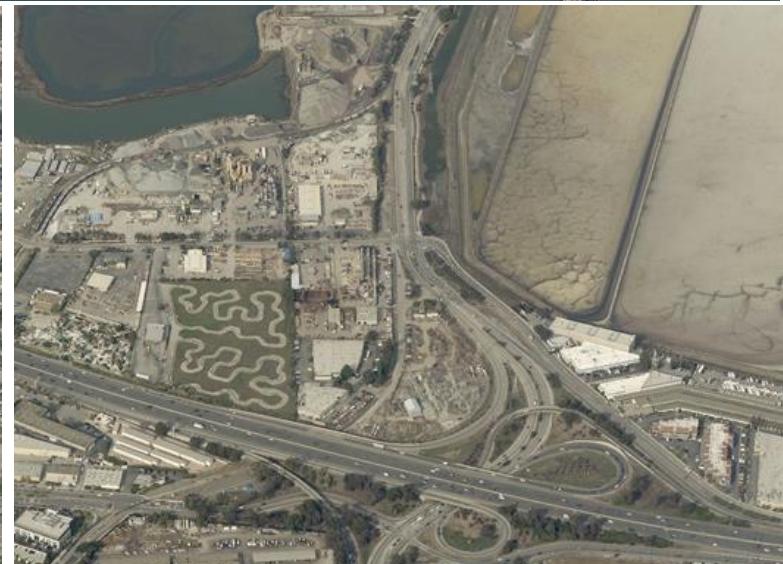




San Mateo County

Transportation Programs Climate Impact Report

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C/CAG
City/County Association of Governments
of San Mateo County

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Acknowledgements

C/CAG Board of Directors

Elizabeth Lewis, Town of Atherton
Doug Kim, City of Belmont
Cliff Lentz, City of Brisbane
Ricardo Ortiz, City of Burlingame
Diana Colvin, Town of Colma
Juslyn Manalo, City of Daly City
Lisa Gauthier, City of East Palo Alto
Herb Perez, City of Foster City
Debbie Ruddock, City of Half Moon Bay
Marie Chuang, Town of Hillsborough
Catherine Carlton, City of Menlo Park
Gina Papan, City of Millbrae
John Keener, City of Pacificia
Maryann Moise Derwin (Chair), Town of Portola Valley
Alicia Aguirre, City of Redwood City
Irene O'Connell, City of San Bruno
Mark Olbert, City of San Carlos

Diane Papan, City San Mateo

David Canepa, County of San Mateo

Karyl Matsumoto, City of South San Francisco /
San Mateo County Transit District / San Mateo
County Transportation Authority

Deborah Gordon, Town of Woodside

C/CAG Executive Director

Sandy Wong

C/CAG Staff

John Hoang
Sara Muse

County of San Mateo Staff

Kim Springer

With assistance from DNV GL

Betty Seto, Tara Jankowski, Ben Butterworth



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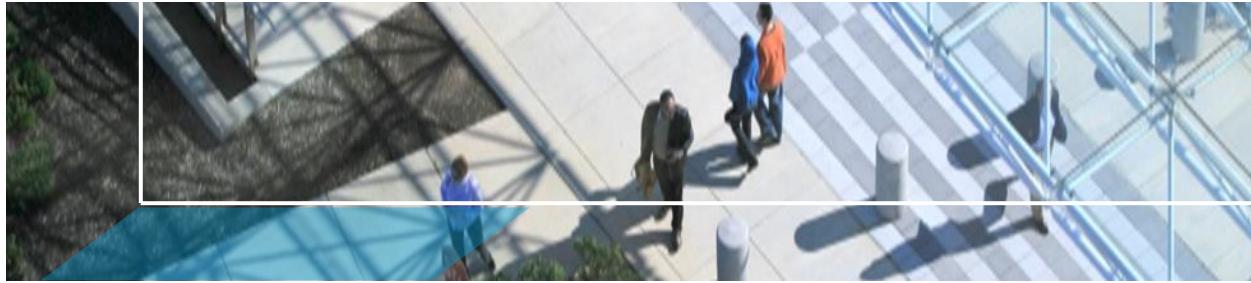


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TECHNICAL APPENDIX



Executive Summary

The challenge of climate change is not new, and addressing it has long been a priority for San Mateo County. City/County Association of Governments of San Mateo County (C/CAG) is responsible for administering many state-mandated programs related to transportation, air quality and federal and state transportation funding programs in San Mateo County.

This Transportation Programs Climate Impact Report refers to C/CAG's long-range planning document, the recently adopted San Mateo Countywide Transportation Plan 2040 (SMCTP 2040), and its anticipated reduction in Vehicle Miles Traveled (VMT) and resulting impact in greenhouse gas (GHG) emissions countywide and identifies strategies for all transportation plans in the county on meeting the State of California's climate goal of 40% below 1990 levels by 2030..

The SMCTP 2040 is intended to articulate clear transportation planning objectives and policies and to promote consistency and compatibility among all transportation plans and programs within the county. By doing so, SMCTP 2040 supports an integrated, system-wide approach to transportation planning that gives proper consideration to the countywide transportation network as a whole, not just in its constituent parts. Through its countywide initiatives, C/CAG is supporting its member jurisdictions to meet city-level climate action commitments.

Together with anticipated improvements to vehicle fuel efficiency, the SMCTP 2040 is forecasted to reduce GHG emissions associated with on-road emissions 8% below 1990 levels by 2030 and 18% by 2040. While these are significant achievements, the emissions trajectory associated with the SMCTP 2040 falls short of state targets. Therefore, this report also examines how increasing the adoption rate of alternatively fueled zero emission vehicles will help close the gap to the state's emissions target.

C/CAG is committed to meeting State of California's climate target of 40% below 1990 emissions levels by 2030.

This Transportation Programs Climate Impact Report identifies nine strategies for achieving the State of California's GHG reduction target of 40% below 1990 levels by 2030.

Figure 1. C/CAG Transportation Programs Climate Impact Report Strategies



The strategies identified above in Figure 1 have been identified in the SMCTP 2040. It is recognized that continuing to implement transportation projects and programs contributes towards the reduction of GHG emissions.

Through its existing planning efforts, C/CAG is connecting a multitude of agencies with overlapping jurisdictions and responsibilities, including the County and the 20 cities/towns within its boundaries that each plan and implement improvements to local roadways within their own jurisdictions. As identified in this Transportation Programs Climate Impact Report, C/CAG will continue to articulate clear policy goals and objectives to foster optimal performance of the County's transportation network and effectiveness of new transportation investments to do its part to achieve climate targets in service of a healthier, safer and high quality of life throughout the region.

1. Introduction



C/CAG is pleased to present the following Transportation Programs Climate Impact Report. This Report outlines how C/CAG's transportation planning objectives and policies results in community GHG emissions reductions consistent with local and state climate goals.

Our agency cannot solve the climate change dilemma alone. Together with our partners in local, county, state, and federal government, C/CAG has committed to doing its part to facilitate GHG emissions reductions through the creation of new programs and services countywide.

As the Congestion Management Agency for San Mateo County, we present C/CAG's transportation-specific initiatives and what is needed to meet the state's 2030 climate target.

We have developed this report in order to support San Mateo County in achieving the State's climate goals

1.1 The Climate Imperative

Climate scientists around the world, represented by the Intergovernmental Panel on Climate Change (IPCC), have an unequivocal position: human activity is changing the Earth's climate through the release of greenhouse gas (GHG) emissions resulting from the combustion of fossil fuels. A focus on reducing anthropogenic (human-caused) GHG emissions as quickly as possible in the coming years is the best strategy for limiting the negative impacts that climate change will have on both natural systems and humans.

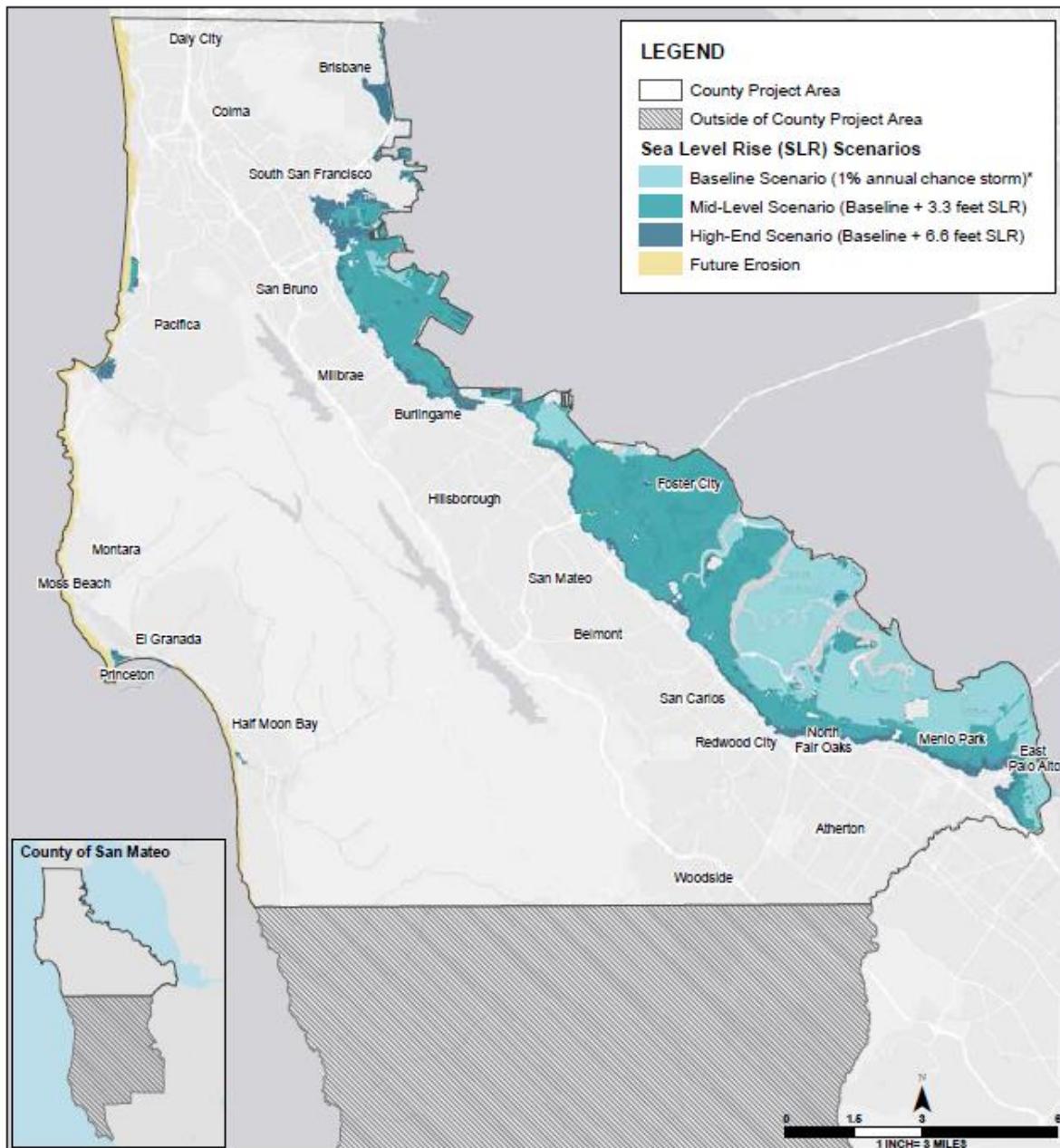
1.1.1 Sea Level Rise

The San Francisco Bay Area is one of the top hotspots for sea level rise in the nation, and the economic value of property located in San Mateo County at risk from sea level rise exceeds that of any other county in the Bay Area. When population projections are taken into account, the County is one of six counties in the nation (and the only one on the west coast) with over 100,000 people living in an area affected by 3 feet of sea level rise. The assessed value of parcels in the project area exposed to near-term (present-day) flooding exceeds \$1 billion, and the assessed value of parcels exposed to erosion and flooding in the long term (50–100 years) totals roughly \$39.1 billion. More than 30,000 residential parcels and 3,000 commercial parcels may also be vulnerable in the long term. In addition, the built and natural infrastructure meant to protect people and properties from flooding could be lost or severely affected - more than 7,000 acres of wetlands (over 80% of all wetlands assessed) and as much as 24 miles of floodwalls and levees.

In addition to directly affecting properties, sea level rise can also have a substantial impact on interdependencies such as travel time and risks to supporting infrastructure. Networked physical infrastructure in the County includes transportation assets, which enable access to goods, services, and evacuation, such as mass transit like BART and Caltrain; major roads (e.g., State Route 1 and Highway 101) and local roads; trails (e.g., the California Coastal Trail and the San Francisco Bay Trail); bus and bicycle routes; and airports. Other networked infrastructure includes utilities, such as power, water, wastewater, and telecommunications, and shoreline infrastructure, including both natural and structural shorelines that protect people, infrastructure, and property from flooding.

Transportation impacts include potential inundation of 70 to 94 miles of highways. Flooding of critical transportation routes such as Highway 101 or State Route 1 can cause significant traffic delays in the County and across the Bay Area region.

Figure 2. Sea Level Rise Scenarios for San Mateo County



In 2018, in response to these concerns, the County of San Mateo finalized a Sea Level Rise Vulnerability Assessment¹ for the Bayshore and coastside Half Moon Bay north, in coordination with cities, agencies, businesses, community groups, and others. The County is now moving forward on a Vulnerability Assessment for the south coast of the County.

1.1.2 Extreme Heat & Storm Events

The climate is already changing. In the fall of 2017, a series of all-time high temperature records were set in San Francisco and Oakland. These extreme heat events overwhelmed the protective and social infrastructure in San Francisco, resulting in 6 deaths and 38 hospitalizations. Heat waves pose increased health risks due to urban heat islands and the lack of local experience and cooling infrastructure (air conditioning) in bayside cities. Elevated nighttime temperatures can be as much as 22°F higher in urban settings. These risks are compounded for low-income communities, with limited resources to invest in air-conditioning and other protective features, and lack of access to community-based cooling centers.

In addition to extreme heat, the Bay Area's largest winter storms will likely become more intense, and potentially more damaging in the coming decades. What is currently considered a 20-year return frequency one-day storm event for the Bay Area would become a once-in-seven-year or more frequent storm. The largest individual storms are becoming more intense with climate change and more frequent "whiplash" events that swing from extremely dry to extremely wet conditions in California could become the new normal.



Additional Resources about Climate Change

- California's 4th Climate Assessment:
<http://www.climateassessment.ca.gov/regions/>
- San Mateo County Sea Level Rise Vulnerability Assessment:
<https://seachangesmc.org/vulnerability-assessment/>
- Cal-Adapt (Resources for how climate change might affect California):
<http://cal-adapt.org/>
- International Panel of Climate Change Fifth Assessment Report:
<https://www.ipcc.ch/report/ar5/>
- U.S. Global Change Research Program:
<http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts>
- Center for Climate and Energy Solutions: <http://www.c2es.org/>

¹ [http://seachangesmc.org/vulnerability-assessment/](https://seachangesmc.org/vulnerability-assessment/)

1.1.3 Public Health

A comprehensive report by the Surgeon General of the United States (U.S. Department of Health and Human Services) documented the need for Americans to become more physically active. A review of studies on the link between physical activity and health status presented in the report concluded that “regular physical activity and higher cardiorespiratory fitness decrease overall mortality rates in a dose-response fashion” and also that “physical activity appears to improve psychological well-being.” Even modest amounts of physical activity, especially for sedentary people, can be beneficial.

Researchers in both public health and urban planning professions have argued that “increasing walking and bicycling as two means of improving health and quality of life represents a shared goal between the fields of public health and urban planning”. Creating more bicycle- and pedestrian-friendly communities will also promote healthier communities. The health effects are amplified if the cycling or pedestrian trip replaces a trip that would otherwise be made by motor vehicle.

In addition, climate change, including increased summer temperatures, can have adverse effects for the health of San Mateo County’s residents and workers, especially the vulnerable populations such as children, seniors, and those with chronic illnesses.

C/CAG intends to work with the County of San Mateo Health System to mitigate public health dangers and maintain or improve long-term health by encouraging local residents and workers to be part of the solution.



C/CAG and the County of San Mateo Health System will support programs that promote more walkable and bikeable cities, which not only promote healthier lifestyles, but also decrease reliance on vehicles that contribute to climate change.

1.2 Charting a Path to 2030 and Beyond

The challenge of addressing climate change has been a priority for San Mateo County.

This Transportation Programs Climate Impact Report identifies how C/CAG's long-range planning documents provide policy and program direction to set the County on the path to meeting State of California's climate goal of 40% below 1990 levels by 2030.

The strategies highlighted in this document demonstrate how C/CAG's San Mateo Countywide Transportation Plan 2040 (SMCTP 2040) reduces emissions associated with reduce vehicle miles traveled (VMT), combined with a targeted focus on zero emission vehicles can result in emissions reductions consistent with California's state requirements for 2030 and beyond. Through its countywide initiatives, C/CAG is supporting its member jurisdictions to meet city-level climate action commitments to state targets, as well.

Senate Bill 32, the California Global Warming Solutions Act of 2006

Emissions Limit

In September of 2016, the California legislature approved Senate Bill (SB) 32, which extends the state's targets for reducing greenhouse gas emissions from 2020 to 2030. Under SB 32, the state will reduce emissions 40 percent below 1990 levels by 2030.

Governor's Executive Order B-30-15

Affirmed by Governor Jerry Brown, the Executive Order set out greenhouse gas reduction targets for the State of California to reduce emissions 80% below 1990 levels by 2050.

C/CAG: A Regional Resource for Climate Action

As a council of governments consisting of the County of San Mateo and its 20 cities, C/CAG has a unique role to address topics countywide such as transportation, air quality, stormwater runoff, hazardous waste, solid waste and recycling, land use near airports, abandoned vehicle abatement, and issues that affect quality of life in general.

C/CAG also provides a forum for the 20 cities and towns, the County of San Mateo, the San Mateo County Transit District, and the San Mateo County Transportation Authority to deliberate on public policy issues that transcend jurisdictional and agency boundaries. This is a key asset, since air and water pollution, as well as the climate effects of greenhouse gas emissions, readily cross these boundaries.

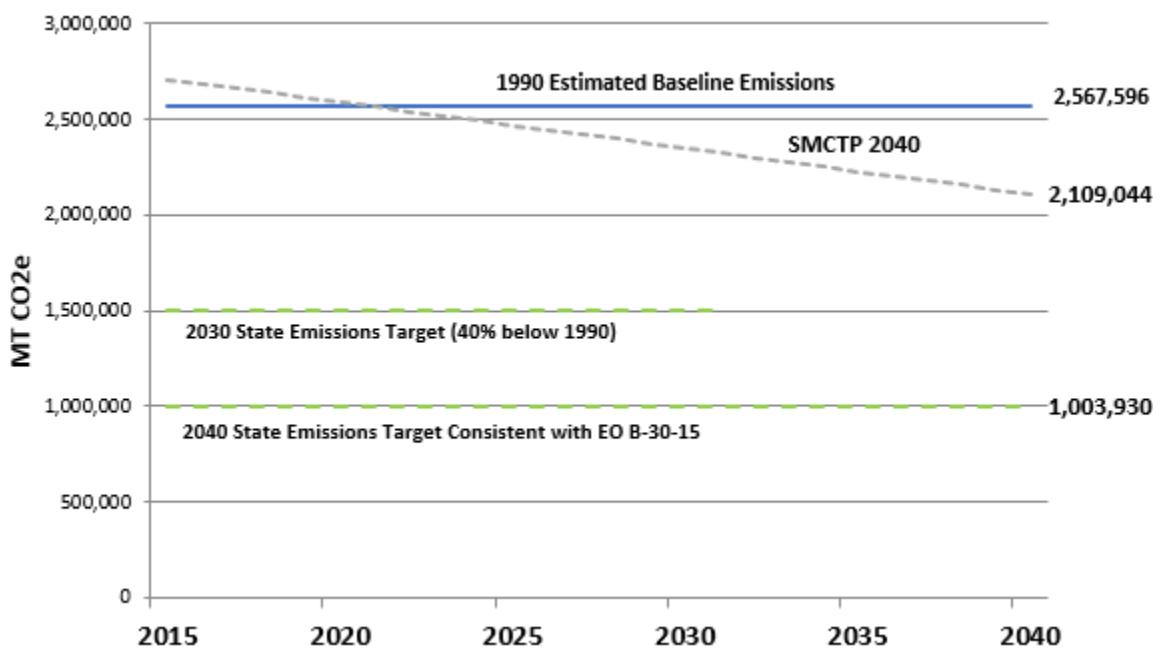


2. Countywide Transportation Emissions

The SMCTP 2040 was adopted in February 2017 and serves as the long-range, comprehensive transportation planning document that sets forth a coordinated planning framework and establishes a systematic transportation planning process for identifying and resolving transportation issues. The SMCTP 2040 is intended to articulate clear transportation planning objectives and policies and to promote consistency and compatibility among all transportation plans and programs within the county. By doing so, SMCTP 2040 supports an integrated, system-wide approach to transportation planning that gives proper consideration to the countywide transportation network as a whole, not just in its constituent parts.

Together with anticipated improvements to vehicle fuel efficiency, the SMCTP 2040 is forecasted to reduce GHG emissions associated with on-road emissions 8% below 1990 levels by 2030 and 18% by 2040. Refer to the Technical Appendix for calculations, data sources and methodologies utilized to estimate GHG emissions associated with transportation sector related to the SMCTP 2040. As seen in Figure 3 below, while these are notable achievements, the emissions trajectory associated with the SMCTP 2040 falls short of state targets. Therefore, this report also examines how increasing the adoption rate of alternatively fueled zero emission vehicles can help close the gap to the state's emissions target, along with additional focus on strategies to reduce VMT.

Figure 3. Countywide On-Road Transportation Greenhouse Gas Emissions and Reduction Goals²



The 2015 and 2040 GHG emissions associated with the SMCTP 2040 utilize vehicle-miles traveled (VMT) estimates from C/CAG's travel demand model, and are back casted utilizing the Metropolitan Transportation Commission (MTC) regional travel demand model. Countywide emissions associated with the transportation sector are estimated to have increased since 1990. With improved fuel efficiency standards, however, emissions are forecasted to decrease going forward, despite a forecasted increase in VMT as described below.

2.1 Inventory Sources and Data Collection Process

An inventory of GHG emissions requires the collection of information (data) from a variety of sectors and sources. The transportation-related emissions inventory completed for C/CAG utilizes modeled VMT impacts associated with both the existing conditions in 2015, and in the build-out scenario of 2040.

As shown in Figure 4, the SMCTP 2040 projects an increase in VMT overall, due to increased population and jobs. The VMT estimates for 2015 and 2040 are derived from the C/CAG-VTA travel demand model, accounting for infrastructure projects planned in the SMCTP 2040.

² Note that the SMCTP 2040 provides estimated vehicle-miles traveled (VMT) for the existing conditions in 2015 and for build-out in 2040. The corresponding 1990 emissions baseline is estimated based on regional VMT trends as modeled by MTC and with guidance from State of California.

While VMT is expected to increase, the overall emissions are expected to decrease by 2040 due to significant improvements in vehicle efficiency related to California's clean car standards.

Figure 4. Summary of SMCTP 2040 Assumptions

	2015	2040	Data Source
Annual VMT	6,161,994,000	7,463,578,000	C/CAG-VTA travel demand model
Gasoline vehicle efficiency (miles per gallon)	9.81	17.62	CARB EMFAC2017 (v1.0.2)
Diesel vehicle efficiency (miles per gallon)	23.13	34.89	CARB EMFAC2017 (v1.0.2)
Electric vehicle % of vehicle fleet	0.7%	4.5%	CARB EMFAC2017 (v1.0.2)
Projected Countywide GHG emissions (MTCO₂e)	2,711,700	2,109,000	Calculated by DNVGL

Data related to vehicle efficiency is sourced from the California Air Resources Board's EMFAC 2017 model of motor vehicle travel activities and associated emissions levels for San Mateo County. As shown above, the EMFAC 2017 model utilizes a very conservative estimate of 4.5% electric vehicle adoption rate for 2040. As of January 2018, approximately 2% of vehicles registered in San Mateo County were all-electric or plug-in hybrid electric vehicles³.

2.2 Meeting the State Climate Targets

The SMCTP 2040 sets a path forward for coordinating transportation planning and programming in San Mateo County across a multitude of agencies to offer practical travel choices, enhanced public health and inter-jurisdiction cooperation to manage vehicle-miles traveled. In addition to the SMCTP 2040, the Alternative Fuel Readiness Plan for San Mateo County (AFRP) also provides guidance to local jurisdictions on increasing the adoption of alternative fuel vehicles.

To address the projected increase in VMT, C/CAG and its member agencies will need to explore opportunities to expand adoption of electric vehicles and other alternative fuel vehicles above and beyond state projections.

C/CAG is committing to reducing countywide greenhouse gas emissions related to transportation 40% percent below 1990 levels by 2030

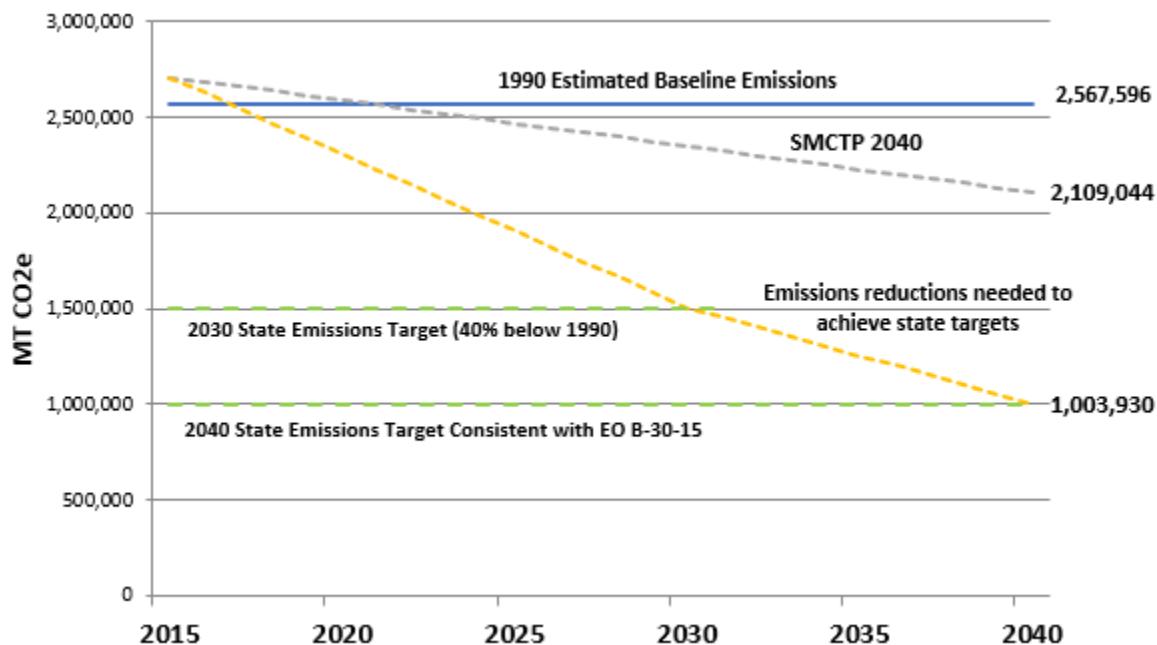
³ Source: Department of Motor Vehicles. Vehicle registration data for San Mateo County (January 2018)

Figures 4 and 5 show the necessary penetration of zero emission vehicles given a straight-line projection of SMCTP 2040 impacts on VMT for 2030 and 2040, and the associated emissions pathway to meeting the state climate targets. Approximately 45% of on-road vehicles must be electric or zero emissions by 2030, ratcheting up to 60% by 2040. In comparison, approximately 2% of registered vehicles in San Mateo County in 2018 are plug-in electric.

Figure 5. Alternative Fuel Vehicle Penetration Needed to Achieve State Climate Goals

	2030	2040
Electric vehicle percentage of fleet	45%	60%

Figure 6. C/CAG Transportation Climate Plan Pathway to State Targets



This report builds on the leadership of C/CAG as a regional convener for sustainability programs countywide related to transportation and mobility. The analysis shows that a high target for zero emission vehicles is needed to achieve the state's climate target, assuming the modeled VMT impacts for 2040. However, significant opportunity is not being captured to reduce VMTs through alternative transportation modes and reimagining the built environment for non-vehicle modes of transportation. These must be considered and balanced with the need for more electric vehicles and other zero emission vehicle technologies.

The following chapter provides an overview of how C/CAG's transportation programs – through the SMCTP 2040, AFRP and other planning documents – align with the state's ambitious

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climate targets and supports a vibrant San Mateo County with connected people, places, and products.



3. Transportation Climate Action Strategies

The SMCTP 2040 identifies an overarching vision to “provide an economically, environmentally, and socially sustainable transportation system that offers practical travel choices, enhances public health through changes in the built environment, and fosters inter-jurisdictional cooperation.” The following visions, goals, and objectives are taken from the SMCTP 2040.

In this section, the countywide objectives related to GHG emissions reduction programs and policies that will put San Mateo County on the path to meeting state requirements for emissions reductions by 2030 and 2040 are explained.

3.1 Land Use

Vision: A San Mateo County transportation system that is safe and convenient for all people whether travelling on foot, by bicycle, via public transportation, or in an automobile, to reach places they wish to go.

Goal: Integrate transportation and land use plans and decisions in support of a more livable and sustainable San Mateo County.

3.1.1 Reducing Emissions

Much of San Mateo County is characterized by comparatively low land use densities and separation of land uses. The prevailing pattern of low-density land development supports dependence on the automobile and makes transportation by alternative travel modes, like public transit, bicycling, or walking in some areas infeasible or unsafe. Changes in land use patterns can encourage the use of alternative travel modes and may decrease traffic congestion and overall vehicle miles travelled.

Increasing density results in decreased auto use and increased use of alternative transportation modes. In general, as densities increase, people need to travel shorter distances to reach their destinations, and are more likely to choose transportation modes other than automobiles. Higher densities improve the viability of transit as increases in ridership allow for improved

public transportation service levels. Locating higher-density development near transit stations and along major bus transit corridors, such as Caltrain and BART systems, can reduce congestion and increase transit trips. The research indicates that people who live within walking distance of a transit station are much more likely to use transit, and locating employment centers within close proximity to regional rail stations increases the likelihood of employees commuting via public transportation.

Another effective way to reduce dependence on the automobile is by promoting a mix of land uses. Encouraging mixed-use development can reduce VMT and increase transit and pedestrian trips. Greater land use mixture can be achieved through 1) adding housing in commercial areas, particularly along transit stations, major bus transit service corridors, and in existing downtown areas and 2) creating new zoning frameworks that do not prescribe land uses but do establish clear design standards for new development.

Lastly, the County must actively work to promote geographic areas that have a housing supply that meets the needs of its workers. The current imbalance in housing prices and worker incomes has contributed to some of the highest levels of in- and out-commuting and increased traffic congestion in the Bay Area; achieving a better balance may yield transportation benefits. To promote a jobs and housing balance as the County grows, it is recommended that the cities of San Mateo County continue to encourage production of housing units at a variety of prices to accommodate more workers who wish to live close to their jobs. In relation to housing developments, automobile use can be discouraged through the project approval process by requiring developers to adhere to site design standards that promote alternative modes of transportation.

3.1.2 Land Use Objectives and Goals

Progress toward improvement of the land use and transportation linkage in San Mateo County requires a planned approach. Specific objectives and an associated set of performance measures are needed to chart the amount and pace of progress toward achievement of policies, goals, and vision.

LAND USE	
Objective	Goal
1. Develop a “Multimodal Connection Program”	Enhance the "Multimodal Connections" Program included in San Mateo County's portion of the MTC's Transportation for Livable Communities Program, as measured in the number of projects funded and implemented.

	House 100% of the region's projected growth by income level without displacing current low-income residents and with no increase in in-commuters over the Plan baseline year (Plan Bay Area 2040).
2. Implement the Grand Boulevard Initiative	Implement the Grand Boulevard Initiative vision of transit-oriented development along the El Camino Real Corridor in proximity to Caltrain, BART, and prospective bus rapid transit stations. Performance shall be measured in monies for enhanced C/CAG ECR Incentive Program, the number of Smart Growth projects, and the number of housing units.
3. Increase housing and affordable housing supplies near transit-rich areas	<p>Enhance the Housing Incentive Program, as measured in the number of projects, number of housing units, and amount of funding.</p> <p>Decrease the share of lower-income residents' household income consumed by transportation and housing by 10% (Plan Bay Area 2040):</p> <ul style="list-style-type: none"> • Increase the share of affordable housing in PDAs, TPAs, or high-opportunity areas by 15% (Plan Bay Area 2040) • Do not increase the share of low- and moderate-income renter households in PDAs, TPAs, or high-opportunity areas that are at risk for displacement (Plan Bay Area 2040)
4. Revise and Enhance the TDM guidelines	<p>C/CAG will revise and enhance the Transportation Demand Management (TDM) guidelines.</p> <p>Increase by 20% the share of jobs accessible within 30 minutes by auto or within 45 minutes by transit in congested conditions (Plan Bay Area 2040):</p> <ul style="list-style-type: none"> • Increase by 38% the number of jobs in predominately middle-wage industries (Plan Bay Area 2040)

3.2 Bicycles

Vision: A San Mateo County in which bicycling for both transportation and recreation is safe, comfortable, and convenient.

Goal: Provide people with viable travel choices and encourage use of healthy, active transportation through a safe, continuous, convenient and comprehensive bicycling network that reduces reliance on the automobile for short trips.

3.2.1 Reducing Emissions

Bicycling has the greatest untapped potential of any travel mode in the United States, with only about 2% of local travel made by bicycle. Bicycling is one of the most cost-effective, cleanest ways of reducing automobile use in San Mateo County. The bicycle emits no air pollution, is virtually silent, and is both energy-efficient and space efficient. Bicycles offer other considerable personal and social benefits over automobile use, including substantially lower acquisition and maintenance costs, as well as health benefits. As such, bicycling is a viable and attractive alternative to the automobile, particularly in areas that are not well served by public transit.

Safety has been noted as a main priority for the protection of current cyclists, and the encouragement of future cyclists. C/CAG will promote collaboration among the Sheriff's Office, local police departments, and other county and local agencies to develop and administer effective safety, education, and enforcement strategies related to bicycling. Additionally, C/CAG will provide support for programs that educate drivers and bicyclists about their rights and responsibilities with regards to sharing the road. Finally, C/CAG will ensure data on traffic collisions involving cyclists is shared with local agencies to assist in identifying and remedying problem locations.

3.2.2 Bicycle Objectives and Goals

Progress toward improving cycling conditions in San Mateo County requires a planned approach. Specific objectives and an associated set of performance measures are needed to chart the amount and pace of progress toward achievement of policies, goals, and vision, as explained in the table below. New forms of transportation to consider that are associated with bicycle may include scooters and motorized devices such as motorized bicycle as well as motorized scooters, which are typically operated on a bicycle path, trail or bikeway, but not on a sidewalk.

BICYCLES	
Objective	Goal
1. Increase Number of Miles of Bicycle Facilities	Increase the number of miles of Class I, II, III, and IV bikeways as part of a comprehensive network of bicycle facilities in San Mateo County, as measured in the number of miles of Class I, II, III, and IV bicycle facilities added.
2. Increase Number of Racks of Bicycle Lockers and Racks	Increase the number of bicycle lockers and racks in San Mateo County, as measured in the number of bicycle lockers and racks added.
3. Increase Bicycle Safety Education and Training	Increase bicycle safety education and training in San Mateo County, as measured in the number of bicycle safety education programs participants.
4. Establish Bike Sharing Programs	Establish bike sharing programs in San Mateo County, as measured by the number of bicycle sharing programs and number of bicycles.
5. Increase the Bicycle Market Share	Increase the bicycle market share in San Mateo County, such that there is a 5% increase in biking (all trips), and a 3% increase for work commutes in 2040. ⁴

3.3 Pedestrians

Vision: A San Mateo County in which walking for both active transportation and recreation is safe, comfortable, and convenient.

Goal: Promote safe, convenient, and attractive pedestrian travel that promotes healthy, active communities while reducing reliance on the automobile for short trips.

3.3.1 Reducing Emissions

The extent of walking diminished as automobiles became widespread and that subsequently had significant impacts on urban design starting in the mid-20th century. Stores were moved back from the street to make room for parking, sidewalks were narrowed to increase roadway capacity, and homes were oriented around the garage instead of the street front. Yet walking holds great promise as an alternative to short automobile trips in San Mateo County. Mild year-

⁴ Approximately 2.4% of work trips are currently by bicycle.

round climate, relatively flat urban terrain, and a strong environmentally and health conscious resident culture suggest an opportunity to increase pedestrian trips in the County.

Sidewalks are the staple element of the pedestrian infrastructure. Therefore, crossing signals, marked crosswalks, and signs alerting automobiles of the presence of pedestrians are ancillary parts of the pedestrian infrastructure. This is especially critical in school sites, since many students commuting on foot or by bicycle are required to cross streets in order to reach their campus. Land use also has a major influence on use of the pedestrian networks; designing safe, walkable communities encourages pedestrian travel and reduces automobile use.

3.3.2 Pedestrian Objectives and Goals

Progress toward improvement of the pedestrian environment in San Mateo County requires a planned approach. Specific objectives and an associated set of performance measures are needed to chart the amount and pace of progress toward achievement of policies, goals, and vision.

PEDESTRIANS	
Objective	Goal
1. Increase the number of pedestrian signals	Increase the number of pedestrian signal heads, countdown signals and accessible pedestrian push buttons in San Mateo County; measured by the number of pedestrian signal heads added.
2. Increase the number of safe intersections	Increase the number of intersections with enhanced treatments for pedestrian safety and comfort, such as raised center medians, in-pavement lights, pedestrian-activated crossing signals, and raised crosswalks appropriate to the location; measured in the number of intersections with enhanced pedestrian treatment.
3. Increase the sidewalk network	Increase the sidewalk network in San Mateo County, where supported locally, by closing gaps, restoring deteriorated sidewalks, adding accessible curb ramps and providing adequate maintenance; measured by the amount of linear feet of sidewalk added.
4. Increase the pedestrian market share	Increase the pedestrian market share in San Mateo County; measured in the percent of people walking for all trip purposes.
5. Increase walking for	Increase walking for all trip purposes in San Mateo County, with

all trip purposes	a goal of 15% increase in all trips, and a 5% increase in work trips in 2040. ⁵
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3.4 Public Transportation

Vision: A public transportation system in San Mateo County that provides essential mobility for all, offers a competitive alternative to the automobile, and contributes to environmental and socio-economic well-being.

Goal: Develop and maintain a seamless, safe and convenient public transportation system in San Mateo County.

3.4.1 Reducing Emissions

Public transportation is an important component of the mobility and accessibility strategies of urban areas; particularly, those experiencing substantial traffic congestion. Public transportation has a variety of roles in San Mateo County and other urban areas. Transit service quality factors include the following: coverage, comfort, travel time, reliability, convenience and courtesy. When any one or more of these factors do not meet the needs of a traveler, they will turn to another transportation source, which may likely be the automobile. The Bay Area Rapid Transit District (BART) system is the only electrified transit system, and therefore is an opportunity to reduce GHG emissions. However, BART has current network capacity constraints, and further capital investment is needed to meet its full potential at increasing public ridership. Increasing CalTrain and SamTrans penetration also can reduce single ridership of automobiles, but operate on diesel and natural gas, respectively, and emit greenhouse gases. Improving efficiencies can contribute to reduced impacts of GHG emissions.

3.4.2 Public Transportation Objectives and Goals

Progress toward making the public transit system as effective and efficient as possible in San Mateo County requires a planned approach. Specific objectives and an associated set of performance measures are needed to chart the amount and pace of progress toward achievement of policies, goals, and vision.

⁵ Approximately 9% of all person trips within or out of San Mateo County were on foot, compared with 2.5% of employees traveling to work.

PUBLIC TRANSPORTATION	
Objective	Goal
1. Improve the competitiveness of public transit	<p>Improve the competitiveness of public transit relative to private transportation for key trips as measured by travel time, reliability and customer satisfaction.</p> <p>Increase weekday fixed-route ridership by 15% (SamTrans Strategic Plan 2015-2019)</p> <ul style="list-style-type: none"> • Enhance fixed-route service in core markets with denser populations and job centers • Consider a timed-transfer pulse system at key transfer points within limited headways from one or more routes • Explore amenities such as WiFi on buses that could attract commuters, students, and others who have longer trips
2. Lower costs	Lower the cost per passenger, mile and hour for the aggregate of public transit service in the county, discounting for inflation; measured in transit costs per passenger, mile and hour.
3. Improve productivity	Improve system productivity as measured by passengers per hour and passengers per mile of service provided
4. Increase the public transit mode share	Increase the public transit mode share of travel to, from and within San Mateo County over both a ten-year and twenty-five year horizon, with a goal of 7.55% increase in public transportation in all trips, and a 15% increase in work trips in 2040. ⁶

3.5 Transportation System Management and ITS

Vision: A San Mateo County in which the transportation system is safe, efficient, cost-effective, and environmentally responsible.

Goal: Manage travel efficiently through supply-side measures, including low-cost traffic operations improvements and use of technologies that reduce or eliminate the need for increases in physical capacity.

⁶ Approximately 4% of all trips within and out of San Mateo County are by transit, compared with 9% of work trips.

3.5.1 Reducing Emissions

Transportation Systems Management and Operations (TSM) and Intelligent Transportation Systems (ITS) focus on efficiency improvements to existing transportation infrastructure rather than major investments in system capacity. TSM not only provides interim solutions to system capacity problems, it can be a continuous approach to optimizing available capacity anywhere in the transportation system. In fulfilling this role, TSM can contribute to “right-sizing” transportation facilities and potentially reduce transportation’s fiscal, social, and environmental impacts.

3.5.2 Transportation System Management and ITS Objectives and Goals

The 2005 ITS Strategic Plan for San Mateo County provides a good framework for ITS deployment. The San Mateo County Congestion Relief Plan commits seed funding annually for ITS projects. C/CAG will work with the San Mateo County Transportation Authority (SMCTA), the Metropolitan Transportation Commission (MTC), and the California Transportation Commission (CTC) to develop funding for ITS deployment.

TRANSPORTATION SYSTEM MANAGEMENT AND ITS	
Objective	Goal
1. Increase public transit traffic signal pre-emption intersections	Increase the number of intersections in San Mateo County equipped with public transit traffic signal pre-emption; measured by the number of corridors with traffic signal pre-emption.
2. Increase number of public transit stops/stations with real-time transit service information.	Increase the number of public transit stops and stations in San Mateo County equipped with real-time transit service information; measured in number of public transit stops & stations with real-time transit service information.

3.6 Transportation Demand Management

Vision: A San Mateo County in which reliance on solo occupant motor vehicle travel is minimized.

Goal: Reduce and manage travel efficiently through demand-side measures, including land use planning and transportation demand management efforts at work sites.

3.6.1 Reducing Emissions

Transportation Demand Management (TDM) is focused on influencing travel behavior as well as informing travelers about available mobility choices with the aim to reduce traffic congestion and associated air emissions. Representative TDM measures that can help the County reduce transportation emissions include various aspects from other noted transportation climate action strategies, such as vanpool subsidies, bicycle parking, telecommuting, and demand-based bridge and road pricing. In San Mateo County, Commute.org, which offers a wide array of commuter incentives, provides Countywide TDM services to both employers and employees. Commute.org sponsors carpool matching, carpool and vanpool incentives, commuter shuttles, bicycle parking subsidies, bicycle and pedestrian safety workshops, and more.

3.6.2 Transportation Demand Management Objectives and Goals

Success in managing transportation demand in San Mateo County requires a planned approach. Specific objectives and an associated set of performance measures are needed to chart the amount and pace of progress toward achievement of policies, goals, and vision. C/CAG is currently updating its Land Use Impact Analysis Program to reflect current Transportation Demand Management (TDM) strategies and programs that increase the efficiency of the transportation system through alternative modes of travel. The update will be incorporated into the 2019 Congestion Management Plan (CMP).

TRANSPORTATION DEMAND MANAGEMENT	
Objective	Goal
1. Increase access to a commute alternatives program at work	Increase the number of employers and employees within the geographic limits of San Mateo County who have access to a commute alternatives program at work; measured in number of commute alternatives programs and number of participants using these programs.
2. Increase telecommuting participation	Increase the participation in telecommuting by employees who work in San Mateo County; measured in number of employees who telecommute.
3. Expand participation in the commuter pre-tax benefit program	Expand participation in the commuter pre-tax benefit program in San Mateo County; measured in number of employees participating.

3.7 Parking

Vision: Parking in San Mateo County that is a "right-sized" balance of supply and demand, supportive of Transit Oriented Development, and Sustainable Communities Strategies, intuitive to use, and environmentally responsible.

Goal: Encourage innovations in parking policy and programs, including incentives for reduced parking requirements, and a comprehensive approach to parking management and pricing.

3.7.1 Reducing Emissions

Parking has come to the forefront as a potential tool for transportation demand management. For example, Redwood City has been a pioneer in California and the nation in implementing a downtown parking management plan that combines differential parking prices and "smart" parking meters. Setting parking prices so that the more desirable spaces cost more to use, can increase turnover and reduce the searching done by motorists seeking a parking space. To be most effective, parking management plans should address the complete access trip to destinations. This may include the walk trip after parking, as well as shuttle bus connections between the parking facility and the destination. To have a substantive effect on reducing VMT, C/CAG can and should encourage parking management plans, appropriate revisions to zoning code parking requirements, and investment in new parking technologies.

3.7.2 Parking Objectives and Goals

Optimizing the parking system in San Mateo County requires a planned approach. Specific objectives and an associated set of performance measures are needed to chart the amount and pace of progress toward achievement of policies, goals, and vision.

PARKING	
Objective	Goal
1. Reduce parking requirements	Increase the number of San Mateo County communities that reduce parking requirements in the case of affordable housing projects, transit-oriented development, and proposed shared-parking arrangements; measured in number of communities with reduced parking requirements.
2. Increase parking facility solar installations	Increase the number of solar panel installations on top of parking facilities in San Mateo County; measured in number of solar installation projects.

3. Increase the number of bicycle lockers and racks	Increase the number of bicycle lockers and racks at offices, shops, stores, parking lots and structures, and transit stations in San Mateo County; measured in number of bicycle racks and lockers.
4. Provide incentives for standards reform	Provide C/CAG incentives for parking standards reform; measured in adoption of such Incentive Program, the number of projects, and the amount of funding.

3.8 Modal Connectivity

Vision: Seamless travel within San Mateo County using different modes of transportation.

Goal: Integrate the roadway, public transit, and non-motorized transportation networks to advance system efficiency, effectiveness, and convenience.

3.8.1 Reducing Emissions

An important success factor for multimodal transportation is that it links the various travel modes together as seamlessly as possible, which can in turn help reduce overall transportation emissions. Seamless connections are facilitated by integration of transit service schedules, electronic fare payment usable across transit modes, bicycle storage on buses or in trains, convenient pedestrian and bicycle access to transit stations and stops, and “right-sized” car parking at rail passenger stations. Encouraging clean, efficient intermodal travel by making access to public transit stations safe, convenient, and comfortable will promote more pedestrians and bicyclists and less automobile use.

3.8.2 Modal Connectivity Objectives and Goals

Enhancing intermodal connections in San Mateo County requires a planned approach. Specific objectives and an associated set of performance measures are needed to chart the amount and pace of progress toward achievement of policies, goals, and vision.

MODAL CONNECTIVITY	
Objective	Goal
1. Improve intermodal travel information dissemination	Improve intermodal travel information dissemination to San Mateo County transportation system users; measured in survey results ratings.

2. Increase the number of intermodal transit service hubs	Increase the number of intermodal transit service hubs; measured in the number of hubs.
3. Implement bicycle and pedestrian access improvements	Implement bicycle and pedestrian access improvements at public transit stations and stops in San Mateo County; measured in number of improvement projects.
4. Enhance connecting shuttle bus services	Enhance shuttle bus services connecting work sites and public transit stations and stops; measured in the number of shuttle bus service hours.

3.9 Clean Vehicles

Vision: Wholly decarbonized transportation system in which people choose to walk, bicycle, and take public transit and when driving, choose electric vehicles and other zero emission vehicles

Goal: Support alternative fuels and electric vehicles as a priority for on-road vehicles and shuttles and other last-mile solutions such as e-bikes, e-scooters, bike sharing, and ride-sharing to meet the needs of diverse communities throughout San Mateo County.

3.9.1 Reducing Emissions

Transportation is the source of approximately 55% of GHG emissions in San Mateo County.⁷ Alternative fuel vehicles (AFVs) offer an important option for reducing GHG emissions. Alternative fuels allow for the continued convenience of personal vehicles, buses, and trucks, while reducing the environmental impacts from motorized transportation. The most common alternative fuels include electricity, hydrogen, compressed natural gas, liquefied natural gas, liquefied petroleum gas, ethanol, biodiesel, and renewable diesel. Using these fuels instead of conventional fuels helps to reduce petroleum use, air pollution, and GHG emissions.

To support alternative fuels, including electric vehicles, C/CAG will adopt strategies laid out in the “Alternative Fuel Readiness Plan” for San Mateo County in order enable the uptake of alternative fuels vehicles in the region. Many statewide and national incentives exist for alternative fuel vehicles. The Alternative and Renewable Fuel and Vehicle Technology Program (ARFVTP) provides \$100 million annually in support of projects that assist in planning and deployment of alternative fuel vehicles and infrastructure. The Clean Vehicle Rebate Program

⁷ San Mateo County 2015 Greenhouse Gas Inventory (County Office of Sustainability, DNV GL)

(CVRP) has already been heavily leveraged in San Mateo County, with County residents receiving \$14 million in rebates through the program to date. C/CAG will continue to leverage funding and apply for grant funding that will help the County achieve its goal of decreasing transportation emissions through the promotion of alternative fuels.

Additionally, electrification of other last-mile solutions related to e-bikes, bike sharing, scooters and ride-sharing would further support an integrated transportation approach that makes it easier and more convenient to travel by non-vehicular modes.

3.9.2 Clean Vehicles Objectives and Goals

San Mateo County will experience significant growth in alternative fuel demand in the years to come. Jurisdictions will be far more prepared for this increase in alternative fuels if they consider possible new requirements and potential impacts in advance. Understanding the current state of alternative fuels in California, what role governments play in their integration, and assessing the local influx of alternative fuels in the future will be crucial to driving societal norms towards a cleaner fuel economy. With this knowledge, jurisdictions can collaborate to develop siting and zoning plans that ensure sufficient coverage of each fuel, and communicate these plans and this knowledge to residents, investors, and the community at large. Specific objectives and an associated set of performance measures are needed to chart the amount and pace of progress toward achievement of policies, goals, and vision.

CLEAN VEHICLES	
Objective	Goal
1. Educate and train government staff	Review guidelines for streamlined permitting; adopt and become familiar with existing standards for alternative fuel infrastructure; review California's Title 24 Green Building Code; and review signage requirements for refueling stations and parking spots.
2. Implement public outreach and marketing strategies	Create a webpage on city or county websites with information and useful resources about alternative fuels; organize community events, demonstrations and workshops; hold educational events at K-12 schools; and distribute brochures at relevant gatherings.
3. Introduce initiatives to increase alternative fuel use	Coordinate aggregate purchase orders with other agencies; identify funding opportunities from BAAQMD, CARB, CEC, DOE, etc. for building infrastructure, purchasing new fleets and converting existing fleets; perform environmental cost benefit analyses for different AFV options; include green procurement

	requirements in contracting evaluation.
4. Explore public-private partnership opportunities	Build refueling stations on public land and outsource construction and maintenance to a private company; Purchase or lease fleet vehicles from a retailer who can capture the federal tax incentive for PEVs and pass on the savings; explore options for converting potential feedstocks into alternative fuels for use in vehicles; the sale of LCFS credits can help to offset the cost of building infrastructure; consider partnering with companies that can fund infrastructure development through the sale of advertising space.



4. Next Steps

As described above, C/CAG has already adopted numerous strategies for reducing vehicle-miles traveled, and supporting multimodal transportation choices to connect to regional transportation systems and destinations. However, more work is needed to ensure the implementation of the SMCTP 2040 and to strengthen policies and programs related to clean vehicles, such as electric vehicles.



5. Conclusion

C/CAG is focused on creating a safe, interconnected, vibrant, affordable, and innovative region for all - residents, local businesses and visitors alike. We recognize that climate change is a global problem and only through local solutions designed to meet the needs of our County can we mitigate and adapt to its impacts and protect the environment. C/CAG has numerous transportation planning documents and initiatives identified in this report that will result in emissions reductions.

Through its existing planning efforts, C/CAG is serving to connect multitude of agencies with sometimes overlapping jurisdictions and responsibilities, including the County and the twenty cities within its boundaries that each plan and implement transportation improvements within their own jurisdictions. This report identifies that while C/CAG's policies and programs are forecasted to significantly reduce emissions, additional action is needed to meet the state's climate targets, including supporting the transition to clean vehicles.

As identified in this Transportation Programs Climate Impact Report, C/CAG will continue to articulate clear policy goals and objectives to foster optimal performance of the County's transportation network and effectiveness of new transportation investments to do our part to achieve climate targets in service of a healthier, safer and high quality of life throughout the region.

Transportation Programs Climate Impact Report

Technical Appendix

City/County Association of Governments of San Mateo County

January 2019

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1 INTRODUCTION

This Transportation Programs Climate Impact Report identifies C/CAG's long-range planning documents and provides policy and program direction for all transportation plans in the County to meet the State of California's climate goal of 40% below 1990 levels by 2030.

In order to provide recommendations, DNV GL analyzed the projected emissions impact of C/CAG's recently adopted San Mateo Countywide Transportation Plan 2040 (SMCTP 2040). In this Technical Appendix, we document the calculations, data sources and methodologies utilized to estimate greenhouse gas (GHG) emissions associated with the transportation sector related to the SMCTP 2040. We also document the assumptions and approach for estimating the penetration of zero emission vehicles needed to meet the State of California's climate targets.

In the report, DNV GL assessed how close the SMCTP 2040 was to meeting the following two California climate targets:

- SB 32 sets into law to require a statewide reduction in GHG emissions to 40% below 1990 levels by 2030
- Executive Order S-3-05 was signed by Governor Schwarzenegger and extended by Governor Brown to establishing a statewide GHG emissions target of 80% below 1990 levels by 2050

Therefore, the basic methodology is to evaluate the projected GHG emissions associated with the SMCTP 2040 relative to the baseline year of 1990. A 2040 emissions target is calculated by interpolating the state's goals for 2030 and 2050.

2 ESTIMATING BASELINE EMISSIONS

In general, there is limited data available at the local level for energy consumption and emissions back to the 1990 base year. Therefore, most jurisdictions are utilizing 2005 as the base year, based on guidance from California Air Resources Board (CARB) and Office of Planning and Research (OPR), utilizing a rule-of-thumb that 15% below 2005 levels is equivalent to 1990 levels.

Therefore, the calculations in the report are based on 2005 VMT baseline estimates. The methodology for estimating emissions associated with the transportation sector utilizes the U.S. Community GHG Protocol and Global Protocol for Community GHG Emissions.

$$\text{GHG Emissions (MTCO}_2\text{e)} = \text{Countywide VMT} \times \text{Emissions Factor (MTCO}_2\text{e/VMT)}$$

In order to estimate the County's compliance with state requirements, a VMT and emissions factor was needed for 2005, 2030 and 2040.

2.1 Countywide VMT Data

C/CAG licenses the San Mateo Countywide travel demand model from the Santa Clara Valley Transportation Authority (VTA), which maintains a travel demand model that is optimized for the counties of Santa Clara and San Mateo and accounts for transportation impacts from neighboring counties and regional commute sheds. The C/CAG-VTA Model is a four-step travel demand model implemented in Citilabs Cube Voyager software that is based on the BAYCAST-90 travel forecasting system used by the Metropolitan Transportation Commission (MTC)¹.

The C/CAG-VTA model is utilized to provide VMT associated with the baseline year of 2015 and the build-out year of 2040 associated with SMCTP. Table 1 summarizes the data output for 2015 and 2040 VMT from the C/CAG-VTA model.

Table 1. C/CAG–VTA Model: Data Outputs and Total VMT

Description	2015	2040
AM 4-Hr Peak Period	4,056,511	4,850,352
PM 4-Hr Peak Period	5,189,961	6,284,599
Midday 6-Hour Period	5,607,131	6,928,803
Night 10-Hour Period	2,904,305	3,445,117
Daily Total	17,757,908	21,508,871
Annualization Factor	347	347
Total Annual VMT	6,161,994,076	7,463,578,237

The C/CAG-VTA model did not provide VMT estimates associated with 2005. Therefore, MTC modeled VMT data for County of San Mateo was utilized to backcast VMT to 2005, by utilizing the ratio of 2005 to 2015 (0.965) increase in total VMT in the MTC model and applied to the C/CAG-VTA data.

¹ <http://ccag.ca.gov/programs/travel-demand-model/>



Table 2 below summarizes the raw data received from MTC related to non-commercial VMT.

Table 2. MTC Model: Non-Commercial VMT

Description	2005	2015	2040
Entirely In Daily VMT	5,303,847	5,446,550	6,332,942
Partially In Daily VMT	13,001,816	13,560,909	15,759,430
Annualization Factor	346.7	346.7	346.7
Entirely In Annual VMT	1,839,098,208	1,888,580,184	2,195,934,815
Partially In Annual VMT	4,508,353,372	4,702,217,737	5,464,550,442
Total Non-Commercial Annual VMT	4,093,274,894	4,239,689,053	4,928,210,037
Ratio of 2005 / 2015 VMT	0.965		

Applying the ratio to the C/CAG-VTA 2015 VMT = 6,161,994,076 (2015 C/CAG-VTA VMT) x 0.965 = 5,949,194,701 VMT estimated for 2005 consistent with the C/CAG-VTA model

2.2 Countywide Emissions Factor for Transportation Sector

In order to calculate emissions, the countywide VMT is further broken out by fuel usage. DNV GL utilized the CARB EMFAC2017² representing the current understanding of motor vehicle travel activities and their associated emission levels.

The EMFAC2017 database provides county-specific and year-specific VMT, fuel consumption and CO₂ emissions associated with specific vehicle categories. The data is aggregated for total diesel (DSL), electricity (ELEC) and gasoline (GAS) consumption by county and by year.

² <https://www.arb.ca.gov/msei/categories.htm>

Table 3, Table 4 and Table 5 below summarize the analysis for San Mateo County, which is based on a summation of EMFAC2017 data based on vehicle type and fuel type. The percent of total VMT associated with each fuel type, total emissions, emissions rate and miles per gallon are calculated.

Table 3. EMFAC2017 Calculations for 2005 (San Mateo County)

Vehicle Type	VMT / Day	% Total VMT	Fuel Consumption (Gallons/Day)	Emissions (MT CO ₂)	Emissions Rate (MTCO ₂ /Gallon)	MPG
	Summation	Calc	Summation	Calc	Calc	Calc
DSL	575,000	4%	69,747	785	0.011	8.24
ELEC	4,199	0%	0	0	0	0
GAS	14,719,982	96%	709,752	6,808	0.010	20.74
TOTAL	15,299,181	100%		7,593		

Table 4. EMFAC2017 Calculations for 2015 (San Mateo County)

Vehicle Type	VMT / Day	% Total VMT	Fuel Consumption (Gallons/ Day)	Emissions (MT CO ₂)	Emissions Rate (MTCO ₂ /Gallon)	MPG
DSL	668,523	4%	68,117	764	0.011	9.81
ELEC	123,459	1%	0	0		
GAS	16,114,539	95%	696,598	6,600	0.009	23.13
TOTAL	16,906,521	100%		7,364		

Table 5. EMFAC2017 Calculations for 2040 (San Mateo County)

Vehicle Type	VMT / Day	% Total VMT	Fuel Consumption (Gallons/Day)	Emissions (MT CO ₂)	Emissions Rate (MTCO ₂ /Gallon)	MPG
	Summation	Calc	Summation	Calc	Calc	Calc
DSL	1,297,898	6%	73,678	827	0.011	17.62
ELEC	926,153	5%	0	0		
GAS	18,189,659	89%	521,407	4,940	0.009	34.89
TOTAL	20,413,710	100%		5,766		

Note that the electricity emissions factor is calculated separately and utilizes PG&E and PCE specific emissions factors.

2.3 Calculating Total Emissions for 2005, 2015 and 2040

In order to calculate the total emissions for the base year (2005), current conditions (2015) and future build-out scenario (2040), the Countywide VMT is disaggregated based on estimated fuel type based on the EMFAC2017 data. Table 6 summarizes the VMT estimated by fuel type. Table 7 summarizes the fuel consumption by vehicle type.

Table 8 calculates the total annual emissions by applying the fuel-specific and year-specific emissions factors to the amount of fuel consumed.

Table 6. Estimated VMT per Fuel Type (SMCTP 2040)

Vehicle Type	CCAG-VTA 2005 Annual VMT*	CCAG-VTA 2015 Annual VMT	CCAG-VTA 2040 Annual VMT
Diesel Vehicles	235,245,075	243,659,660	474,532,243
Electric Vehicles	43,443,540	44,997,491	338,616,495
Gasoline Vehicles	5,670,506,086	5,873,336,925	6,650,429,499
All Vehicles	5,949,194,701	6,161,994,076	7,463,578,237

* 2005 Annual VMT was estimated utilizing the MTC ratio of 2005 to 2015 VMT

Table 7. Estimated Fuel Consumption by Year based on MPG (SMCTP 2040)

Vehicle Type	Unit	2005 Fuel Consumption	2015 Fuel Consumption	2030 Fuel Consumption
Diesel Vehicles	Gallons	28,534,986	24,827,066	26,937,849
Electric Vehicles	kWh	14,336,368	14,849,172	74,098,619
Gasoline Vehicles	Gallons	273,414,369	253,892,266	190,634,857

Table 8. Estimated Emissions per Fuel Type (SMCTP 2040)

Vehicle Type	2005 CCAG-VTA Annual Emissions (MT CO ₂ e)	2015 CCAG-VTA Annual Emissions (MT CO ₂ e)	2040 CCAG-VTA Annual Emissions (MT CO ₂ e)
Diesel Vehicles	305,118	278,571	302,255
Electric Vehicles	129	2,944	734
Gasoline Vehicles	2,647,489	2,405,349	1,806,055
All Vehicles	2,952,736	2,686,863	2,109,044

3 CALCULATING EMISSIONS REDUCTIONS NEEDED

The calculations utilized a 2005 base year for estimating emissions reductions needed. Table 9 provides a mapping of the state's climate targets based on a 1990 baseline year, compared to utilizing a 2005 baseline year.

Table 9. Overview of State Climate Targets

	Target Year	% below 1990	% below 2005
SB 32	2030	40%	49%
(Interpolated by DNV GL)	2040	60%	66%
Executive Order S-3-05	2050	80%	83%

In order to estimate the target level of emissions for San Mateo County for the transportation sector to meet state goals,

Table 10 summarizes the baseline 2005 emissions levels and associated emissions targets for 2030 and 2040, along with the estimated SMCTP emissions expected as business-as-usual. Additional emissions reductions needed are calculated for 2030 and 2040.

Table 10. Emissions Targets for San Mateo County (Transportation Sector)

Year	Business-as-usual Estimated SMCTP Emissions Levels (MTCO ₂)	Emissions Target Level (MTCO ₂)	Description	Additional Emissions Reductions Needed (MTCO ₂)
2005	2,952,736			
2030	2,350,099*	1,505,895	49% below 2005	844,203
2040	2,109,044	1,003,930	66% below 2005	1,105,114

*Estimated based on straight-line interpolation between 2005 and 2040 SMCTP emissions estimates

4 ASSESSING CLEAN VEHICLE POTENTIAL

The following analysis focused on zero emission vehicles, specifically electric vehicles as the potential market transformational strategy for emissions reductions within the next decade or so. The report emphasizes that VMT reduction strategies are still of highest importance, recognizing that while electric vehicles reduce emissions, they do not reduce congestion which is a key priority for C/CAG.

Below, we document the calculation methodology for assessing the target penetration of electric vehicles, as percent of VMT for 2040. The analysis assumes that electric vehicles displace gasoline-related VMT.

Electric vehicle efficiency is based on an average of three common electric vehicle makes and models as shown below in Table 11. The electric vehicle efficiency is assumed to increase at the same rate as gasoline-powered vehicles which is forecasted to increase from 23 MPG to 35 MPG, per the analysis described in Section 2.

Table 11. Electric Vehicle Fuel Efficiency

Make	Model	Vehicle Efficiency (kWh/mile)	Data Source
Nissan	Leaf	0.34	FuelEconomy.Gov
Chevrolet	Volt	0.36	FuelEconomy.Gov
Toyota	Prius (Plug-in)	0.29	FuelEconomy.Gov
	2005 Average of All Vehicles:	0.33	Assume the same as 2015
	2015 Average of All Vehicles:	0.33	Average of above vehicles
	2040 Average of All Vehicles:	0.22	Estimated based on gasoline efficiency trend

The CARB EMFAC Web Database does not provide emissions rates or fuel efficiencies for electric vehicles. In order to estimate fuel efficiency of electric vehicles in San Mateo County, data on fuel efficiency from FuelEconomy.gov for the three best selling electric vehicles of 2015 was used. The 2005 average is equal to 2015 as there is presumed to be little to no all-electric vehicles on the road in 2005.

Furthermore, the analysis assumes an average electricity emissions factor of 0.00001 MTCO₂e/kWh for 2040, which is 95% below the 2015 emissions factor. This is an estimate accounting for a mix of direct access, PG&E and PCE electricity consumption.

Therefore, the calculation to achieve the percent electric vehicles needed is based on:

- Emissions reductions needed (MTCO₂) / Emissions Rate (MTCO₂/gallon) = Gallons of gasoline
- Gallons of gasoline * MPG = additional clean VMT needed

Table 12 summarizes the calculation, accounting for an assumption that electric vehicles have an emissions factor of 0.00001 MTCO₂e/kWh. The calculation also assumes that electric vehicles and gasoline vehicles drive the same number of miles each year, and that displacement of gasoline vehicle can be assumed as 1-to-1 for electric vehicle in terms of driving patterns.

Table 12. Calculation of Percent Electric Vehicle Needed

Year	Emissions Reduction Needed (MTCO ₂)	Gallons of Gasoline to be reduced	Annual clean VMT needed	% of Total VMT forecasted
2030	844,203	89,100,000	3,100,000,000	45%
2040	1,105,114	116,650,000	4,070,000,000	60%