicycle and pedestrian facilities). Use of this method is appropriate because **the SVTL Study focuses on infrastructure and Vehicle Miles Traveled (VMT)-reducing programs consistent with Integrated Connectivity Projects.**

Consistent with the SGC AHSC Program Guidelines, the following calculations were used to capture emissions reductions associated with improved trail and transit infrastructure and mode shift programs (i.e., VMT-reducing programs):

- Calculations that underlie the "California Emissions Estimator Model" (CalEEMod), which are appropriate because CalEEMod accounts for “commute” and “site enhancement” programs (note that direct application was not appropriate because Integrated Connectivity Projects do not contain housing infrastructure).²⁷.

²⁷ California Air Pollution Control Officers Association (2010). *Quantifying Greenhouse Gas Mitigation Measures: a Resource for Local Government to Assess Emission Reductions from Greenhouse Gas Mitigation Measures* underlies the CalEEMod model. CARB recommends the manual calculation approach over modeling because there is no housing component associated with the infrastructure improvements and VMT-reducing programs to be implemented.

- “Transit And Connectivity” methods,²⁸ to determine emissions reductions not covered in CalEEMod such as transit projects, bicycle paths and pedestrian facilities. TAC methods consist of a series of manual calculations that include estimating the changes in VMTs, and calculating GHG emission reductions over the life of the project (new trails, transit service, programs, etc.) based on the project’s specific emission factors²⁹, land use and transportation characteristics.³⁰.

All calculations and data-specific assumptions are contained in Appendix F.

4.4 Santa Clara Valley Transportation Authority Countywide Model

The VTA model is a typical four-step regional travel demand model, the use of which is standard practice at major Metropolitan Planning Organizations and most transportation planning agencies. These types of models explicitly consider trip demand caused by the locations of population and employment patterns in an urban area, and the impacts to transportation supply (roads, transit services, and bicycle and pedestrian paths) caused by the travel demand and flows. The models are sensitive to changes in development patterns, transportation

²⁸ "Methods to Find the Cost-Effectiveness of Funding Air Quality Projects of Evaluating Motor Vehicle Registration Fee Projects and Congestion Mitigation and Air Quality Improvement Projects" (CMAQ Methods) were used to calculate emissions reductions.

²⁹ In California, the use of the [California Air Resources Board EMFAC model](#) is considered standard best practice for transportation planning and future. EMFAC projects emissions factors through 2035.

³⁰ For this study, only annual emissions reduction estimates are presented (rather than extending annual emissions reductions over the life of the study).

infrastructure and pricing, and can be used to evaluate transportation alternatives for a base year and for future horizons.

The VTA model includes the current trail network and makes assumptions about what 2020 and 2040 trails look like. It was coded with new trails and access points to the new trails for 2025. The VTA model was also calibrated using 2014 and 2015 trail count data before analysis to determine VMTs. Similarly, the model reflects the current and future transit network infrastructure, including all transit stops and connections. Specifically in 2025, transit service includes the full Santa Clara BART extension (Milpitas, San José and Santa Clara – six new stations), El Camino Real Bus Rapid Transit, Stevens Creek Bus Rapid Transit, and the Light Rail System Efficiency Projects (speed improvements, express service and new line from Alum Rock to Mountain View).

Current TDM programs are not explicitly accounted for in the VTA model; their effect is indirectly factored into the model, however, captured in the actual observed data about trips by mode (auto, transit, non-motorized) with which the model is calibrated.

The VTA model was used to determine auto VMTs for the entire Santa Clara county under the core assumptions for different scenarios. EcoShift conducted post-processing of this VMT data to estimate the GHG emissions avoided in the study scenarios (i.e., used emissions factors derived from [CARB EMFAC model](#), the tool used to calculate emissions from on-road vehicles).

All calculations and data-specific assumptions are contained in Appendix F.

4.5 Methodology Comparison

The use of more than one method enables comparison of the merits, disadvantages and tradeoffs. For example, a regional model (e.g., VTA) theoretically should be more accurate than a static set of calculations (e.g., SGC AHSC).

Both methods use assumptions that require a deep dive into the literature and documentation. Although the calculations and assumptions underlying the VTA model are less clear than the calculations of the SGC AHSC method, the VTA model factors in a much greater number of variables and calibration, perhaps yielding a more realistic view of emissions-reduction potential when compared to the relatively simplistic SGC calculation process.

An advantage of using both methods was that the more robust results of the VTA model could be used to help “customize” application of the SGC method (because some, though not all, specific regional model output is fed into the SGC calculations). For example, the SGC method assigns default average trip lengths for each mode, which is a limitation that impacts the accuracy of the emission reduction determinations. When this limitation was recognized, the study team was able to conduct a second iteration of calculations that used actual average trip lengths for each mode (presented in Table F-1) as determined by the VTA model.

It is also assumed that due to its complexity, the VTA model output includes the synergistic effects of trail and transit use in tandem, as opposed to the static calculations for the two components as prescribed by the SGC method.

Finally, using two methods also allows a sensitivity analysis to be conducted, giving a range of expected emissions reductions

attributable to trail and transit use as well as mode shift programs under each scenario.

4.5.1 Synergistic Effects

Implementation of trail and transit improvements and the impact of TDM programs and incentives act in a synergistic fashion to reduce SOV trips and GHG emissions. Research evaluating the impact of vehicle trip reduction strategies sometimes attempts to isolate the stand-alone effects of implementation of transportation infrastructure, policies and programs—but it is difficult to isolate these effects because, in reality, implementation of infrastructure, policies and programs occurs concurrently.

For example, a city may implement a subsidized transit pass at the same time it completes a trail or implements a policy enhancing access to TDM programs and incentives. It is difficult to identify with absolute certainty which of the changes caused the resulting increase in transit ridership. Because trip reduction strategies often support one another in creating high-quality alternatives to auto commuting, multiple strategies implemented jointly can leverage greater impacts when compared to stand-alone implementation. In fact, the California Air Pollution Control Officers Association (CAPCOA) recognizes that the “synergistic effects” of combinations of measures enhance the performance of a measure.

On the other hand, TDM policies, programs and incentives have a limited useful life, after which their effectiveness at motivating mode shift away from SOV to trail and transit is reduced. For example, as more employees take advantage of incentives, employers may determine that incentives are too cost prohibitive and eliminate or constrain the requirements to participate in the program. According to CAPCOA, when “more and more measures are implemented to

mitigate a particular source of emissions, the benefit of each additional measure diminishes” (2010).

4.5.2 Comparing Differences, Strengths, and Weaknesses

There are some key differences between the two methods, which means each brings particular strengths and weaknesses.

Ability to determine emissions reductions per component (infrastructure improvement or TDM program/incentive) - Because the SGC method prescribes calculations for each infrastructure component and TDM program implemented, there is visibility into how much each component contributes to the overall emissions reduction potential. In contrast, the VTA model output only enables visibility into the overall emissions reduction potential for each scenario. It also only considers TDM programs and incentives indirectly (in that it is calibrated with observed traffic, trail and transit use, which should reflect the impact of those programs).

Ability to Capture Synergistic Effects -The VTA model, by design, is able to simulate synergistic and diminished return effects because its results are calibrated with real-world counts of traffic, ridership and trail use. The static SGC method cannot capture dynamic synergistic impacts, and its guidance document acknowledges that “interactions between the various categories of transportation related mitigation measures is complex and sometimes counter-intuitive.” This study does, however, enable this method to capture synergistic effects to some degree by virtue of its reliance on VTA model outputs as calculation inputs.

Ability to Isolate the Trail Contribution - An advantage of the VTA method is that its range of output metrics enable greater insight into how the SVTL and its feeder trails impact emissions reduction potential

in combined trail and transit trips, and how the SVTL enables increased and quicker access to jobs in 2025.

Table 4.5.2-1 summarizes the two methodologies in an at-a-glance format.

Table 4.5.2-1. At-a-glance summary of two methodologies

CHARACTERISTICS	SGC	VTA
Method type	Static sets of calculations with study specific inputs, assumptions	Dynamic computer model with region specific inputs and assumptions
Emissions determination	apply EMFAC emission factors to VMTs	apply EMFAC emission factors to VMTs
Addresses Emission Source or Factor?		
Operation of Bus/ Transit Service	Yes	Yes
New bicycle + pedestrian paths	Yes	Yes
TDM programs + incentives	Yes addresses prioritized measures	No but accounted for in calibration with observed mode counts
Land Use + Density	Indirectly via VTA data	Yes
Trail comfort, perceived safety + infrastructure quality	No	No
Models Synergistic Effects of Combined Trail and Transit Use	No	Yes
Enables visibility of SVTL impact beyond overall emissions reduction potential	Enables visibility by contribution of each trail, transit and TDM program use component	Enables visibility into other metrics like increased access to jobs

4.5.3 Limitations of SGC and VTA Methodologies

Limitations of the study include:

- The VTA model is not yet able to account for the impact of TDM programs (but will perhaps do so in a later version of the model). The contribution of TDM programs was, however, captured by the SGC methodology.
- **Neither** the SGC methodology nor the VTA model³¹ is able to break out and quantify the trail’s influence on transit use. For example, neither separates out how much the presence of a connected trail is facilitating or increasing the use of transit, or increasing the participation in TDM programs (e.g, one may purchase a subsidized transit pass only because s/he can walk or bike to the transit station).

³¹ Although the VTA was able to calculate the emissions reductions that result from walking or biking to and from transit (see Section 5.3.1).

5.0 Summary of Emissions Reduction Potential

5.1 Overall Summary and Results Comparison

The following table (Table 5.1-1) presents the emissions reduction potential under each study scenario as forecasted by the two different methodologies discussed above. Results are shown in metric tons of carbon dioxide equivalent (MT CO₂e). Note that these results reflect all trips combined; **the break-out of emissions reduction potential for commute versus non-commute trips using each method are detailed in subsequent sections.**

Table 5.1-1. Comparison of emissions reduction estimates by scenario and method³²

STUDY SCENARIOS	SGC Emissions Reduction Potential (MT CO ₂ e)	VTA Emissions Reduction Potential (MT CO ₂ e)
(1) 2015 Conditions: 2015 trails, transit, and TDM programs	2,492	3,616
(2) Scenario 1, plus 2025 Trail: 2015 transit and TDM programs, plus fully built and connected Silicon Valley Trail Loop	4,511	5,458
(3) 2025 Trail and Transit: Scenario 2, plus 2025 transit network	6,303	28,195
(4) 2025 Trail, Transit, and TDM programs: Scenario 3, plus 2025 TDM programs	7,063	NA ³³

The study capitalized on the strengths of each quantitative method to determine emissions reduction forecasts appropriate to each scenario. As indicated previously, the SGC method is not intended to break out the trail-transit interactions, and the current iteration of the VTA model does not yet account for the effect of TDM programs. The projected emissions reduction potential results are well in line with the order of

³² The forecast emissions reductions are compared to having no trails, transit, or TDM programs.

³³ The VTA model does not specifically include TDM programs and incentives, and thus is not appropriate for Scenario 4.

magnitude of other similar projects where the SGC method was utilized, giving a degree of confidence that the results are sound.

For scenarios 1 and 2, the two methods correlate well in terms of magnitude of emissions reductions estimated. However, the VTA model estimates emissions reduction potential to be higher in all scenarios than the SGC method, and in Scenario 3 its estimate is over four times that of the SGC method .

As discussed in the previous section, the following factors likely account for the differences in results:

- Although the SGC method uses some (but not all) output from the VTA model (such as average traffic and transit use), it uses static calculations and a limited set of factors to discount the VMTs; the VTA model considers a greater number of factors dynamically and synergistically.
- The VTA model captures “synergistic effects,” i.e., it is able to consider the multiplier effect of the combined use of trail and transit systems on reducing auto trips (the SGC method considers trail use separately from transit use).

The Planning Team sought to further explore synergistic effects by determining emissions reductions from **taking the trail to and from transit**. The VTA was able to provide context on emissions reduction potential from people walking, biking, and driving to transit through the model’s estimation of arrivals to transit by mode. By applying average trip lengths by mode and the emission factor for avoiding running autos, it was estimated that **potentially 524 MT CO₂e of emissions could be reduced annually by walking or biking to and from transit under Scenario 3, the 2025 combined trail and transit scenario**. In contrast, the SGC method cannot account for the additional

reduction of taking the trail to/from transit; it treats each trip as either “trail only” or “transit only.

Furthermore, we can assume that a portion of the emissions avoided in Scenario 3 by using transit is attributable to the new BART extension (according to BART, projected daily BART ridership for the Silicon Valley Extension will reduce regional traffic congestion and GHG emissions over 3,400 MT/year when completed ³⁴). Scenario 3 also includes emissions reduction from use of bus, light rail and other forms of transit, bicycling, and walking. Because BART is the major new infrastructure piece in 2025, comparing its projected emissions avoided with the overall projected emissions avoided for Scenario 3 determined by the VTA gives a degree of confidence in that the orders of magnitude are the same for the SCG method and similar for the VTA method. It is unlikely, however, that BART considered the synergistic effects of trail and transit use in combination as the VTA model does.

The following are notable conclusions drawn from the results:

- **The effect of trails alone—a fully built and connected trail loop, independent of additional transit—almost doubles the amount of emissions reductions compared with existing conditions, a partially-built trail network** (note the difference between Scenario 2 and Scenario 1);
- **A fully completed trail loop will result in a substantial increase in the number of jobs that can be reached within just 15 minutes via bicycle—in some zones, up to 42,300 additional jobs** (see Figure 5.3.2-1);

³⁴<http://www.vta.org/sfc/servlet.shepherd/document/download/069A0000001Pkv2IAC>

- **Combining use of transit with trails yield up to eight times the amount of emissions reductions compared with existing conditions** (note the difference between Scenario 3 and Scenario 1).

Note that another 2025 scenario was initially considered: “Baseline, plus 2025 Trail and TDM programs,” to capture the effect of people using a fully built and connected trail system in concert with TDM programs and incentives (but with no transit build-out beyond the baseline network). As detailed in Section 3.4.3, TDM programs/incentives were prioritized based on both effectiveness and ease of implementation, and only the highest-ranking were included in the emissions reductions calculations for each study scenario. Interestingly, three of the four TDM programs/incentives prioritized for inclusion were transit-focused (on-site transit information and pass sales, free/reduced price transit passes, and pre-tax deduction benefit) rather than trail-focused (such as “policy enabling bicycles in the building,” or “provision of secure bike lockers”). Although these programs/incentives may indirectly influence use of the trail in a trail-transit combination (e.g., perhaps one would purchase a pass because s/he could walk or bike to transit), the Planning Team ultimately determined that the connection was not strong enough to ensure the emissions reduction results under this scenario would be meaningful. Hence, results from this scenario are not included in this study. Yet the intent of the scenario is still included in the discussion because it provides a good example of things to consider when formulating scenarios, and will hopefully increase the usefulness of this effort as a case study.

The following sections provide details on the emissions reduction potential determined under both methods, present two additional ways to contextualize each scenario’s emission reduction estimate, and compare the estimated emissions reduction potentials with overall

emissions from a variety of sources (making the emissions reduction potential estimates more tangible).

5.2 Emissions Reduction Potential from SGC Method

Results by trip type (commute versus non-commute) - The emissions reduction potential from TDM programs was only calculated for the commute portion of emissions (assumed to be 25%) because the TDM programs are only available to those commuting for work purposes. Hence, there is no difference in the non-commute-related emissions between Scenarios 3 and 4, as the only difference in these scenarios is the application of TDM programs.

The following table (Table 5.2-1) shows both **commute- and non-commute-related emissions reduction potential** for the study scenarios. The proportion of emissions avoided that is attributable to commuting is as follows: Scenario 1 – nearly half; Scenarios 2 and 3 – about one quarter; Scenario 4 – over a third.

Table 5.2-1. Emissions reduction forecasts from SGC method³⁵

STUDY SCENARIOS	COMMUTE-RELATED EMISSIONS POTENTIALLY REDUCED ANNUALLY (MT CO2e)	NON-COMMUTE-RELATED EMISSIONS POTENTIALLY REDUCED ANNUALLY (MT CO2e)	TOTAL EMISSIONS POTENTIALLY REDUCED ANNUALLY (MT CO2e)
(1) 2015 Conditions: 2015 trails, transit, and TDM programs	1,088	1,404	2,492
(2) Scenario 1, plus 2025 Trail: 2015 transit and TDM programs, plus fully built and connected Silicon Valley Trail Loop	1,128	3,383	4,511
(3) 2025 Trail and Transit: Scenario 2, plus 2025 transit network	1,576	4,727	6,303
(4) 2025 Trail, Transit, and TDM programs: Scenario 3, plus 2025 TDM programs	2,336	4,727	7,063

³⁵ The total parking and commute VMT reduction does not exceed 70% in any of the scenarios that include TDM programs and incentives (1 and 4), so the CAPCOA rule is not violated. The impact of the four TDM programs and incentives recommended for analysis are included in the SGC method estimates presented in Section 6.

Results by emissions-reducing category (trail or transit infrastructure, or specific TDM program/incentive) - One of the

benefits of the SGC method is that emissions avoided are calculated by emissions-reducing category. However, it is important to provide more information on why and how each emissions-reducing category changes between scenarios. Table 5.2-2 separates out each scenario’s emissions-avoidance categories and their corresponding estimates of emissions avoided.

Emissions reduction potential from the operation of transit service increases substantially between 2015 and 2025 due to increased service frequencies and the addition of the Silicon Valley BART extension.

Emissions reduction potential from use of bicycle paths and lanes decreases from Scenario 2 to 3 because there are fewer auto trips anticipated since more people are expected to take transit. Thus, there are fewer auto VMTs that will convert to trail use.

We also might intuitively expect that there would be a greater increase in the potential emissions reduction potential between 2015 and 2025 scenarios for bicycle and pedestrian use of SVTL paths and lanes and from TDM programs and incentives. However, in addition to auto trips avoided, emissions avoided are also based the emission factor of automobiles running, which decreases over time. **Due to cleaner vehicles anticipated in 2025, the amount of emissions avoided per mile decreases by 23% between 2015 and 2025.**

In both 2015 and 2025 scenarios, the majority of overall emissions anticipated to be reduced are from the use of transit. However, one of the drawbacks of the SCG method is that we are unable to determine the emissions avoided through the *combination* of trail and transit trips, a key objective of this study. This limitation is addressed in the following section that discusses the VTA method, as its model was able

to shed more light on teasing out the contribution of trails in emissions reduction from combined trail-transit use. To conclude discussion of

the SGC method results, we compared our study's results with those from other similar projects.

Table 5.2-2. Emissions reduction forecasts from SGC method by category (in metric tons of CO2e)

STUDY SCENARIOS	Emissions Reduction Potential from use of Transit	Emissions Reduction Potential from use of Bicycle Paths and Lanes	Emissions Reduction Potential from use of Pedestrian Facilities	Emissions Reduction Potential from On-site transit information/ sales pass	Emissions Reduction Potential from Free or reduced price transit pass	Emissions Reduction Potential from Limiting parking supply	Emissions Reduction Potential from an Employer Pre-tax deduction	Total MT CO2e potentially reduced annually
(1) 2015 “Baseline”: 2015 trails, transit, and TDM programs	1,794	77	1.2	13.3	116	408	83	2,492
(2) Baseline, plus 2025 Trail: Baseline transit and TDM programs, plus fully built and connected Silicon Valley Trail Loop	4,428	81	1.5	NA	NA	NA	NA	4,511
(3) 2025 Trail and Transit: Scenario 2, plus 2025 transit network	6,221	80	1.9	NA	NA	NA	NA	6,303
(4) 2025 Trail, Transit, and TDM programs: Scenario 3, plus 2025 TDM programs	6,221	80	1.9	12.6	142	503	102	7,063

“Reality Check” -- Emissions Reduction Forecasts From Other Projects Analyzed Using the SGC Method

The SGC AHSC program has funded a number of transportation projects with new bike and pedestrian paths or lanes and transit. Although it is not possible to determine the emissions reduction potential from each emission-reducing category (trail, transit and TDM programs), it is

useful to compare the order of magnitude of four similar projects³⁶ to the emissions reduction potential from the SVTL study.

³⁶ Comparison projects were selected from those that received funding and had emissions reductions verified by CARB. The four included in Table 5.2-3 are “Camino 23” (Oakland, Alameda County), “Westside Infill Transit-Oriented Development (City of National City, San Diego County), “El Cerrito

As shown in the table below (in Table 5.2-3), the order of magnitude for the total emissions reduction potential is aligned with those computed from the SVTL study. However, it is important to note that due to the lack of granularity in the SGC project reports, it is uncertain which and to what degree transit and TDM programs are included in the emissions reduction potential.

Table 5.2-3. GHG emissions reduction from other projects funded by AHSC funds

GHG Emissions Reduction Potential	New bike path or lane (miles)	New walkways (linear feet)	Has a transit component
5,138	0.7	800	yes
16,103	2.0	N/A	yes
14,140	1.0	1,500	yes
20,079	1.2	9,200	yes

5.3 Emissions Reduction Potential from VTA Model and Methods

The VTA provided daily VMTs for the entire Santa Clara county from model runs that selectively included and excluded components of the transportation network. **Below is an explanation of the model runs—note that they do not directly correspond to the study scenarios.** The technical team made calculations to translate emissions reduction

Senior Mixed-use Apartments” (El Cerrito, Contra Costa County), and “Truckee Rail-yard Downtown Corridor Improvements” (Truckee, Nevada County).

results from the model runs to the corresponding study area and scenarios (see Appendices F and G).

VTA Model Runs (do not directly correspond to study scenarios)

2015 NO SVTL: A base year 2015 model run with daily VMT output that includes 2015 transit services and roadway networks, but excludes the SVTL existing trail sections.

2015 WITH SVTL: A base year 2015 model run with daily VMT output that includes 2015 transit services and roadway networks, plus 2015 trail.

2025 NEW TRANSIT: A forecast year 2025 model run with daily VMT output that includes all proposed transportation projects/services assumed to be in operation in 2025 (full BART extension, light rail improvements, El Camino Real bus rapid transit), roadway projects, and other trails networks, but excluding the SVTL entirely (even at 2015 level of development).

2025 NEW TRANSIT + TRAIL: A forecast year 2025 model run with daily VMT output that includes all proposed transportation projects/services assumed to be in operation in 2025 (full BART extension, light rail improvements, El Camino Real bus rapid transit), roadway projects, other trails networks, and the SVTL as planned for completion by 2025.

2025 “BACKGROUND” TRANSIT + TRAIL: A forecast year 2025 model run with daily VMT output that includes 2025 levels of transit and trail in all areas *except* the SVTL (includes 2015 levels of transit and trail in the SVTL study area).

Annualized VMTs were multiplied by the average automobile running emission factor for Santa Clara County for each year to determine

overall annual emissions avoided forecasts. Commute emissions avoided were determined by multiplying annual emissions avoided by 25% and non-commute emissions avoided were determined by multiplying annual emissions avoided by 75%. The following table (Table 5.3-1) presents the commute and non-commute emissions reduction estimates from use of the VTA model. It is assumed that the impact of TDM programs are indirectly reflected in the model runs but cannot be separated out.

Table 5.3-1. Emissions reduction forecasts from VTA model

STUDY SCENARIOS	COMMUTE-RELATED EMISSIONS POTENTIALLY REDUCED ANNUALLY (MT CO2e)	NON-COMMUTE-RELATED EMISSIONS POTENTIALLY REDUCED ANNUALLY (MT CO2e)	TOTAL EMISSIONS POTENTIALLY REDUCED ANNUALLY (MT CO2e)
(1) 2015 Conditions: 2015 trails, transit, and TDM programs	904	2,712	3,616
(2) Scenario 1, plus 2025 Trail: 2015 transit and TDM programs, plus fully built and connected Silicon Valley Trail Loop	1,365	4,094	5,459
(3) 2025 Trail and Transit: Scenario 2, plus 2025 transit network	7,049	21,146	28,195
(4) 2025 Trail, Transit, and TDM programs: Scenario 3, plus 2025 TDM programs	NA	NA	NA

5.3.1 Contribution of the Trail – Walking or Biking to Transit

As indicated in the previous section, the VTA was able to help shed light on teasing out the contribution of the trail in emissions reduction from combined trail-transit use by directly estimating the emissions reductions from walking or biking to transit. Bike mode estimates from a 2008 BART survey³⁷ include the share of transit trip originations that are from walking, biking, transit, taxi and car. While the car remains the primary access mode for passengers traveling from home to BART, walking (31%) and bicycling (4%) together comprise a significant proportion. By using auto trip arrivals to the three closest stations (generated by the VTA model) for year 2025 (and none in 2015) - Berryessa, Diridon and Alum Rock - and applying the walk/bike to transit shares, the avoided trip distance (as presented in Table 5.3.1-1) and the auto running emissions factor, the emissions avoided attributable to the trail use portion of a combined trail/transit trip was determined³⁸.

³⁷ www.bart.gov/sites/default/files/docs/2008StationProfileReport_web.pdf

³⁸ Bus and light rail were ignored for this exercise as, according to VTA, busses are limited in their capacity to handle bikes and LTR is too far away.

Table 5.3.1-1. Trips, VMT, and emissions reduction potential from using the trail to get to/from transit in 2025 under Scenario 3

	Total Morning Access Trips Projected for All 3 Stations	Total Annual VMT avoided by Bike/Walk to Transit Use	Total Annual Emissions Reduced by Bike/Walk to Transit Use (MT CO ₂ e)
Auto Access	3,797	--	--
Bike Access (4% of Auto)	152	461,229	122
Walking Access (26% of Auto)	987	528,755	140
TOTAL <i>one-way</i>		989,984	262
TOTAL <i>daily</i>			524

As presented in Table 5.3.1-1, **about 524 MT CO₂e³⁹ were forecasted to be reduced annually by walking or biking to and from transit under Scenario 3.** Note that this does not capture the additional emissions reductions from the “transit” portion of the combined trail-transit trip. Under Scenario 3, fully built and connected trail loop and transit system, the walk/bike share of the commute emissions reduction forecast is 7.4%.

5.3.2 Contribution of the Trail to Future Jobs Accessibility

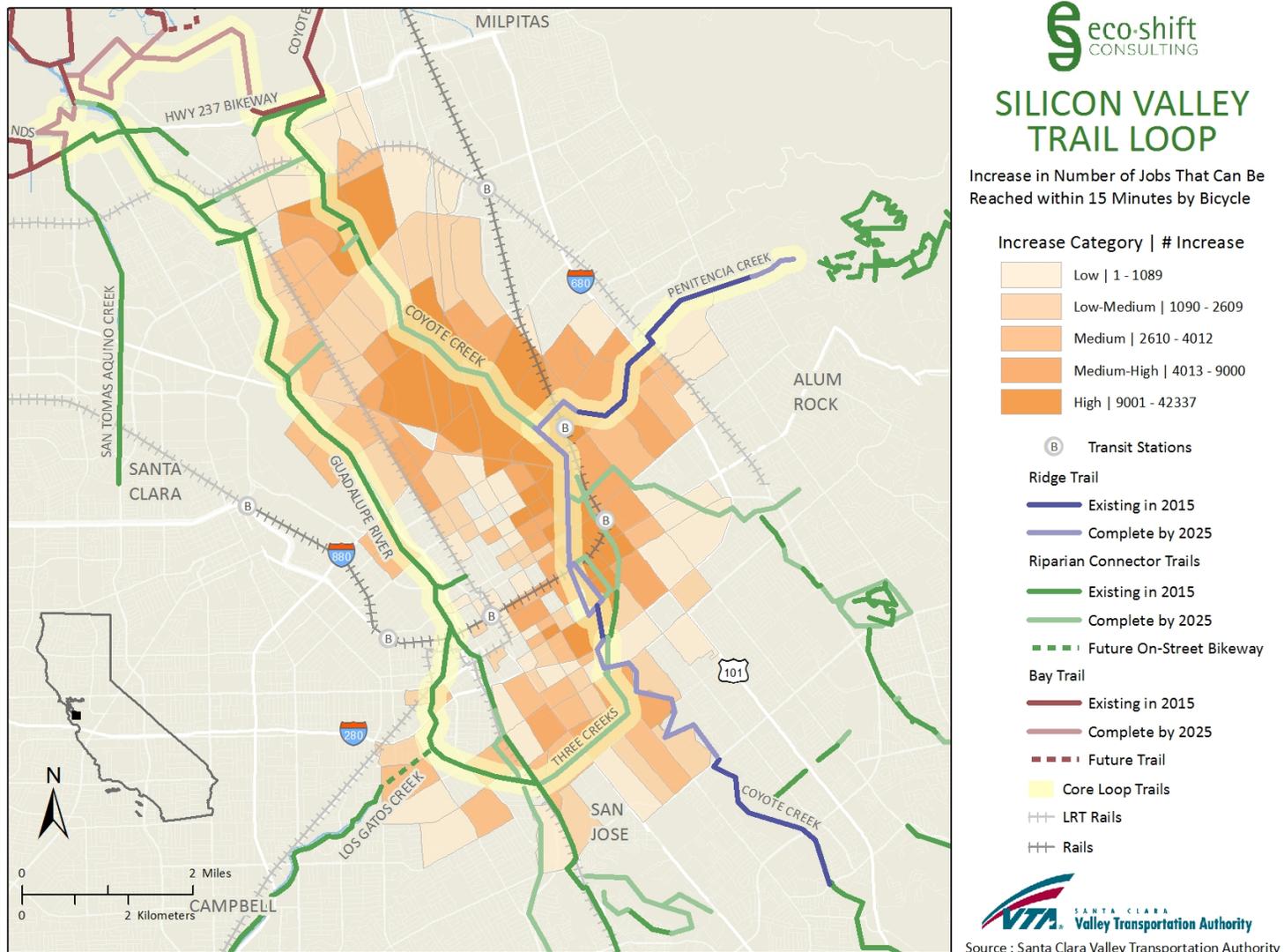
The VTA model indicates that with the SVTL trail complete in 2025, there will be **a substantial increase in the number of jobs that can be reached within 15 minutes via bicycle.** Figure 5.3.2-1 depicts the

estimated increase in the number of jobs, per TAZ [Traffic Analysis Zone], that can be reached within 15 minutes by bicycle (the dark orange TAZs have the highest change in job accessibility from the new trail).

Those TAZs directly adjacent to the new trail segments have the highest increase. **The majority of the “high” increases are clustered where the Penitencia Creek trail intersects the Coyote Creek trail, with about 9,000 to 42,300 additional jobs made accessible** in these TAZs. As the distance increases away from that intersection point in the westward, north and south directions, in general, the increase in jobs accessibility diminishes to about 1,090 to 4,012 jobs (medium-low to medium-high) in most TAZs. One exception to that general observation is that the model indicates high jobs accessibility (~9,000 – 42,300 jobs) on the north end of the Coyote Creek trail just south of its intersection with the light rail where a number of stations are also clustered. Some TAZs close to the new trail do not have large increases. According to the VTA, this is most likely because access to the trail is assumed from the street network, which could be circuitous to access the trail.

³⁹ 262 MT CO₂e one way is multiplied by two trips per day to yield 524 MT CO₂e reduced annually.

Figure 5.3.2-1. Projected increase in number of jobs that can be reached within 15 minutes by bicycle in 2025 under Scenario 3



6.0 Recommendations + Strategies

Recommendations center on the following key strategies, and are based on the responses and comments of those surveyed as well as the potential emissions reduction estimates from replacing SOV use with trail and transit:

1. Maximizing user-friendliness of trails, including completing the trail network
2. Maximizing user-friendly transit development
3. Maximizing TDM program effectiveness and benefits in both the short and long terms

Note that increasing the user-friendliness of trails and transit includes integrating the two, and enhancing connectivity to destinations (e.g., workplace, schools, commerce and event centers, recreational opportunities).

6.1 Recommendations for Maximizing User-Friendliness of Trails

Employer transportation coordinators and study partners indicated that the trail amenities resulting in the greatest mode shift from SOV trips to trail and trail-transit commutes (in order) include:

- **A fully connected trail loop,**
- Paved trails,
- On-street connection signs to trails with distance,

- Warning signs (pedestrian crossing, etc.) and advisory signs (nearest restrooms, drinking water, etc.), and
- Integration of social activities as part of alternative transportation planning and promotion (e.g. more events like Bike to Work Day), and dedicated “bike cars” on BART and Caltrain during peak commuter hours.

The Planning Team also recommends the promotion of the substantial projected improvement in job accessibility due to the completion and use of the SVTL (see Figure 5.3.2-1).

6.2 Recommendations for Maximizing User-friendly Transit Development

6.2.1 Input from a VTA Study

The VTA has taken steps to understand some of the significant challenges in developing more efficient system-wide transit, which include system underutilization, uncompetitive travel times, and routes and transfers that do not match user demand and travel patterns:⁴⁰

⁴⁰ Determined by the VTA via a 2010 Light Rail System Analysis, a two-year study which provided the first-ever comprehensive evaluation of the system’s effectiveness in meeting present and future market needs, and made recommendations for improvements.

The following actions were recommended to improve system-wide performance and speed:

- Grade separation of North First and Montague (including a light rail bridge over Montague),
- Fencing on North First (allows trains to increase to 45 mph),
- Pocket track at Ohlone/Chynoweth (timed transfers during night/weekend),
- Train signal improvements (improved reliability), and
- New Great America station (improved connection to commuter rail).

The following actions were recommended to make the light rail system more user-friendly and more competitive with auto travel:

- Continue the EcoPass program with employers/institutions,
- Implement real-time information services for riders (via cell phones, internet, and station signage),
- Create a “how to ride light rail” section on the web site,
- Revisit the intermodal (to/from bus) transfer policy,
- Improve signage inside the vehicles so that riders know what line they are on,
- Use colors to reference all route lines (today they are sometimes referred to by number and sometimes by color),
- Install signage in stations to indicate where 1- and 2-car trains will stop so that passengers will know where to stand as they wait for the train,

- Improve signage to facilitate transfers throughout the system (i.e. prominent wayfinding signage at SJC and transit centers),
- Accept credit/debit cards in ticket vending machines, and
- Maintain cleanliness of the system, although the VTA does a good job of this today.

Regional stakeholders surveyed for the purpose of this study also expressed opinions about transit and made suggestions for improvements (some of which align with regional transit agencies’ planning and programming):

- Invest in signage that directs and connects transit users to the trail loop and vice versa,
- Decrease travel time, and
- Improve safety of transit routes.

6.2.2 Input From Survey Respondents

Of the 20 *employer transportation coordinators on bus service*,

- Seven (35%) indicated bus service should be provided every 10 minutes,
- Two (10%) indicated every 30 minutes, and
- One (5%) indicated every hour.

Of the 11 *study partners on bus service*,

- Three (27%) indicated bus service should be provided every 10 minutes.

Of the 20 *employer transportation coordinators on BART and light rail service*,

- Six (30%) indicated BART and light rail service should be available every 10 minutes,
- Three (15%) indicated every 15 minutes,
- One (5%) indicated every 20 minutes, and
- One (5%) indicated every 30 minutes.

Of the 11 *study partners on BART and light rail service*,

- Three (27%) indicated BART and light rail service should be available every 10 minutes, and
- One (9%) indicated every 20 minutes.

Employer transportation coordinators and study partners indicated that the transit amenities resulting in the greatest mode shift from SOV trips to trail and trail-transit commutes are (in order):

- New transit stations,
- On-street connection signs to trails that indicate distance,
- Dedicated bike cars on BART during peak commuter hours, and
- Integration of social activities as part of alternative transportation planning and promotion (e.g. more events like Bike to Work Day), and dedicated “bike cars” on BART and Caltrain during peak commuter hours.

One employer transportation coordinator also offered a comment that increasing transit use requires regional agencies working together to “shift the norm” away from SOV travel.

6.3 Recommendations for Maximizing TDM Program Effectiveness

Evaluation Factors

Three evaluation factors were considered in making TDM program recommendations:

- The **effectiveness** to reduce VMTs and emissions, based on both regional (from the study stakeholder surveys) and statewide effectiveness values (from SGC literature).
- **Relative Cost** to implement the program widely in the study area, based on Planning and Consulting Team knowledge of programmatic costs⁴¹.
- **Ease of Implementation**, based on the Planning Team’s knowledge of future programmatic and policy drivers or barriers (considers the degree to which each program is technically feasible, the precedence of existing program models, whether the program constitutes an ongoing cost, and the potential for program implementation to “push the envelope”).

⁴¹ Please see Appendix H for a summary of planned active transportation and transit infrastructure projects and their budgeted costs.

Values for each of these factors were assigned for each TDM program (Appendix H contains a summary table of values, and explanation of how they were quantified to yield a ranked prioritization of each TDM program).

Table 6.3-1 summarizes the perceptions of the Planning Team and those surveyed about the barriers and co-benefits of each TDM program. This information was considered in determining ease of implementation, and may also be useful to provide additional context to decision-makers. For reference, **bolded values** indicate those programs that were included in the emissions reduction forecasts for the study scenarios that included TDM programs and incentives.

Table 6.3-1. TDM program implementation -- Barriers and co-benefits

PROGRAM	BARRIERS	CO-BENEFITS
Operation of new transit and bus service	May need to purchase additional transit vehicles and hire additional operators to deliver new service May not be cost effective	Revenues cover a portion of the cost of service
New trails that accommodate bikes and pedestrians	Remaining gaps are generally more difficult projects; Increased maintenance cost	Improved health, recreation, safety; Closing gaps decreases time to get to work
Provision of secure bike lockers, showers, and/or changing facilities	Assumes space available Ongoing maintenance Ongoing locker management (unless e-lockers)	Improved experience
Installed on-site infrastructure that facilitates the use of trails or transit	Cost of Planning time and capital investments	Improved connectivity/ safety
On-site transit information and/or pass sales	Lack of nearby/convenient route; inefficient use of personal time; secondary trips (e.g., trip chaining) prevent use of transit	
Policy enabling "bikes in the building"	Assumes space available	Reduced theft potential
Bicycle loan program for home-to-work commute	Liability concerns	
Guaranteed ride home		Improved safety
Free or reduced price transit passes	Requires executive buy-in	
Educational seminars on bicycle safety and/or route planning	Generating interest in attending	Supports local bike advocacy; opportunities for community engagement
Limited parking	Requires executive buy-in	
Pre-tax deduction benefit	Requires executive buy-in	
Employer-provided subsidy	Requires executive buy-in	
Rewards and recognition		
Cash benefits, such as a parking cash out		
Parking fees or elimination of subsidized parking (except for rideshares/vanpools)	Requires executive buy-in Requires employee buy-in	Revenue generation

Factor Weighting

The Planning Team was interested in seeing how the ranking/prioritization of recommendations might change depending on which of the evaluation factors—effectiveness, relative cost, and ease of implementation—received greater emphasis. The measures were therefore weighted using two rubrics,⁴² one which gave effectiveness greater weight, and one in which all evaluation factors were weighted equally:

1. Rubric that gives effectiveness greater weight (the environmental benefit is valued twice the other factors)
 - a. Where combined statewide and regional effectiveness are considered
 - b. Where only statewide effectiveness is considered
 - c. Where only regional effectiveness is considered
2. Rubric where all three primary evaluation factors are weighted equally
 - a. Where combined statewide and regional effectiveness are considered
 - b. Where only statewide effectiveness is considered
 - c. Where only regional effectiveness is considered

⁴² A rubric is a scoring tool used to evaluate and assess a set list of criteria and objectives. In this case, the objective is to evaluate criteria to identify how to maximize TDM effectiveness.

6.3.1 Recommendations -- When “Effectiveness,” “Cost,” and “Ease of Implementation” are Weighted Differently

Recommendations when carbon-reducing effectiveness is given greater weight

When weighting the environmental benefit of each program, the two TDM programs that are the highest-ranked and recommended to be implemented under the statewide-only and combined regional and statewide effectiveness factors include **a pre-tax deduction benefit, employer-provided subsidy** and **policy enabling “bikes in the building.”**

However, when only considering the regional effectiveness, the recommendations are more infrastructure-centric and include **policy enabling “bikes in the building,” provision of secure bike lockers, showers, and/or changing facilities** and **limited parking**. This finding demonstrates that when environmental benefit and regional stakeholder values are emphasized, recommendations prioritize policy and infrastructure modifications over provision of monetary benefits to encourage a mode shift.

Table 6.3.1-1 presents the TDM programs in ranked order/priority under this weighting scheme.

Recommendations when all evaluation factors are weighted equally

When weighting of all evaluation factors equally, **a pre-tax deduction benefit, policies that enable bikes in the building, and rewards and recognition** are the highest-ranked and recommended to be implemented. There is no observable difference in the ranking of programs based on the three effectiveness considerations.

Table 6.3.1-2 presents the TDM programs in ranked order/priority under this weighting scheme.

A final observation is that the TDM programs recommended under both weighting schemes are **not the same** as those programs survey respondents reported are currently (in 2015) implemented and anticipated to be implemented (in 2025). Thus, the programs implemented or anticipated to be implemented do not necessarily represent the least cost, most easily implementable and highest potential to reduce GHG emissions. *Planners should consider these findings when planning future programs.*

Table 6.3.1-1. TDM program implementation - Ranked prioritization with emphasis on environmental benefit⁴³,

RECOMMENDATIONS CONSIDERING BOTH EFFECTIVENESS FACTORS, COST AND EASE OF IMPLEMENTATION	RECOMMENDATIONS CONSIDERING ONLY STATEWIDE EFFECTIVENESS, COST AND EASE OF IMPLEMENTATION	RECOMMENDATIONS CONSIDERING ONLY REGIONAL EFFECTIVENESS, COST AND EASE OF IMPLEMENTATION
Pre-tax deduction benefit	Pre-tax deduction benefit	Policy enabling "bikes in the building"
Employer-provided subsidy	Employer-provided subsidy	Provision of secure bike lockers, showers, and/or changing facilities
Policy enabling "bikes in the building"	Policy enabling "bikes in the building"	Limited parking
Free or reduced price transit passes	Rewards and recognition	Pre-tax deduction benefit
Provision of secure bike lockers, showers, and/or changing facilities	Educational seminars on bicycle safety and/or route planning	Rewards and recognition
Limited parking	Bicycle loan program for home-to-work commute	Educational seminars on bicycle safety and/or route planning
Rewards and recognition	On-site transit information and/or pass sales	On-site transit information and/or pass sales
Educational seminars on bicycle safety and/or route planning	Free or reduced price transit passes	Free or reduced price transit passes
On-site transit information and/or pass sales	Provision of secure bike lockers, showers, and/or changing facilities	Parking fees or elimination of subsidized parking (except for rideshares/vanpools)
Parking fees or elimination of subsidized parking (except for rideshares/vanpools)	Parking fees or elimination of subsidized parking (except for rideshares/vanpools)	Employer-provided subsidy
Guaranteed ride home	Limited or inconvenient parking	Guaranteed ride home
Bicycle loan program for home-to-work commute	Guaranteed ride home	Installed on-site infrastructure that facilitates the use of trails or transit
Installed on-site infrastructure that facilitates the use of trails or transit	Cash benefits, such as a parking cash out	Bicycle loan program for home-to-work commute
Installed on-site infrastructure that facilitates the use of trails or transit	Installed on-site Infrastructure that facilitates the use of trails or transit	Cash benefits, such as a parking cash out
Cash benefits, such as a parking cash out		

⁴³ The **bolded values** in Tables 6.1.2-1 and 6.1.2-2 are those TDM programs that were analyzed for emissions reduction potential.

Table 6.3.1-2. TDM program implementation - Ranked prioritization with all factors weighted equally⁴⁴,

RECOMMENDATIONS CONSIDERING BOTH EFFECTIVENESS FACTORS, COST AND EASE OF IMPLEMENTATION	RECOMMENDATIONS CONSIDERING ONLY STATEWIDE EFFECTIVENESS, COST, AND EASE OF IMPLEMENTATION	RECOMMENDATIONS CONSIDERING ONLY REGIONAL EFFECTIVENESS, COST AND EASE OF IMPLEMENTATION
Pre-tax deduction benefit	Pre-tax deduction benefit	Policy enabling "bikes in the building"
Policy enabling "bikes in the building"	Policy enabling "bikes in the building"	Pre-tax deduction benefit
Rewards and recognition	Rewards and recognition	Rewards and recognition
Educational seminars on bicycle safety and/or route planning	Educational seminars on bicycle safety and/or route planning	Educational seminars on bicycle safety and/or route planning
Provision of secure bike lockers, showers, and/or changing facilities	On-site transit information and/or pass sales	Provision of secure bike lockers, showers, and/or changing facilities
Employer-provided subsidy	Bicycle loan program for home-to-work commute	Limited or inconvenient parking
On-site transit information and/or pass sales	Provision of secure bike lockers, showers, and/or changing facilities	On-site transit information and/or pass sales
Free or reduced price transit passes	Employer-provided subsidy	Parking fees or elimination of subsidized parking (except for rideshares/vanpools)
Parking fees or elimination of subsidized parking (except for rideshares/vanpools)	Parking fees or elimination of subsidized parking (except for rideshares/vanpools)	Free or reduced price transit passes
Guaranteed ride home	Limited or inconvenient parking	Guaranteed ride home
Bicycle loan program for home-to-work commute	Free or reduced price transit passes	Employer-provided subsidy
Limited or inconvenient parking	Guaranteed ride home	Installed on-site infrastructure that facilitates the use of trails or transit
Installed on-site infrastructure that facilitates the use of trails or transit	Cash benefits, such as a parking cash out	Bicycle loan program for home-to-work commute
Cash benefits, such as a parking cash out	Installed on-site infrastructure that facilitates the use of trails or transit	Cash benefits, such as a parking cash out

⁴⁴ The **bolded values** in Tables 6.3.2-1 and 6.3.2-2 are those TDM programs that were analyzed for emissions reduction potential.

6.4 Potential Barriers to Active Transportation Infrastructure Improvements and Mode Shift

The improvements necessary to complete the SVTL, nearby transit, and connections in-between by year 2025 require substantial investment by multiple agencies. As detailed in Appendix I, bike and pedestrian facilities within a half-mile of the SVTL are estimated to cost nearly \$100M. Transit improvements within a half-mile of the SVTL, excluding new BART infrastructure, is estimated to cost over \$1B⁴⁵.

These facilities compete with other roadway improvements for federal and state transportation grants and other funding sources. It is imperative to demonstrate the importance of this infrastructure in terms of emissions reduction potential, traffic congestion mitigation, and other co-benefits like improved health outcomes. Cost could be considered one barrier to the realization of the 2025 vision for the SVTL.

Employers and study partners surveyed indicated what they perceived as barriers that hamper efforts to shift from SOV to trail and trail-transit use. *Employer transportation coordinators* indicated that the greatest barriers are (the top 50%, in descending order):

- Takes too much time compared to driving,
- Lack of available appropriate and safe trail or transit routes,
- Resistance to change from employees,

- Resource constraints (financial) for TDM programs, e.g., lack of adequate funding, and
- Resource constraints (capacity) for TDM programs, e.g., lack of adequate staffing.

Of the 10 choices for barriers that hamper efforts to shift from single occupancy vehicle to trail and trail-transit use, *study partners* indicated that the greatest barriers are (top 50%, in descending order):

- Takes too much time compared to driving,
- Lack of available appropriate and safe trail or transit routes,
- Resource constraints (capacity) for TDM programs, e.g., lack of adequate staffing,
- Resistance to change from employees, and
- Not enough information about appropriate and safe trail or transit routes.

When asked which other barriers may exist, study partners indicated a challenging political and organizational environment for significant change, primarily with respect to making it more expensive to drive (e.g., more expensive and/or less parking), distance to transit, and the lack of affordable housing near jobs. On a positive note, **this study determined that completing a fully-connected trail loop will substantially increase the number of jobs that can be reached within 15 minutes by bicycle.**

⁴⁵ Source:

www.vta.org/sfc/servlet.shepherd/document/download/069A0000001M1PQIA0

7.0 Conclusions

We hope that the study report findings and recommendations will be helpful to other trail and transit planners in demonstrating the emissions reduction potential of these systems working in concert, and planning future investments and programming that support trail and transit use.

The intent is for results to also help catalyze the following actions:

- **Use quantifiable, supportable data to effect policy and funding decisions;**
- Complete and extend trails, and ensure connections to where people live, work, and play;
- Develop or enhance programs or tools that support voluntary mode shift to trails and transit;
- Support active transportation and sustainable community efforts;
- Use as a case-study for other communities.

7.1 Emission Reduction Potential Forecasts

7.1.1 Evaluating the methods used to forecast emissions reduction potential

The study capitalized on the strengths of two quantitative methods to determine emissions reduction forecasts appropriate to each scenario. Use of both the SGC method and VTA model to forecast emissions

reduction potential met the Planning Team’s intent to use methods that were recognized as comprehensive, robust, replicable, and verifiable, and that considered local conditions. These methodologies also provided the following benefits:

- The SGC method was provided by the California Air Resources Board (CARB), the agency charged with providing the quantification methodology to estimate GHG emission reductions from projects receiving monies from the Greenhouse Gas Reduction Fund, an account established to receive Cap-and-Trade proceeds;
- The VTA model was specifically developed for the region in which the study area is located;
- The SGC method enabled determination of emissions reductions per component (infrastructure improvement or TDM program/incentive);
- The SGC method was able to directly analyze the effect of TDM programs;
- The VTA model was able to capture synergistic and “diminished return” effects because its results are calibrated with real-world counts of traffic, ridership and trail use;
- The VTA model was able to isolate the trail contribution, i.e., how the SVTL and its feeder trails impact emissions reduction potential in combined trail and transit trips, and how the SVTL enables increased and quicker access to jobs in 2025.

7.1.2 Conclusions Drawn from Results

Table 7.1-1 summarizes the emission reduction potential forecasts for each study scenario by method.

Table 7.1-1. Forecasted emissions reduction potential by scenario and method

STUDY SCENARIOS	SGC EMISSIONS REDUCTION POTENTIAL (MT CO2e)	VTA EMISSIONS REDUCTION POTENTIAL (MT CO2e)
((1) 2015 Conditions: 2015 trails, transit, and TDM programs	2,493	3,616 ⁴⁶
(2) Scenario 1, plus 2025 Trail: 2015 transit and TDM programs, plus fully built and connected Silicon Valley Trail Loop	4,511	5,458
(3) 2025 Trail and Transit: Scenario 2, plus 2025 transit network	6,303	28,195
(4) 2025 Trail, Transit, and TDM programs: Scenario 3, plus 2025 TDM programs	7,063	NA

The following are notable conclusions drawn from the results:

- **The effect of trails alone—a fully built and connected trail loop, independent of additional transit—almost doubles the amount of emissions reductions** (note the difference between Scenario 2 and Scenario 1);

⁴⁶Since TDM programs are not modeled separately in the VTA model, it is not possible to determine the separate impact of them in Scenarios 1 and 4.

- **A fully completed trail loop will result in a substantial increase in the number of jobs that can be reached within just 15 minutes via bicycle—in some zones, up to 42,300 additional jobs** (see Figure 5.3.2-1);
- **Combining use of transit with trails yield up to eight times the amount of emissions reductions** (note the difference between Scenario 3 and Scenario 1).
- Potentially **524 MT CO2e of emissions may be reduced annually by walking or biking to and from transit** under Scenario 3, the 2025 combined trail and transit scenario.
- Seventy-five percent (75%) of trips on the SVTL are non-commute (e.g., recreation, etc.).
- Differences in results between methods are attributable to synergistic effects, and the inherent differences in the methods (static calculations versus dynamic model).
- The projected emissions reduction potential results are well in line with the order of magnitude of other similar projects where the SGC method was utilized, giving a degree of confidence that the results are sound.

7.1.3 Putting Results in Context

It is helpful to put the emissions reduction estimates into context with other tangible emissions quantities. The following table (Table 7.1-2) compares emissions reductions under the study scenarios with other quantified estimates.

Table 7.1-2. Annual GHG emissions estimates at various scales

GHG EMISSIONS ESTIMATES	ANNUAL MT CO ₂ e
Average Global Carbon Footprint per person ⁴⁷	4
Average US Carbon Footprint per person	20
Silicon Valley BART Extension Estimated Emissions Reduced when completed	3,400
Range from Study Scenario 1 (2015 Trails, Transit, and TDM Programs)	2,493 – 3,616
Range from Scenario 3 (Baseline TDM Programs, plus 2025 Trail and Transit)	6,303 – 28,195
Santa Clara County Community Transportation Emissions ⁴⁸ (2007)	423,000
San José Transportation Emissions ⁴⁹ (2014)	4 Million
Bay Area Transportation Emissions ⁵⁰ (2007)	35 Million
California’s Transportation Sector Emissions (2013)	170 Million

Note that **the contribution of “baseline” trail, transit, and TDM programs is comparable to the effect of the BART extension, and the 2025 scenarios may have over eight times its effect.**

It is difficult to imagine what reducing one metric ton of CO₂e really means. The range of Scenario 3 emissions reduction forecasts can be thought of in terms of equivalent emissions avoided from various

emission source activities. The US Environmental Protection Agency⁵¹ developed a greenhouse gas equivalencies calculator to help understand this concept, translating abstract measurements into concrete, understandable terms. The purpose of this tool is to provide a uniform way to communicate and compare GHG reduction strategies and targets or other initiatives that aim to demonstrate GHG reduction potential, such as the findings of this study. For the range of 6,303 to 28,195 emissions reduced through the use of SVTL as determined in the study, Figure 7.1-1 displays how the SVTL trail and transit use in 2025 compares to other equivalent emissions activities such as

- carbon sequestered from seedlings grown over 10 years,
- the combustion of gallons of gasoline, and
- the number of utility scale wind turbines installed to avoid emissions an equivalent amount.

⁴⁷ Average global and US carbon footprints from www.coolclimate.org

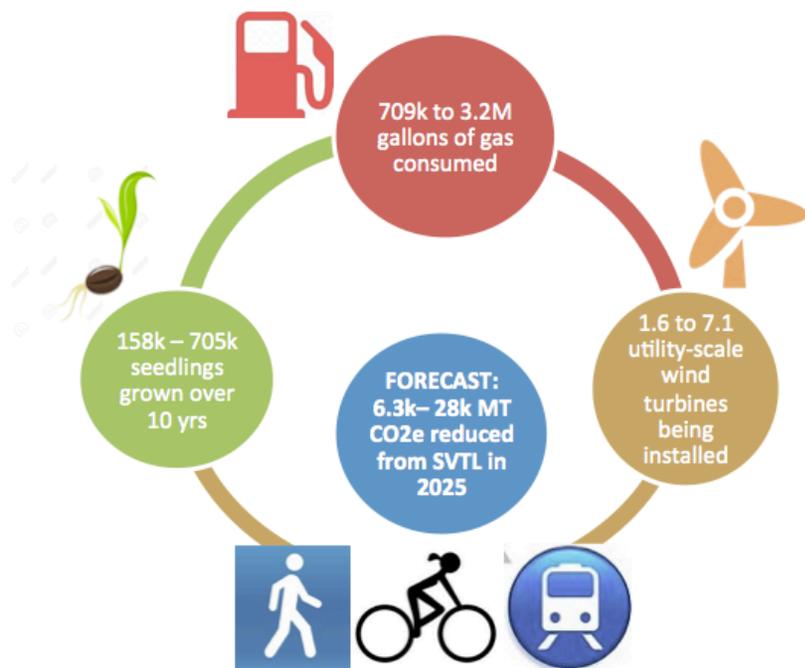
⁴⁸ <http://www.santaclaraca.gov/home/showdocument?id=10170>

⁴⁹ <https://www.sanjoseca.gov/DocumentCenter/View/55505>

⁵⁰ http://www.baaqmd.gov/~media/Files/Planning%20and%20Research/Emission%20Inventory/regionalinventory2007_2_10.ashx

⁵¹ <http://www2.epa.gov/energy/greenhouse-gas-equivalencies-calculator>

Figure 7.1-1 Emissions activity equivalencies (generated or avoided)



Note: Ranges correspond to the forecast range of 6,303 – 28,195 MT CO₂e under Study Scenario 3.

7.2 Recommendations for Effective Mode Shift

7.2.1 Recommendations for Maximizing User-friendliness of Trails

Employer transportation coordinators and study partners indicated that the trail amenities resulting in the greatest mode shift from SOV trips to trail and trail-transit commutes (in order) include:

- **A fully connected trail loop,**
- Paved trails,
- On-street connection signs to trails with distance,
- Warning signs (pedestrian crossing, etc.) and advisory signs (nearest restrooms, drinking water, etc.), and
- Integration of social activities as part of alternative transportation planning and promotion (e.g. more events like Bike to Work Day), and dedicated “bike cars” on BART and Caltrain during peak commuter hours.

Note that a fully-completed trail loop ranked as the #1 factor that would result in the greatest mode shift to trail-and-transit commutes.

The Planning Team also recommends the promotion of the substantial projected improvement in job accessibility due to the completion and use of the SVTL (see Figure 5.3.2-1).

7.2.2 Recommendations for Maximizing User-friendly Transit Development

The following actions were recommended to make the light rail system more user-friendly and more competitive with auto travel:

- Continue the EcoPass program with employers/institutions,
- Implement real-time information services for riders (via cell phones, internet, and station signage),
- Create a “how to ride light rail” section on the web site,
- Revisit the intermodal (to/from bus) transfer policy,
- Improve signage inside the vehicles so that riders know what line they are on,
- Use colors to reference all route lines (today they are sometimes referred to by number and sometimes by color),
- Install signage in stations to indicate where 1- and 2-car trains will stop so that passengers will know where to stand as they wait for the train,
- Improve signage to facilitate transfers throughout the system (i.e. prominent wayfinding signage at SJC and transit centers),
- Accept credit/debit cards in ticket vending machines, and
- Maintain cleanliness of the system, although the VTA does a good job of this today.

Based on the Planning Team and regional stakeholders’ input, recommendations include:

- Invest in signage that directs and connects transit users to trails and vice versa,

- Decrease travel time between stations,
- Improve safety on transit.

Employer transportation coordinators and study partners also indicated that the transit amenities resulting in the greatest mode shift from SOV trips to trail and trail-transit commutes are (in order):

- New transit stations,
- On-street connection signs to trails that indicate distance,
- Dedicated bike cars on BART during peak commuter hours, and
- Integration of social activities as part of alternative transportation planning and promotion (e.g. more events like Bike to Work Day), and dedicated “bike cars” on BART and Caltrain during peak commuter hours.

Note that **even low-cost, simple measures to promote bicycling to work have a significant impact**, such as policies enabling bicycles in the building, “social” measures such as active commute contests, and educational/safety seminars.

7.2.3 Recommendations for Maximizing Transportation Demand Management (TDM) Program Effectiveness

With the aim of identifying programs with **the least cost, most easily implementable, and highest potential to reduce GHG emissions**, the following recommendations for TDM program implementation arose from the prioritization process:

Recommendations when carbon-reducing effectiveness is given greater weight. When weighting the environmental benefit of each program, the two TDM programs that are the highest ranked and recommended to be implemented under the statewide-only and combined regional and statewide effectiveness factors include **a pre-tax deduction benefit, employer-provided subsidy and policy enabling “bikes in the building.”**

However, when considering effectiveness as identified by regional stakeholders, the recommendations are more infrastructure-centric and include **policy enabling “bikes in the building,” provision of secure bike lockers, showers, and/or changing facilities and limited parking.** This finding demonstrates that when environmental benefit and regional stakeholder values are emphasized, recommendations prioritize policy and infrastructure modifications over provision of monetary benefits to encourage a mode shift.

Recommendations when all evaluation factors are weighted equally. When weighting of all evaluation factors equally, **a pre-tax deduction benefit, policies that enable bikes in the building, and rewards and recognition** are the TDM programs recommended to be implemented. There is no observable difference in the ranking of programs based on the three effectiveness considerations.

A final observation is that the TDM programs recommended under both weighting schemes are **not the same** as those programs survey respondents reported are currently (in 2015) implemented and anticipated to be implemented (in 2025). Thus, the programs implemented or anticipated to be implemented do not necessarily represent the least cost, most easily implementable and highest potential to reduce GHG emissions. *Planners should consider these findings when planning future programs.*

7.2.4 Use of an Interactive Tool

This study was complemented by development of an interactive trip-planning and map tool for the greater study area. The Silicon Valley Trails and Transit tool (**svtrailfinder.ridgetrail.org**) was developed by Trailhead Labs as a pilot to help the public plan commute, school, recreation, and other trips using existing trails and transit. The tool maps out a viable route and calculates carbon emission savings and cost savings (associated with not driving) for any individualized trip, as well as for a curated series of sample trips and explorations.

Silicon Valley Trails and Transit

A Bay, Ridge and Riparian Trail Network



Explore Trails & Transit

Take trails and transit around town, to work, to school, or out into nature! Driving less is healthy, fun, and good for the planet. A remarkable network is waiting to explore, and more connections are coming soon (dashed lines indicate future trail and transit).

Trip Ideas using Trails & Transit

Culture, Arts & Nature

9.9 Mi LENGTH Halfday DURATION Easy INTENSITY

Explore the Guadalupe River Trail: Find a mammoth at the Children's Discovery Museum and along...

19.6 Lbs. of CO2 CARBON EMISSIONS REDUCTION \$ 3.00 MONEY SAVED

Downtown to the Ridgelines

9.8 Mi LENGTH Day Trip DURATION Moderate INTENSITY

Los Gatos Creek Trail to Lexington Reservoir: Starting at the trailhead at Meridian Avenue, the...

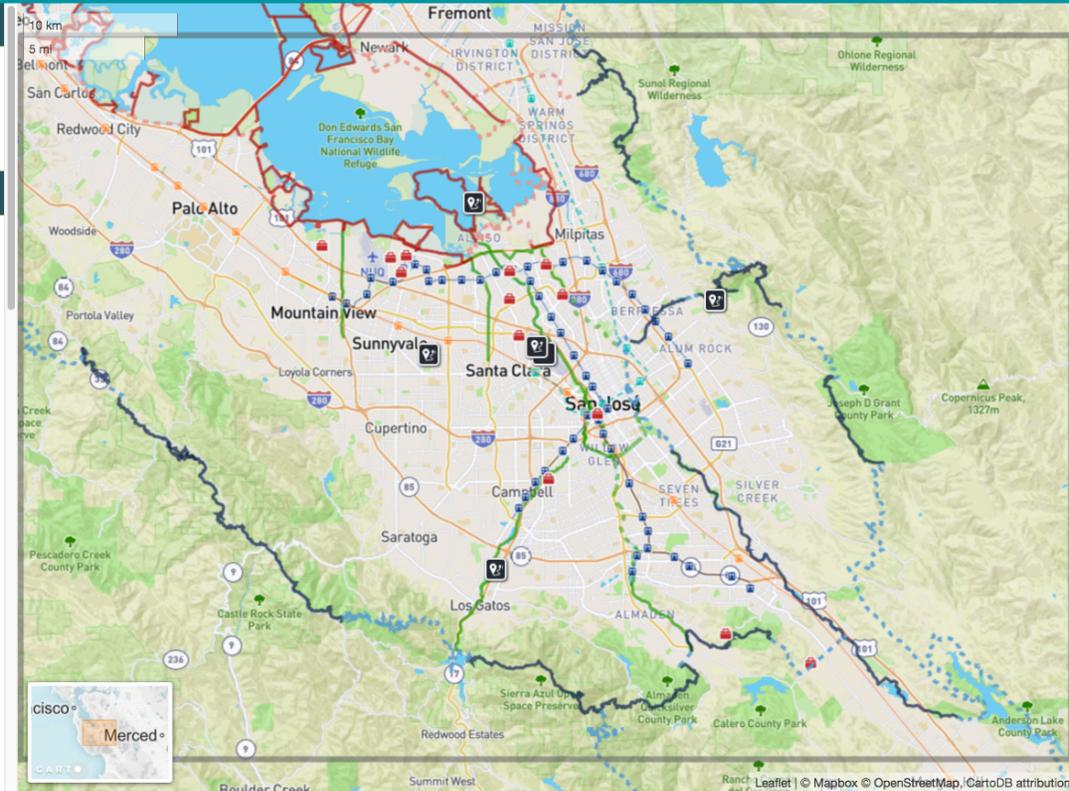
23.6 Lbs. of CO2 CARBON EMISSIONS REDUCTION \$ 3.60 MONEY SAVED

House to Work – Willow Glen to Silicon Valley

11.9 Mi LENGTH Easy INTENSITY

Willow Glen to Silicon Valley Employer: Take the Guadalupe River Trail from Willow Glen to your...

19.6 Lbs. of CO2 CARBON EMISSIONS REDUCTION \$ 3.00 MONEY SAVED



Expand Map

Zoom In

Zoom Out

Fit Map

Maps

Layers

Legend

Ridge Trail:

- Existing
- Planned

Bay Trail:

- Existing
- Planned

Riparian Trails:

- Existing
- Planned

Transit:

- BART Planned
- BART Extension
- CalTrain
- CalTrain Stops
- VTA Light Rail

APPENDIX A

Policies, Goals + Targets for Mode Shift from SOVs

State, regional and local level policy act as drivers to motivate mitigation of GHG emissions. California is the most progressive state in this regard with a number of policies implemented that directly or indirectly result in emissions reductions, whether associated with transportation or otherwise.

Assembly Bill 32 – California Global Warming Solutions Act of 2006

Assembly Bill (AB) 32, the California Global Warming Solutions Act, was approved by the legislature and signed by Governor Schwarzenegger in 2006. The landmark legislation requires that California Air Resources Board (CARB) develop regulatory and market mechanisms that will reduce GHG emissions to 1990 levels by 2020. **One mechanism to reach this goal is use of market-based regulations, such as the “Cap and Trade”** program--proceeds from which are used to invest in GHG-reducing measures such as alternative transportation infrastructure. It is anticipated that study results will be used to help build the case (particularly, by adding quantitative data) for a fully complete and connected trail network as part of a suite of transportation options.

Senate Bill 97 – California Environmental Quality Act Guideline Amendments of 2007

Senate Bill (SB) 97 was adopted in 2007 by the State of California and required amendment of the California Environmental Quality Act (CEQA) Guidelines to address GHG emissions. The CEQA Guidelines went into effect March 18, 2010. Local governments may use adopted plans consistent with the CEQA Guidelines to assess the cumulative impacts of projects on climate change if the adopted plan includes a certified environmental impact report or adoption of an environmental document.

Senate Bill 375 – Sustainable Communities and Climate Protection Act of 2008

SB 375 aims to reduce GHG emissions by linking transportation funding to land use planning by requiring metropolitan planning organizations to create a sustainable communities strategy in their regional transportation plans. The sustainable communities strategy demonstrates how the region will achieve the GHG emissions reduction target set by CARB for 2020 and 2035.

A.1 Regional Plans, Goals and Policies

Regional plans, goals and policies in the study's geographic area call for GHG reductions using a variety of strategies; the following specifically target reductions in transportation-oriented GHG emissions:

Plan Bay Area, the Bay Area's regional plan led by the Association of Bay Area Governments and the Metropolitan Transportation Commission, intends to allocate \$4.6 billion to bicycle and pedestrian improvements funded by state Transportation Development Act and local sales tax funds. In addition, the One Bay Area Grant program plans to make \$14.6 billion in investment over the life of the plan to be used for complete streets projects that include stand-alone bicycle and pedestrian paths, bicycle lanes, pedestrian bulb-outs, lighting, new sidewalks, and Safe Routes to Transit and Safe Routes to Schools projects that will improve bicycle and pedestrian safety and travel.

[Valley Transportation Plan 2040](#), the long-range transportation plan for Santa Clara County, is updated by the Valley Transportation Authority (VTA), which serves as the Congestion Management Agency for the area. The Valley Transportation Plan describes the bicycle network as an "essential component of a fully integrated, multimodal, countywide transportation system." VTP includes a section on Multimodal Transportation Investments as well as a Bicycle Expenditure Plan, both of which specifically target improvements to the cycling transportation network. The VTP also details improvements to the transit system, such as construction of the Berryessa BART station. Concerned with transportation within and outside of the study's geographic area, VTA indicates that to comply with SB 375, it will proactively work with local jurisdictions and the public to develop input that combines both broad land use objectives with transportation

policies and projects in its long-range transportation planning efforts (VTA 2014, p. 15)⁵²

[The Santa Clara Countywide Trails Master Plan](#) (1995) includes policy language that calls for the "provision of a countywide trail network that connects to transit, offers the public environmentally superior alternative transportation routes; closes strategic gaps in non-motorized transportation; and offers opportunities for maintaining personal health." (PR-T.S. 1.1, page 20).

Bay Area employers with 50 or more employees are required to register and offer commuter benefits to their employees in order to comply with the Bay Area Commuter Benefits Program administered by 511. Org⁵³.

A.2 City Plans, Goals and Policies

The General Plans for the Cities within the study' geographic area have goals that relate to TDM programs, reduction in VMTs, and advancement of non-motorized transport. The following list of representative samples of goals and policies is included to give a sense of the policy environment throughout the study area:

San José Envision 2040 General Plan

Goal TR-9 Reduce VMTs 40% below 2009 levels by 2040, with interim goal of 10% by 2025

Policy TR-9.1 Enhance, expand and maintain facilities for walking and bicycling, particularly to connect with and ensure access to transit and

⁵² <http://www.vta.org/projects-and-programs/planning/valley-transportation-plan-2040-vtp-2040>

⁵³ See more at: <http://www.bart.gov/tickets/benefits#sthash.EbMYLuV8.dpuf>

to provide a safe and complete alternative transportation network that facilitates non-automobile trips

Policy TN-2.12 Develop a trail network that extends a minimum of 100 miles.

Policy TN-2.13 Provide all residents with access to trails within 3 miles of their homes

San José Green Vision

Goal 10: Interconnected Trails, calls for 100 miles of interconnected trails and 400 miles of on-street bikeways by 2022. As of 2014, 56.8 miles of trail and 240 miles on-street bikeway has been constructed.

[San José Greenprint \(2009 update\)](#)

Defines the 100-mile trail network, composed of 35 trail systems that follow creeks, rivers, utility corridors and former railways.

San José Housing Element

The [SJ Housing Element](#) includes language on planned growth: "The General Plan 2040 includes growth capacity for the development of up to 470,000 new jobs and up to 120,000 new dwelling units. Combined with the City's current development and this additional growth capacity, San José could grow to 840,000 jobs and 430,000 dwelling units, supporting a residential population of 1.3 million people with a Jobs/Employed Resident Ratio of 1.3/1."

San José has also adopted policy to ensure that with this planned growth, there will be measures implemented at each new development study to mitigate SOV use and traffic congestion. Specifically, under the provisions of Section 20.90.220(A)(1) of the San José Municipal Code, a reduction in required vehicle parking spaces of up to 50 percent may be authorized for structures or uses that implement at least three

transportation demand management (TDM) measures specified in said Section. To satisfy this requirement the following TDM measures may be implemented by the building owner and coordinated with future tenants occupying the study development:

- The building owner will provide an on-site TDM coordinator to develop and implement a transit use incentive program for building employees, including on-site distribution of Eco-passes (or equivalent broad spectrum transit pass) and/or subsidized transit passes for local transit systems (participation in the Clipper program would satisfy this requirement).
- The on-site TDM coordinator will distribute transit information to employees.
- On-site TDM coordinator will implement a carpool program, providing carpool ridematching for employees.
- Provide designated preferential parking for carpool vehicles. Provide designated preferential parking for electric or alternatively-fueled vehicles.

Mountain View North Bayshore Precise Plan 2014

In order to promote Transit, Biking and Walking, the City of Mountain View has set a target 45% drive-alone rate by 2030 for the North Bayshore area (the portion that falls within the study planning area). New development projects will be required to join the Transportation Management Association, while both existing and new employers will be required to implement TDM strategies to meet the 45% target.

8.12-83 Santa Clara Housing Element

Traffic volume studies for 2035 were developed using the Santa Clara Travel Demand Model. The model anticipates a reduction in trips

originating and/or ending in Santa Clara by 2035 (14.35 VMT per person in 2008 versus 12.19 VMT per person in 2035). The projected reduction is attributable, in part, to the mix of land uses outlined in the General Plan that will result in shorter trips for residents because of the closer proximity of jobs and services to housing as well as the increased availability and accessibility of other modes of travel, such as bicycling and walking.

Santa Clara Climate Action Plan 6.1 Transportation demand management program

This Plan section requires that new development located in the City's transportation districts to implement a TDM program to reduce drive-alone trips. The City will require all new developments greater than 25 housing units or more than 10,000 nonresidential square feet to draft and implement a VMT reduction strategy that reduces drive-alone trips.

Sunnyvale General Plan

LT-5.2c Encourage mixed use developments that provide pedestrian scale and transit oriented services and amenities.

LT-5.5a Promote alternate modes of travel to the automobile.

LT-5.5b Require sidewalk installation in subdivisions of land and in new, reconstructed or expanded development.

LT-5.5c Support land uses that increase the likelihood of travel mode split.

Policy LT-5.9 Appropriate accommodations for motor vehicles, bicycles, and pedestrians shall be determined for City streets to increase the use of bicycles for transportation and to enhance the safety and efficiency of the overall street network for bicyclists, pedestrians, and motor vehicles.

A.3 Other Plans and Actions to reduce transportation emissions

Employers, compelled by regulation and/or a corporate sustainability ethic, also enact policies and implement programs that contribute to overarching regional and city-specific efforts to reduce transportation oriented GHG emissions. For example, Google developed and is implementing [its Bike Vision Plan for North Santa Clara County](#) (2015) where a combination of infrastructure provisions and programmatic offerings aim increase bike commuting and reduce reliance on fossil fueled transportation options.

In another example, Samsung, during the development of their North First Street Industrial Park facility, complied with Section 20.90.220(A)(1) of the San José Municipal Code, by augmenting 1,925 vehicle parking spaces required based on 577,340 net square feet of research and development/office uses. A total of 1,545 parking spaces were proposed on-site, representing a 20 percent reduction in required parking spaces. Under the provisions of Table 20-120 of the San José Municipal Code, a total of 144 bicycle parking spaces were required based upon 577,340 net square feet of research and development/office uses. A total of 144 bicycle parking spaces were proposed on-site⁵⁴.

Similarly, while not mandated, the efforts of a number of the study partners focus on bicycle use and trail advocacy, which assist in achieving regional and city goals and targets.

⁵⁴ <http://www.sanjoseca.gov/DocumentCenter/View/13578>

APPENDIX B

Summary of Study Partner and Employer Surveys

Number of employees based at your Silicon Valley site/campus. This includes employees who physically work at the location and telecommute from another location but are based out of your site.

The range provided by *employer transportation coordinators* for number of employees is 8-20,000. The average number of employees per employer is 3,943. The total number of employees represented in this survey is 74,910.

If known, what is the average employee's commute length?

The range provided by *employer transportation coordinators* for average employee commute length is 13-50 miles. The average employee commute length across all employers is 22.9 miles.

Estimate the Mode Share of Your Organization's Program Participants. What proportion of your program participants regularly telecommute or use alternative transportation to get between home and work? Proportions may sum to more than 100% if program participants identify that they use more than one mode.

See Table 3.4.1.

For each of the incentives or programs your company (or participants) already implement(s), rate to what degree you think each is making a difference in mode shift from single occupancy vehicle trips to trail and trail-transit commutes (where 5 is large difference and 1 is no difference).

Of 17 choices for TDM incentives or programs, *employer transportation coordinators* indicated that on average the top 50% of those TDM incentives and programs making the most difference currently in shifting employees from SOV trips to trail and trail-transit commutes includes (in order): free or reduced price transit passes, telework and flexible work scheduling, provision of secure bike lockers, showers, and/or changing facilities, employer-provided subsidy, policy enabling bikes in the building, limited or inconvenient parking, pre-tax deduction benefits, and guaranteed rides home.

Of 17 choices for TDM incentives or programs, *study partners* indicated that on average the top 50% of those TDM incentives and programs making the most difference currently in shifting employees from SOV trips to trail and trail-transit commutes includes (in order): policy enabling bikes in the building, telework and flexible work scheduling, free or reduced price transit passes, rewards and recognition, provision of secure bike lockers, showers and/or changing facilities, installed on-site infrastructure that facilitates the use of trails or transit, on-site transit information and/or pass sales, limited or inconvenient parking, and employer-provided subsidies.

For each of the incentives or programs your company (or participants) already implement(s), indicate the proportion of your employees that participate in the program/incentive. Skip those programs/incentives that are not implemented.

Of 17 TDM programs and incentives, *employer transportation coordinators* indicated that those with the most employee participation include (in order) employer-provided transit (13.6%), telework and flexible work scheduling (13.1%), free or reduced price transit passes (7.6%), provision of secure bike lockers, showers and/or changing facilities (5.7%), guaranteed ride home (4.7%), bicycle loan program for home-to-work commute (4.3%), rideshare matching services (4.3%), and educational seminars on bicycle safety and/or route planning (4.2%).

Of 17 TDM programs and incentives, *study partners* indicated that those with the most participation include (in order) free or reduced priced transit passes (34.8%), telework and flexible schedule (11.5%), provision of secure bike lockers, showers, and/or changing facilities (8.0%), limited or inconvenient parking (6.4%), on-site transit information and/or sales pass (6.0%), policy enable bikes in the building (5.5%), installed on-site infrastructure that facilitates the use of trails or transit (4.2%), and rewards and recognition (4.1%).

Indicate which of the following programs and incentives the organization is planning to implement in the future. Skip any actions where there is no plan or discussion of implementation.

See Table 3.4.2.

Thinking about your employees, what would be the ideal frequency for bus service?

Of the 20 *employer transportation coordinators*, 7 (35%) indicated bus service should be provided every 10 minutes, 2 (10%) indicated every 30 minutes, and 1 (5%) indicated every hour.

Of the 11 *study partners*, 3 (27%) indicated bus service should be provided every 10 minutes.

Thinking about your employees/organization's members, what would be the ideal frequency for BART and light rail service?

Of the 20 *employer transportation coordinators*, 6 (30%) indicated BART and light rail service should be available every 10 minutes, 3 (15%) indicated every 15 minutes, 1 (5%) indicated every 20 minutes, and 1 (5%) indicated every 30 minutes.

Of the 11 *study partners*, 3 (27%) indicated BART and light rail service should be available every 10 minutes, and 1 (9%) indicated every 20 minutes.

By year 2025, how would your organization like to see people commuting to and from work within in the Silicon Valley Loop area?

Employer transportation coordinators indicated their organization would like to see people commuting via a variety of responses, including: public transit, BART and light rail, bicycle, shuttle, carpool, vanpool, electric vehicles, and walking.

Study partners indicated their organization would like to see people commuting via carpool, train, bicycle, and walking.

To what degree do you feel each of the barriers listed below hamper efforts of your organization's program participants/employees to shift from single occupancy vehicle trips to trail and trail-transit? (Where 5 is a significant barrier and 1 is no barrier)

Of the 10 choices for barriers that hamper efforts to shift from single occupancy vehicle to trail and trail-transit use, *employer transportation coordinators* indicated that the top 50% of those barriers by weighted average are (in order): takes too much time compared to driving, lack of available appropriate and safe trail or transit routes, resistance to change from employees, resource constraints (financial) for TDM programs e.g. lack of adequate funding, and resource constraints (capacity) for TDM programs, e.g. lack of adequate staffing. When asked which other barriers may exist, one employer transportation coordinator indicated that trail and trail-transit use is currently not the norm in the region.

Of the 10 choices for barriers that hamper efforts to shift from single occupancy vehicle to trail and trail-transit use, *study partners* indicated that the top 50% of those barriers by weighted average are (in order): takes too much time compared to driving, lack of available appropriate and safe trail or transit routes, resource constraints (capacity) for TDM programs, e.g. lack of adequate staffing, resistance to change from employees, and not enough information about appropriate and safe trail or transit routes. When asked which other barriers may exist, study partners indicated a challenging political and organizational environment for significant change, primarily with respect to making it more expensive to drive, distance to transit, and the lack of affordable housing near jobs.

Indicate which physical barriers along or leading to the Silicon Valley Trail Loop impede utilization of the trails and nearby transit.

Of the 6 suggested choices for barriers, *employer transportation coordinators* indicated that the most impeding barriers are (in order): arterial roads with multiple turn lanes and signal phases, highways or underpasses, railroads, drainage canals or water bodies, frequent construction projects, and off-leash dogs. When asked which other barriers impede trail and transit use, employer transportation coordinators mentioned nearby roads having large truck traffic without bike lanes, safety (should be of the 8-80 quality), and gaps in trail sections.

Of the 6 suggested choices for barriers, *study partners* indicated that the most impeding barriers are (in order): highways and underpasses, arterial roads with multiple turn lanes and signal phases, drainage canals and bodies of water, frequent construction projects, railroads, and off-leash-dogs.

When asked which other barriers impede trail and transit use, study partners listed heavy industry along Three Creeks, incomplete trail segments, and lack of transit.

Are you aware of crime and/or personal safety being a concern of potential users of the Silicon Valley Trail Loop?

Of the 20 survey responses from *employer transportation coordinators*, 3 (15%) indicated there are crime and/or safety concerns for users of the Silicon Valley Trail Loop. When asked to elaborate where crime and/or safety is a concern, employer transportation coordinators said East Palo Alto, all trails after dark particularly Guadalupe River Trail and Coyote Creek Trail, and in trail areas near rivers and creeks where homeless people often live.

Of the 11 survey responses from *study partners*, 3 (27%) indicated there are crime and/or safety concerns for users of the Silicon Valley Trail Loop. When asked to elaborate where crime and/or safety is a concern, study partners indicated the Guadalupe River Trail north of downtown, unfinished portions on Coyote Creek Trail, and where there are large homeless encampments and speeding cyclists.

Indicate to what degree you anticipate implementation of each of the following incentives or amenities would result in a mode shift by your employees from single occupancy vehicle trips to trail or trail-transit commuting. (High, modest, minimal, none)

Of 15 choices for TDM incentives and amenities, *employer transportation coordinators* indicated that the top 50% of those TDM incentives and programs resulting in the greatest mode shift from SOV trips to trail and trail-transit commutes by weighted average (in order): a fully connected trail loop, increased financial incentives for car and vanpools, paved trails, increased federal cap on commuter tax benefits, new transit stations, on street connection signs to trails with distance, dedicated bike cars on BART during peak commuter hours, and warning signs (ped crossing, etc.) and advisory signs (nearest restrooms, drinking water, etc.).

Of 15 choices for TDM incentives and amenities, *study partners* indicated that the top 50% of those TDM incentives and programs resulting in the greatest mode shift from SOV trips to trail and trail-transit commutes by weighted average (in order): paved trails, a fully connected trail loop, new transit stations, increased financial incentives for car and vanpools, on street connection signs to trails with distance, increased facilitation of social aspect of alternative transportation (e.g. more events like Bike to Work Day), and dedicated bike cars on BART during peak commuter hours.

Did the City of San José's 6.4-mile paving study along the Guadalupe Trail between Highway 880 and Gold Street in Alviso, completed in April 2012 make bike commuting more popular with your employees/organization's members?

5 (25%) *employer transportation coordinators* indicated that the trail project made bike commuting among employees more popular, 2 (10%) indicated that it did not, and 9 (45%) indicated that they did not know.

5 (45%) *study partners* indicated that the trail project made bike commuting more popular among organization members, 1 (9%) indicated that it did not, and 2 (18%) indicated that they did not know.

Did your organization highlight the newly paved 6.4 mile trail extension as a resource or amenity?

Only 1 (5%) *employer transportation coordinator* indicated that his/her company highlighted the trail study as a resource or amenity. The remaining coordinators indicated they did not or did not know.

4 (36%) *study partners* indicated that their organization highlighted the trail project as a resource or amenity. The remaining study partners indicated they did not or did not know.

Beyond Transportation Demand Management objectives, has your company located near a trail due to quality of life, wellness, talent recruitment or other factors?

Half of the *employer transportation coordinators* indicated that they located near a trail due to quality of life, wellness, talent recruitment, or other factors. When asked to elaborate on which factors, employer transportation coordinators indicated attractive locations, talent recruitment, and single campus sites.

Does your organization use nearby trails for informal recreation use, team building or other social events as part of the work day?

Of the 20 survey responses from *employer transportation coordinators*, 7 (35%) indicated that their company uses nearby trails for informal recreational use and team building or other social events as part of the workday. 4 (20%) indicated that they did not or did not know.

Of the 11 survey responses from *study partners*, 5 (45%) indicated that their organization uses nearby trails for informal recreational use and team building or other social events as part of the workday. 3 (27%) indicated that their organization does not use the trails during the workday.

APPENDIX C

TDM Programs and Incentives for Analysis

Table C-1. 2015 Recommended TDM Programs and Incentives Analysis Matrix

	Criteria 1: Active Transportation + Transit Measures	Employer Responses		Criteria 3b: Effective- ness Condition from CAPCOA	Study Partner Responses	
		Criteria 2: Participation Condition	Criteria 3a: Effectiveness Condition		Criteria 2: Participation Condition	Criteria 3a: Effectiveness Condition
<i>Provision of secure bike lockers, showers, and/or changing facilities</i>	✓	✓	✓			✓
<i>Installed on-site infrastructure that facilitates the use of trails or transit</i>	✓				✓	✓
<i>On-site transit information and/or pass sales</i>	✓	✓	✓		✓	✓
<i>Policy enabling "bikes in the building"</i>	✓		✓		✓	✓
<i>Bicycle loan program for home-to-work commute</i>				✓		
<i>Guaranteed ride home</i>		✓	✓			
<i>Free or reduced price transit passes</i>	✓	✓	✓	✓	✓	✓
<i>Educational seminars on bicycle safety and/or route planning</i>	✓					
<i>Limited parking</i>	✓		✓	✓	✓	✓
<i>Pre-tax deduction benefit</i>	✓	✓	✓	✓		
<i>Employer-provided subsidy</i>	✓	✓		✓		✓
<i>Rewards and recognition</i>	✓				✓	✓
<i>Cash benefits, such as a parking cash out</i>	✓			✓		
<i>Parking fees or elimination of subsidized parking (except for rideshares/vanpools)</i>	✓			✓	✓	

Table C-2. 2025 Recommended TDM Programs and Incentives Analysis Matrix

	Criteria 1: Active Transportation + Transit Measures	Employer Responses		Criteria 3b: Effective- ness Condition from CAPCOA	Study Partner Responses	
		Criteria 2: Participation Condition	Criteria 3a: Effectiveness Condition		Criteria 2: Participation Condition	Criteria 3a: Effectiveness Condition
<i>Provision of secure bike lockers, showers, and/or changing facilities</i>	✓		✓			✓
<i>Installed on-site infrastructure that facilitates the use of trails or transit</i>	✓				✓	✓
<i>On-site transit information and/or pass sales</i>	✓	✓	✓		✓	✓
<i>Policy enabling "bikes in the building"</i>	✓		✓		✓	✓
<i>Bicycle loan program for home-to-work commute</i>				✓		
<i>Guaranteed ride home</i>		✓	✓			
<i>Free or reduced price transit passes</i>	✓	✓	✓	✓	✓	✓
<i>Educational seminars on bicycle safety and/or route planning</i>	✓					
<i>Limited parking</i>	✓		✓	✓	✓	✓
<i>Pre-tax deduction benefit</i>	✓	✓	✓	✓		
<i>Employer-provided subsidy</i>	✓		✓	✓		✓
<i>Rewards and recognition</i>	✓				✓	✓
<i>Cash benefits, such as a parking cash out</i>	✓	✓		✓		
<i>Parking fees or elimination of subsidized parking (except for rideshares/vanpools)</i>	✓	✓		✓	✓	

APPENDIX D

Ranges of Effectiveness to Reduce VMTs and GHG Emissions

TDM MEASURES	CAPCOA MEASURE #	EFFECTIVENESS IN REDUCING COMMUTE VMT/EMISSIONS	
		MIN	MAX
<i>Provision of secure bike lockers, showers, and/or changing facilities</i>	TRT-5: Provide end of trip facilities	0.63%	3.50%
<i>Installed on-site infrastructure that facilitates the use of trails or transit</i>	SDT-1: Provide Pedestrian Network/Improvements and interconnectivity	0.00%	2.00%
<i>On-site transit information and/or pass sales</i>	TRT-7: Implement Commute Trip Reduction Marketing	0.80%	4%
<i>Policy enabling "bikes in the building"</i>	N/A		
<i>Bicycle loan program</i>	TRT-12: Implement Bike-Sharing Programs	3%	21.30%
<i>Employer-provided transit (e.g. company van or bus)</i>	TRT-11: Provide Employer-Sponsored Vanpool/Shuttle	0.30%	13.40%
<i>Rideshare matching services (i.e. providing employees with tools to find carpools)</i>	TRT-3: Provide Ride-Sharing Programs	1.00%	15.00%
<i>Guaranteed ride home</i>	TRT-9: Implement Car-Sharing Program	0.40%	0.70%
<i>Telework and flexible work scheduling</i>	TRT-6: Encourage Telecommuting and Alternative Work Schedules	0.07%	5.50%
<i>Free or reduced price transit passes</i>	TRT-4: Implement Subsidized or Discounted Transit Program	0.30%	20%
<i>Educational seminars on bicycle safety and/or route planning</i>	TRT-7: Implement Commute Trip Reduction Marketing	0.80%	4%

Limited parking supply	PDT-1: Limit Parking Supply	5%	12.50%
Pre-tax deduction benefit	Acts like TRT-4: Implement Subsidized or Discounted Transit Program	0.30%	20%
Employer-provided subsidy	From literature	23.50%	64%
Rewards and recognition	N/A		
Cash benefits, such as a parking cash out	TRT-15: Implement Employee Parking "Cash-Out"	0.60%	7.70%
Parking fees or elimination of subsidized parking (except for rideshares/vanpools)	TRT-14: Price Workplace Parking	0.10%	19.70%

The SCG AHSC program methodology was used to determine the emissions reduction potential from new transit and trails for bike and pedestrian usage. SCG AHSC provides no corresponding effectiveness measures for those transit and connectivity infrastructure components like those provided for the CAPCOA Transportation Strategies (as contained in table above). Thus, for effectiveness to reduce commute VMTs and emissions, we use other effectiveness measures from similar CAPCOA transportation strategies not accounted for in the TDM measures considered and from other literature to determine the upper and lower bounds of these components.

		EFFECTIVENESS IN REDUCING COMMUTE VMT/EMISSIONS	
	CAPCOA MEASURE # / SOURCE	MIN	MAX
Transit and Connectivity: Operation of New Bus/Transit Service	TST-3: Expand Transit Network	0.1%	8.2%
Transit and Connectivity: Bicycle path or lanes	Requires combination with other measures to use SGC AHSC effectiveness. Instead use TCRP Report 95 ⁵⁵	0.88%	1.38%
Transit and Connectivity: Pedestrian Facilities	SDT-1: Provide Pedestrian Network Improvements	0%	2%

⁵⁵ TCRP Report 95 Chapter 16, "Pedestrian and Bicycle Facilities: Traveler Response to Transportation System Changes." <http://californiawalks.org/wp-content/uploads/2012/12/TCRP-Rpt-95-Ch.-16.pdf>

APPENDIX E

SGC AHSC Method - Equations and Data Sources

Transit and Connectivity: Operation of New Bus/Transit Service

Annual Auto Trips Reduced in trips per year =
 $[(D * R * A) * (1 - AA)]$

Annual Auto VMT Reduced in miles per year =
 $[(D * R * A) * L - AA * LL]$

Where:

D = Days of Operations per year is 365 for commute and non-commutes

R = Ridership in total bus/transit/LTR trips per day (Source: VTA model output)

A = Adjustment factor to account for transit dependency is the average of two defaults: one for local service and one for long distance commuter service, assuming that riders are a mix of both.

L = Length of average auto trip (Source: VTA model output)

AA = Adjustment factor to account for auto trips used to access transit service = average of two defaults: one for local service and one for long distance commuter service, assuming that riders are a mix of both.

LL = Length of average trip for auto access to transit = average of two defaults: one for local service and one for long distance commuter service, assuming that riders are a mix of both.

$$2015 \text{ GHG Reductions} = (\text{AutoTrips} * \text{ATSEF} + \text{AutoVMT} * \text{AREF} - \text{Bus VMT} * \text{BREF} - \text{LTR VMT} * \text{LTR EF}) / 10^6$$

$$2025 \text{ GHG Reductions} = (\text{AutoTrips} * \text{ATSEF} + \text{AutoVMT} * \text{AREF} - \text{Bus VMT} * \text{BREF} - \text{LTR VMT} * \text{LTR EF} - \text{BART VMT} * \text{BART EF}) / 10^6$$

Where:

AutoTrips = Annual Auto Trips Reduced per year calculated above.

AutoVMT = Annual Auto VMT Reduced in miles per year calculated above.

ATSEF = Annual Running Emission Factor in grams/trip from EMFAC 2011

AREF = Auto Running Emission Factor in grams/mile from EMFAC2011

2015 BUS VMT = 50% Annual Transit VMT (Source: based on VTA model output)

2025 BUS VMT = 20% Annual Transit VMT (Source: based on VTA model output)

BREF = Bus Running Emission Factor in grams/mile (Source: BREF = 0 since VTA busses are zero emissions)

2015 LTR VMT = 50% Annual Transit VMT (Source: based on VTA model output)

2025 LTR VMT = 30% Annual Transit VMT (Source: based on VTA model output)

LTR EF = Light Rail Emission Factor in grams/mile = 186 (Source: US Department of Transportation Federal Transit Administration)

2025 BART VMT = 50% Annual Transit VMT (Source: VTA model output)

BART VMT based on Expected transit (BART) ridership attributable to new routes/stations in total trips per day (Source: VTA model output)

BART EF = BART Emission Factor in grams/mile = 0.11 (Source: BART communications)

Transit and Connectivity: Bicycle Paths and Lanes

$$\text{Annual Auto Trips Reduced in trips per year} = D * \text{ADT} * (A + C)$$

$$\text{Annual Auto VMT Reduced in miles per year} = \text{Annual Auto Trips Reduced} * L$$

Where:

D = Days of use per year (default required is 365)

ADT = Annual Average Daily Traffic (two-way traffic volume in trips/day on parallel road) (Source: VTA model output)

A = Adjustment factor to account for bike use considering population and ADT (Source: SCG AHSC Table 6)

C = Activity Center Credit near study based on number of and distance from activity centers (Source: SCG AHSC Table 7)

L = Length of bicycle trip = See Table 5.1.2.

$$\begin{aligned} \text{GHG Reductions (MTCO}_2\text{/yr)} &= \\ &(\text{AutoTrips} * \text{ATSEF} + \text{AutoVMT} * \text{AREF}) / 10^6 \end{aligned}$$

Where:

AutoTrips = Annual Auto Trips Reduced per year calculated above.

AutoVMT = Annual Auto VMT Reduced in miles per year calculated above.

ATSEF = Annual Running Emission Factor in grams/trip from EMFAC 2011

AREF = Auto Running Emission Factor in grams/mile from EMFAC2011

Transit and Connectivity: Pedestrian Facilities

$$\begin{aligned} \text{Annual Auto Trips Reduced in trips/year} &= W * T \\ \text{Annual Auto VMT Reduced in miles/year} &= W * T * L \end{aligned}$$

Where:

W = Weeks of operation per year (default required = 52)

T = Auto trips eliminated (Source: VTA model output)

L = Length of auto trip eliminated (See Table 5.1.2)

$$GHG\ Reductions\ (MTCO_2/yr) = (AutoTrips * ATSEF + AutoVMT * AREF) / 10^6$$

Where:

AutoTrips = Annual Auto Trips Reduced per year calculated above.

AutoVMT = Annual Auto VMT Reduced in miles per year calculated above.

ATSEF = Annual Running Emission Factor in grams/trip from EMFAC 2011

AREF = Auto Running Emission Factor in grams/mile from EMFAC2011

VMT Reduction Measures: Commute

Free/Subsidized/Discounted transit program is the same as a Pre-tax deduction benefit for transit commuting and parking costs⁵⁶

$$\% \text{ Commute VMT reduction} = A * B * C$$

$$CO_2 = VMT \times EF_{\text{running}}$$

Where:

A = % reduction in commute vehicle trips (VT) based on an average daily transit subsidy for urban locations = 16.45% (Source: CAPCOA (2010), Table A, page 231)

B = % employees eligible = 12.9% (from Employer Survey conducted for the study)

C = Adjustment from commute VT to commute VMT = 1.0 (Source: CAPCOA (2010))

VMT = SVTL Commute VMT (Source: VTA model data for 2015)

EF_{running} = emission factor for running emissions (Source: EMFAC 2011)

⁵⁶ CAPCOA defines as “Implement subsidized or discounted Transit Program”

On-site transit information and/or pass sales⁵⁷

$$\begin{aligned} \% \text{ VMT reduction} &= A * B * C \\ \text{CO}_2 &= \text{VMT} \times \text{EF}_{\text{running}} \end{aligned}$$

Where:

A = % reduction in commute vehicle trips (VT) = 4% (Source: CAPCOA (2010))

B = % employees eligible = 6.1% (from Employer Survey conducted for the study)

C = Adjustment from commute VT to commute VMT = 1.0 (Source: CAPCOA (2010))

VMT = SVTL Commute VMT (Source: VTA model data for 2015)

EF_{running} = emission factor for running emissions (Source: EMFAC 2011)

Limited parking⁵⁸

$$\begin{aligned} \% \text{ VMT Reduction} &= \\ &(\text{Actual parking provision} - \text{ITE parking generation rate}) / \text{IT parking generation rate} * 0.5 \\ \text{CO}_2 &= \text{VMT} \times \text{EF}_{\text{running}} \end{aligned}$$

Where:

ITE parking generation rate assuming a 5% and 25% reduction in spaces for the low and high scenarios, respectively.

B = % employees eligible = 11.7% (from Employer Survey)

C = Adjustment from commute VT to commute VMT = 1.0 (Source: CAPCOA (2010))

VMT = SVTL commute VMT (Source: VTA model data for 2015)

EF_{running} = emission factor for running emissions (Source: EMFAC 2011)

⁵⁷ CAPCOA's most closely related measure is to "Implement Commute Trip Reduction Marketing"

⁵⁸ CAPCOA defines as "Limit parking supply"

APPENDIX F

Forecasting Emissions-reduction Potential – Calculations and Assumptions Under Each Method

Strategic Growth Council Affordable Housing and Sustainable Communities Method

Using the average annual average daily traffic, total one-way pedestrian trips and expected transit ridership, emissions reduction calculations in each emission-reducing activity (provision and use of transit, trail, TDM programs and incentives) were calculated. Because the trail use components of the SGC method are generally based on data from roadways parallel to the trail loop, each trail was broken into segments that correspond to each parallel roadway segment. Input data from VTA was averaged for all the segments.

This appendix describes the calculations and assumptions that are method-specific, but exact equations and sources for data and assumptions made are contained in Appendix G. VTA supplied average County-wide trip lengths by mode, presented in Table F.1, utilized in the SGC calculations.

F-1 Average County-wide Trip Distance by Mode

MODE	2015	2025
Auto	9.15	9.07 miles
Transit	7.58	8.15 miles
Bike	5.46	5.84 miles
Walk	1.01	1.03 miles

The results of the calculations for each type of emissions reducing activity according to the SGC AHSC method are presented in Section 5. GHG reductions are reported in units of metric tons of carbon dioxide equivalent per year (MT CO₂e/yr).

Transit and Connectivity: Operation of New Bus/Transit Service

The VTA models bus and light rail ridership in 2015, which enabled calculation of emissions reductions associated with existing route service in the study area. Emissions reductions in 2015 consider emissions avoided from auto miles reduced minus the emissions associated with buses and light rail. This set of calculations was also used to determine emissions reduction potential in 2025 by new fixed route services with cleaner vehicles that increase the hours of service per year and serve additional commuters. In 2025, there are no new bus lines expected, but increased BART ridership is expected due to the Silicon Valley Extension's new stations on 4 trail segments as described in Section 3.0. Thus emissions reductions consider those avoided from auto miles reduced minus the emissions associated with electricity-driven bus/BART vehicle miles.

Transit and Connectivity: Bicycle Paths and Lanes

The potential emissions reduced from the installation of both existing (in 2015) and planned Class 1 bicycle paths (physically separated from motor vehicle traffic installed by 2025) were calculated by estimating the emissions avoided from auto use for all scenarios. This set of calculations is based on two-way traffic volume (25% assigned to commute trips and 75% assigned to non-commute trips), average length of bicycle trips and adjustment factors accounting for population and proximity to activity centers.

Transit and Connectivity: Pedestrian Facilities

The potential emissions reduced from the installation of both existing (in 2015) and planned paths that pedestrians use (physically separated from motor vehicle traffic installed by 2025) were calculated by estimating the emissions avoided from auto use for all scenarios. Pedestrian facilities replace auto trips by providing pedestrian access. For example, a pedestrian passageway over several lanes of heavy traffic provides safe walking access to adjacent activity centers. This set of calculations is based on the number of auto trips eliminated (from the VTA model where 25% are assigned to commute trips and 75% are assigned to non-commute trips) and the average length of auto trips eliminated.

VMT Reduction Measures: Commute

Four commute-related VMT reducing measures were identified for emissions reduction calculations as presented in Section 3.4.2. Note that for each measure recommended for emissions reduction potential analysis, there was not necessarily an exact match for the measure in the CAPCOA measures. In all cases, computations were performed using the most closely related measure based on commute VMTs. Also, the emissions reduction potential calculations for VMT reducing measures used only the commute portion of VMTs determined for each scenario (25% of overall VMTs). Commute VMT reduction measures were included in Scenarios 1 and 4 (the 2015 and 2025 scenarios that included TDM programs and incentives).

Free/Subsidized/Discounted transit program⁵⁹

The Federal tax code allows the use of tax-free dollars to pay for transit commuting and parking costs through employer-sponsored programs. Commuter tax benefits are regulated by the Internal Revenue Code, Section 132(f)—Qualified Transportation Fringe. As of January 2014, the tax code allows tax-free transportation fringe benefits of up to \$130 per month per employee for transit expenses and up to \$250 per month for qualified parking (including parking at BART stations.) Qualified parking is defined as parking at or near an employer's worksite, or at a facility from which employee commutes via transit, vanpool or carpool). Commuters can receive both the transit and benefits (up to \$380 per month). Employers can offer (a) a tax-free employer-paid subsidy, (b) pre-tax employee-paid payroll deduction and/or (c) a combination of both of the above. The VMT reduction for this program is based on the percent employees eligible for the program and the percent reduction in commute vehicle trips expected from comparable average daily transit subsidies in urban locations. The range of effectiveness for this measure in reducing VMTs and emissions is between 0.3% and 20%.

A Pre-tax deduction benefit

A pre-tax deduction benefit is an incentive that employers offer on behalf of employees to defray the cost of transit commuting and parking. However, since CAPCOA does not have a calculation associated with a pre-tax deduction program, the closest CAPCOA listed program, a parking cashout, was utilized to determine VMT and emissions reduction potential. The range of effectiveness for this measure in reducing VMTs and emissions is between 0.6% and 7.7% of overall commute related VMTs and emissions.

On-site transit information and/or pass sales

Programs that offer on-site transit information and/or transit pass sales are most similar to the CAPCOA emissions reduction measure “commute trip reduction marketing.” The VMT reduction calculations from this program are based on the percent of employees eligible to participate, Santa Clara’s commute VMTs, and assumptions about the percent reduction in commute vehicle trips. This measure has a range of effectiveness to reduce commute related VMTs and emissions of between 0.8% to 4%.

Limited parking supply

One parking policy or pricing related VMT reducing measure was identified for emissions reduction calculations: limiting parking supply. This measure involves changing or designing parking requirements and types of supply that encourage smart growth development and alternative transportation choices by employees. For example, strategies to limit parking supply could include elimination or reduction of minimum parking requirements (which could require changes to local ordinances and regulations), creation of maximum parking requirements or provision of shared parking. VMT reduction calculations are based on assumptions about percent reductions in spaces, the percent of employees eligible to participate in the program and commute VMTs. This measure has a range of effectiveness to reduce commute VMTs and emissions of between 5% and 12.5%.

⁵⁹ CAPCOA defines as “Implement subsidized or discounted Transit Program.”

Pursuant to the CAPCOA guidance document, the total VMT reduction in urban environments across all parking and commute VMT categories cannot exceed 70% of the total VMT reduction. Recall that commute VMT reduction measures, defined as TDM programs and incentives for the purpose of this study, are one of three VMT reduction categories considered in the SGC method, with the other two being transit and active transportation use of trails. In other words, the rule means that when the commute VMT reductions are computed for the TDM programs, they cannot exceed 70% of the entire VMT reductions estimated from all three categories. If they do exceed 70%, only up to 70% of the VMT reduction estimated can be included in the overall VMT and emissions reduction estimates.

All example calculations for each category of potential emissions reductions determined through the SGC method are included in Appendix E.

Santa Clara Valley Transportation Authority Model

For the VTA Countywide model, there are three basic types of input data:

- Land use and socioeconomic data in each traffic analysis zone (TAZ), including population, households, employed residents and jobs by category,⁶⁰
- Characteristics of the transportation system, such as number of lanes, speed, capacity, transit stops and frequencies,
- Pricing characteristics such as parking costs, transit fares and auto operating costs.

Transportation networks used by the VTA are consistent with assumptions made by the Metropolitan Transit Commission (MTC) in the latest Regional Transportation Plan called Plan Bay Area, with some refinements to reflect local conditions, particularly for the transit networks. These networks are continually reviewed and updated and are available for the years 2013, 2020, 2025 MTC and VTA to include projects funded in the Plan and VTA Long-Range Countywide Plan VTP 2040.

The VTA model includes all elements of the congestion management plan networks and network attributes both within the jurisdiction and with Santa Clara County. It distinguishes between the following roadway types:

⁶⁰ Currently, VTA maintains socioeconomic databases developed from Association of Bay Area Governments Projections 2013 series datasets allocated to the smaller traffic analysis zones in Santa Clara County. VTA currently maintains zonal socioeconomic data for the years 2013, 2020, 2025 and 2040 reflecting ABAG Projections 2013 datasets.

- Freeways,
- Expressways,
- Freeway ramps (metered and un-metered),
- Arterials, and
- HOV facilities.

The VTA model distinguishes between the following transit submodel types:

- Heavy rail,
- Commuter rail,
- Light rail,
- Express bus,
- Local bus,
- Community bus, and
- Free shuttles.

The VTA model also incorporates parking costs, tolls and transit fares consistent with what MTC assumes for the region. The VTA model was recently enhanced to explicitly consider bicycle and pedestrian infrastructure elements, such as multiuse bicycle/pedestrian paths, bicycle lanes and boulevards. The enhancements allowed for the model to estimate changes in the number of new bicycle and walk trips as well as shifts in travel paths caused by bicycle infrastructure improvements. The bicycle enhancements were validated to year 2013 observed bicycle counts at over 100 intersections and at major bicycle trails with observed counts data. The VTA model is capable of estimating bicycle volumes on individual facilities by hour of the day as well as for the entire day of activity. The VTA model ignores “trip chaining,” which occurs when a trip for shopping, entertainment or any other non-work purpose is combined (or “chained”) before, after or during the commute trip. The VTA model did not directly take into account the impact of TDM programs and incentives.

The existing calibrated VTA model was configured to model the impacts of the presence of several trail and transit combinations. Note that the VTA model runs do not match study scenarios presented in Section 3.0. Furthermore, model runs are presented as overall-County-wide VMTs and not specific VMTs for the SVTL study’s geographic scope. There is also no downscaling factor to convert County-wide emissions to study-based emissions. Due to these two conditions, post-model data processing was required to translate VTA model runs to emissions reduction potential for each study scenario. First, this involved a deduction process to compute VMTs reduced by individual and combinations of trail and transit components and usage. Second, the appropriate CARB EMFAC emission factors were applied to the VMTs reduced to determine the emissions reduction potential. The

calculations for this translation are detailed in Appendix G. Pursuant to VTA, 25% of VMTs reduced are attributable to commute trips and 75% are attributable to non-commute trips.

Determination of Emissions Factors – Both Methods

The EMFAC model is the tool the California Air Resources Board (CARB) uses to calculate emissions from on-road vehicles, and is considered standard best practice for transportation planning. The EMFAC model provides “emissions factors,”⁶¹ which were applied to VMTs in both methods to determine emissions reduction potential for each scenario. EMFAC projects emissions factors through 2035. The average EMFAC emission factor was applied for each year, neglecting speed bins. This was consistent with the emission factors applied to the VMT reductions in the SGC AHSC method.

⁶¹ An emission factor is the measure of the average amount of a specific pollutant or material discharged to the atmosphere by a specific process, fuel, equipment, or source.

APPENDIX G

Translating VTA Model Runs to Study Scenarios

The following model runs were provided by VTA for calculations to determine study scenario emissions avoided forecast:

2015 NO SVTL: A base year 2015 model run with daily VMT output that includes 2015 transit services and roadway networks, but excludes the SVTL.

2015 WITH SVTL: A base year 2015 model run with daily VMT output that includes 2015 transit services and roadway networks, plus 2015 trail.

2025 NEW TRANSIT: A forecast year 2025 model run with daily VMT output that includes all proposed transportation projects/services assumed to be in operation in 2025 (full BART extension, light rail improvements, El Camino Real bus rapid transit), roadway projects, and other trails networks, but excluding the SVTL entirely (even at 2015 build-out).

2025 NEW TRANSIT + TRAIL: A forecast year 2025 model run with daily VMT output that includes all proposed transportation projects/services assumed to be in operation in 2025 (full BART extension, light rail improvements, El Camino Real bus rapid transit), roadway projects, other trails networks, and the SVTL as planned for completion by 2025.

2025 “BACKGROUND” TRANSIT + TRAIL: A forecast year 2025 model run with daily VMT output that includes 2025 levels of transit and trail in all areas *except* the SVTL (includes 2015 levels of transit and trail in the SVTL study area).

The VMTs for each model run were multiplied by 365 days per year to annualize the VMTs and then multiplied by the appropriate automobile running emissions factor to determine County-wide emissions from motorized travel. The auto running emissions factors were 343.3 and 264.7 for 2015 and 2025, respectively.

Table G-1 Santa Clara County VMT + Annual Emissions Avoided Forecast for Model Runs

	2015 BASE	2015 W/SVLT	2025 NEW TRANSIT	2025 NEW TRAILS+TRANSIT	2025 BACKGROUND TRAILS +TRANSIT
Daily VMT	36,541,919	36,513,072	41,338,318	41,281,822	41,573,659
Annual Commute VMT (260 days)	13,337,800,435	13,327,271,280	15,088,486,070	15,067,865,030	15,174,385,535
AREF (g/mi) ⁶²	343.4	343.4	264.69	264.69	264.69
Annual Emissions Avoided Forecast (MT CO2E)	4,580,201	4,576,585	3,993,771	3,988,313	4,016,508

In order to translate the Santa Clara county-wide emissions into emissions reduction potential for the different study scenarios, a series of post-processing calculations were performed according to the following logic:

Scenario 1. Existing trails, transit and TDM incentives and programs – year 2015

There is no VTA model run that computes VMTs without the existing SVTL and transit. Both 2015 model runs include the transit networks so the resulting emissions reduction potential are caused just by the addition of the SVTL.

$$(2015 \text{ NO SVTL}) - (2015 \text{ WITH SVTL})$$

Scenario 2. Background transit and fully built and connected trail loop –year 2025

The following calculation was used to isolate the projected emissions reduction resulting from the use of a fully built and connected SVTL in year 2025:

$$(2025 \text{ NEW TRANSIT}) - (2025 \text{ NEW TRAILS} + \text{TRANSIT})$$

Scenario 3. Fully built and connected trail loop and transit system - year 2025

⁶² Between years 2015 and 2025, the emission factor for autos is projected to decrease 23% due to cleaner vehicles being on the roadways.

The following calculation was used to isolate the projected emissions resulting from the use of a fully built and connected SVTL and transit system in year 2025:

$$(2025 \text{ BACKGROUND TRAILS} + \text{TRANSIT}) - (2025 \text{ NEW TRAILS} + \text{TRANSIT})$$

Scenario 4. Fully built and connected trail loop and transit system plus TDM incentives and programs - year 2025

Because TDM incentives and programs are factored into the VTA model runs but are not explicitly separated as their own component, Scenario 5 is the same as Scenario 3.

APPENDIX H

Evaluation Process for TDM Program Recommendations

This section explains the process by which evaluation factors were considered in making mode shift program recommendations. It considers the programs that were factored into the analysis (i.e., those that shift modes to active transportation), those that shift to other more efficient forms of carbon-intensive commuting, and those that eliminate commute trips.

Effectiveness to reduce VMTs and emissions was tabulated for each TDM program or incentive using both “Statewide” and “Regional” criteria. “Statewide Effectiveness,” shown in Table H-1, was calculated as the average of the effectiveness ranges provided by the California Air Resources Board GHG Quantification Methodology for the Strategic Growth Council (2015). The overall range of effectiveness for all programs considered was translated to a qualitative scale of low, medium and high effectiveness. “Regional Effectiveness,” shown in Table H-2, is as specified in the survey of regional stakeholders conducted at the beginning of the study, and was also translated to a qualitative scale. The tables below reflect the qualitative scale associated with each effectiveness source. Note that the statewide and regional perspectives also correspond to the two emissions calculation methodologies: CARB’s Strategic Growth Council method and the VTA method. See Appendix D for a tabulation of VMT and emissions reducing effectiveness for each program.

Table H-1 Statewide Scale of Effectiveness⁶³

0.1%	10.0%	Low range
10.1%	30.0%	Medium range
30.1%	43.8%	High range

⁶³ Source: CARB, the basis for SGC method

Table H-2 Regional Scale of Effectiveness⁶⁴

1.75	2.51	Low range
2.52	3.29	Medium range
3.30	4.07	High range

Relative Cost to implement the program widely in the study area was tabulated for each TDM program or incentive. This factor is based on Planning and Consulting Team knowledge of programmatic costs and translated to a qualitative scale of low, medium and high cost as defined in Table H-3. Please see Appendix H for a summary of planned active transportation and transit infrastructure projects and their budgeted costs.

Table H-3 Cost Ranges

< \$250k	Low range
\$250k - \$1M	Medium range
≥ \$1M	High range

Implementation feasibility was tabulated for each TDM program or incentive using a qualitative scale of “easy,” “moderate,” and “stretch,” as shown in Table H-4. The Planning Team considered future programmatic and policy drivers that impact the degree each program or study is technically feasible, the precedence of existing program models, whether the program constituted an ongoing cost, and the potential for the program to “push the envelope” if it is be implemented. Barriers to and co-benefits of implementing each program were also considered for this factor and are compiled in Table H-5. Table H-5 is useful also to assist decision-makers who may reference the recommendations for additional context.

Table H-4 Ease of Implementation

Easy	When there is ample precedent and many existing models
Moderate	When there is some precedent and several existing models
Stretch	When there is little precedent or few existing models, and/or will require ongoing employer funding.

⁶⁴ Source: Regional Stakeholders using 0 – 5 rating

Planning Team members came to consensus as to what the most appropriate value should be used for factor each program or study as presented in Table H-5.

Table H-5 Mode Shift Program Recommendation Evaluation Factors For each Study/Program

TDM PROGRAM	EFFECTIVENESS IN REDUCING EMISSIONS		RELATIVE COST RANGE TO WIDELY IMPLEMENT IN STUDY AREA	EASE OF IMPLE- MENTATION
	STATE- WIDE	REGIONAL		
Operation of new transit and bus service	Medium	already planned	already planned	already planned
New trails that accommodate bikes and pedestrians	Medium	already planned	already planned (high)	already planned (varies)
Provision of secure bike lockers, showers, and/or changing facilities	Low	High	Medium	Moderate
Installed on-site infrastructure that facilitates the use of trails or transit	Low	Medium	Medium-High	Moderate
On-site transit information and/or pass sales	Low	Medium	Low	Moderate
Policy enabling "bikes in the building"	Low	High	Low	Easy
Bicycle loan program for home-to-work commute	Medium	Low	Medium	Moderate
Employer-provided transit (e.g. company van or bus)	Low	Medium	High	Moderate – Stretch
Rideshare matching services (i.e. providing employees with tools to find carpools)	Low	Low	Low	Easy
Guaranteed ride home	Low	Medium	Medium	Medium
Telework and flexible work scheduling	Low	High	Medium	Easy
Free or reduced price transit passes	Medium	High	High	Moderate
Educational seminars on bicycle safety and/or route planning	Low	Medium	Low	Easy
Limited parking	Low	High	Low	Moderate- Stretch
Pre-tax deduction benefit	High	Medium	Low	Easy
Employer-provided subsidy	High	High	Medium-High	Stretch
Rewards and recognition	Low	Medium	Low	Easy
Cash benefits, such as a parking cash out	Low	Low	Low	Stretch
Parking fees or elimination of subsidized parking (except for rideshares/vanpools)	Low	Medium	Medium	Moderate-Stretch

Factor weighting

The Planning Team was interested in seeing how the ranking/prioritization of recommendations might change depending on which of the evaluation factors—effectiveness, relative cost, and ease of implementation—received greater emphasis. The measures were therefore weighted using two rubrics (each with three sub-rubrics dependent on consideration of different effectiveness measures),⁶⁵ one which gave effectiveness greater weight, and one in which all evaluation factors were weighted equally:

1. Rubric that gives effectiveness greater weight (the environmental benefit is valued twice the other factors)
 - a. Where combined statewide and regional effectiveness are considered
 - b. Where only statewide effectiveness is considered
 - c. Where only regional effectiveness is considered

2. Rubric where all three primary evaluation factors are weighted equally
 - a. Where combined statewide and regional effectiveness are considered
 - b. Where only statewide effectiveness is considered
 - c. Where only regional effectiveness is considered

Prioritization of recommendations

Next, all low ratings were assigned a value of (-1), medium/ moderate ratings were assigned the normalized value of (0) and high/stretch ratings were assigned the value of (1). For Rubric 1, where the carbon reducing effectiveness (or environmental benefit) is weighted more heavily, the effectiveness ratings considered were doubled. For Rubric 2, each factor value was weighted equally. For each program, the set of factor values were summed and the programs rank ordered from high to low under the two weighting rubrics. Within each rubric, recommendations vary based on which effectiveness factors are considered in the prioritization. However, there are commonalities between effectiveness considerations within and between rubrics and key differences between using regional and statewide effectiveness to note. Specific recommendations are summarized in Section 6.0.

⁶⁵ A rubric is a scoring tool used to evaluate and assess a set list of criteria and objectives. In this case, the objective is to evaluate criteria to identify how to maximize TDM effectiveness.

APPENDIX I

Planned Active Transportation and Transit Improvement Costs

The following lists detail the planned pedestrian and bikeway improvements projects identified by local agencies as part of the Valley Transportation Authority Bicycle Expenditure Plan 2040 (adopted in 2013)⁶⁶. Projects noted are within ½ mile of the SVTL study area. Funding levels noted represent the estimated funding need and the not funds currently available for development.

CATEGORY 1 PEDESTRIAN AND BIKEWAY IMPROVEMENTS

San José	Airport Blvd. : Guadalupe River Trail Bike and Pedestrian connection	\$2.8 M
	Construct a multi-use path along the north side of Airport Blvd. (at south end of Mineta San José International Airport) from the Guadalupe River Trail to Coleman Ave. connecting with existing Coleman Ave. bike lanes and future Santa Clara BART Station (via Brokaw Rd.). Construct a crosswalk on Airport Blvd., south of Skyport Dr. to Airport Blvd. at Coleman.	
San José	Auzerais Ave. Bicycle and Pedestrian Improvements: Sunol St. to Race St.	\$2.2 M
	Construct Class II bikeways, sidewalk improvements, crossing improvements, and bicycle parking.	
San José	Bird Ave. Bicycle and Pedestrian Corridor: Montgomery St. at Santa Clara to Bird Ave. at West Virginia	\$3.5 M
	Construct Class II and III bikeways, enhanced crossing/detection, and sidewalk	

⁶⁶ Source: <http://www.vta.org/sfc/servlet.shepherd/document/download/069A0000001M1PQIA0>

improvements.

San José	Brokaw-Coleman Airport Bikeway: Airport Blvd. and the Guadalupe Trail to Airport Blvd. and Coleman Ave.	\$1.2 M
	Construct Class II bikeways, bicycle crossing improvements, and Class I multi-use path.	
San José	Charcot Bikeway: Orchard Pkwy . to O'Toole Ave ./Hwy . 880	\$0.5 M
	Construct Class II bikeways and bicycle crossing improvements.	
San José	Guadalupe River Trail (I-880 to the Bay Trail) and Tasman Undercrossing	\$0.0 M
	Construct a partially paved trail segment along the Guadalupe River from Gold St. to Montague Expwy. Elements of the trail include a 12-foot-paved AC trail with striping and signage, a seating area midpoint, call boxes, and a gateway structure at Montague Expwy.	
San José	Hedding St . Bikeway: Park Ave. to 17th St .	\$0.3 M
	Enhance on-street crosstown bikeway between San José/Santa Clara city limit with Guadalupe River Trail, Coyote Creek Trail, and Penitencia Creek Trail. Treatment will include bike lanes, sharrows, signs, etc.	
San José	Hwy . 237 Bikeway: Great America Pkwy . to Zanker (Class I and II)	\$0.5 M
	Construct Class II bikeways and bicycle crossing improvements.	
San José	Los Gatos Creek Trail Reach 5d: Park Ave ./Montgomery Ave . to Santa Clara Ave . (Diridon Station Segment)	\$8.5 M
	Completion of the last reach of the Los Gatos Creek Trail, including design, land acquisition and environmental review.	
San José	Los Gatos Creek Trail Reach 5b and 5c: Auzerais Ave . South of W . San Carlos Ave . to Park Ave ./Montgomery Ave . (Trail and Undercrossing)	\$5.8 M
	Completion of the last reach of the Los Gatos Creek Trail including design, land acquisition and environmental review.	
San José	North San José Bike/Pedestrian Improvements: Guadalupe River Trail/Coyote Creek Trail/Alviso Neighborhood	\$35.0 M
	Provide Class I, II, and III bikeways, enhanced crossings/detection, bike parking, sidewalk enhancements.	
San José	Park Ave ./San Fernando St ./San Antonio Bikeway	\$0.3 M
	Provide enhanced on-street crosstown bikeway (bike lanes, sharrows, signs) between San José/Santa Clara city limits with Diridon Transit Center, Downtown San José, San José Creek Trails (Los Gatos, Guadalupe, Coyote), SJSU and east San José.	
San José	Three Creeks Trail: West from Los Gatos Creek Trail/Lonus St . to Guadalupe River	\$2.0 M
	Construct landscaped trail system, with paved alignment along a former railway right-of-way. Signage, striping, mileage markers, seating, fitness stations, and decorative	

gateway elements at all at-grade roadway crossings.

TOTAL OF CATEGORY 1	\$62.6M
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CATEGORY 2 PEDESTRIAN AND BIKEWAY IMPROVEMENTS

San José	Coyote Creek Trail (Montague Expwy . to Oakland Rd .)	\$8.7 M
	Complete the creek trail in the North San José segment.	
San José	Coyote Creek Trail (Oakland Rd . to Watson Park)	\$8.7 M
	Complete the creek trail in the Berryessa BART station segment.	
San José	Coyote Creek Trail (Watson Park to Williams St . Park)	\$5.8 M
	Complete the creek trail of the Northside to Naglee Park Neighborhood Segment.	
San José	Coyote Creek Trail (Williams St . Park to Kelley Park)	\$3.3 M
	Complete the creek trail of the I-280 underpass segment.	
San José	Upper Penitencia Creek Trail Connector Phase 2: Berryessa BART to Coyote Creek	\$2.3 M
	Construct a trail connector from Berryessa BART station to Coyote Creek.	
Santa Clara	Hetch-Hetchy Trail: Calabazas Creek to Lick Mill Blvd .	\$7.6 M
	Install Class II bicycle lanes with bicycle detection at signalized intersections.	
Santa Clara	Lafayette St . Bike Lanes: Calle de Luna to Yerba Buena Way	\$0.3 M
	Install Class II bicycle lanes with bicycle detection at signalized intersections.	
Santa Clara	Tasman Dr . Bike Lanes: Calabazas Creek to Guadalupe River	\$0.6 M
	Install Class II bicycle lanes with bicycle detection at signalized intersections.	
TOTAL OF CATEGORY 2		\$37.3M

The following list details planned transit improvements projects identified by Santa Clara County that will be installed within ½ mile of the SVTL study area.

Guadalupe Express Light Rail Improvement Study	\$22 M
Study reconfigures the southern half of the Light Rail System’s operations to provide express trains along the Guadalupe line. Requires modest track and signal improvements between Ohlone/ Chynoweth and Civic Center.	
Tasman Express Light Rail Improvement Study (Long T)	\$49 M
Study provides infrastructure needed to introduce a new light rail line linking Mountain View to Alum Rock in time for the opening of the critical Light Rail/BART connection at Montague Station in late 2016. The new service will feature peak period express trains between Mountain View and Santa Clara that will expedite access to and from the BART station while improving service to existing and future land uses along the Tasman corridor. The study requires track improvements and signal upgrades at several key points along the Tasman corridor.	
North First Speed Improvements	\$9 M
Study provides several speed improvements for the North First St. corridor—roughly between Tasman and the Metro/Airport stations to allow Light Rail speeds to improve from 35 to 45 miles per hour. A key element of these improvements will be fencing along the Light Rail right-of-way.	
Caltrain Electrification Tamien to San Francisco	\$608 M
Study provides improvements to support a blended HSR/Electrified Caltrain rail system from the Transbay Transit Center to the Tamien station. The blended system coordinates the development and operation of high-speed rail with Caltrain passenger service on the existing two-track configuration. These investments will realize early implementation of modernized electrified Caltrain service by 2019, reduce noise and air pollution, minimize impacts on surrounding communities, reduce study costs, and expedite the implementation of high-speed rail in 2029.	
Caltrain: South County	\$31 M
Double track segments on the Caltrain line between San José and Gilroy.	
Caltrain/HSR Station Improvements: San José Diridon and Gilroy Stations	\$200 M
Provide station improvements needed to accommodate and support the high-speed rail service.	

Altamont Commuter Express (ACE) Upgrade	\$16 M
This program will upgrade service by providing VTA’s share of funds for rolling stock and track improvements. VTA will work with San Joaquin Regional Rail Commission staff to implement this program.	
North San José Transit Improvements	\$35 M
Transit improvements projects included in the North San José Development Area Deficiency Plan.	
Mineta San José International Airport APM Connector	\$81 M
Study would provide transit link to San José International Airport from VTA’s Guadalupe Light Rail Transit (LRT) Line, and from Caltrain and future BART in Santa Clara, using automated People Mover (APM) technology. The environmental phase is included in VTP 2040.	
TOTAL TRANSIT PROJECTS	\$1.05BM