

San Francisco Transportation Sector Climate Action Strategy

2017



SFMTA
Municipal
Transportation
Agency

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Foreword

The earth's climate system is changing in profound ways. The documented impacts to our planet are a result of burning fossil fuels which generate greenhouse gas emissions and air pollutants. The risks associated with the changing climate system are many and will impact us all, from rising sea levels and more intense hurricanes, to increase droughts and heat waves.

By 2050, two-thirds of the world's population are projected to reside in cities. Meaningful climate action requires leadership from these major urban areas. Few global cities are as well positioned as San Francisco to lead on climate action. With our already existing climate action toolbox, the City and County of San Francisco is poised to be a global model. In 2017, San Francisco surpassed two significant climate goals: First, San Francisco reduced its annual greenhouse gas emissions by 28 percent below 1990 levels and second, consistent with its Transit First policy, more than fifty two percent of all trips to, from and within San Francisco used transit, bicycling and walking.

While there has been progress, there remains significant work ahead for San Francisco to reach our mid-century climate goals which call for reducing greenhouse gas emissions by 80 percent from 1990 levels by 2050 and for shifting 80 percent of all trips to environmentally sustainable modes by 2030.

Today, the majority of San Francisco's greenhouse gas emissions and air pollutants are generated by the transportation sector which relies heavily on fossil fuels. The rapidly evolving transportation sector is not only the largest source of emissions within San Francisco; emissions from the sector have increased since 2012 while other sectors have been reduced.

This Transportation Sector Climate Action Strategy continues San Francisco's commitment to addressing a changing climate system. This strategy is our city's call to action for the accelerated reduction of emission from the transportation sector and for the development of a more resilient transportation system in the face of future climate impacts. Fortunately, many of the climate actions that are identified in the Strategy are actions that can also build a healthy, resilient and equitable city in the years ahead.

In order to realize mid-century climate goals, the transportation sector must evolve into an environmentally sustainable system that provides safe, reliable and affordable mobility options for all residents, visitors and employees. This will require sustained leadership, bold policies, innovative projects and strategic investments.

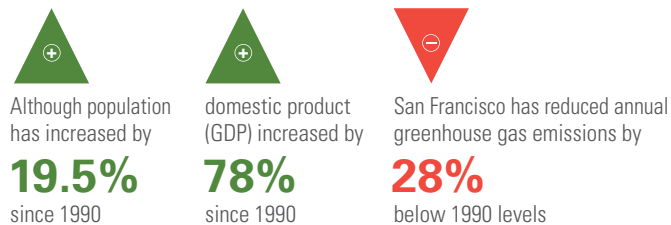
The time to act is now.



Executive Summary

Climate change is a defining issue of our modern era and there is growing recognition that cities are on the front lines in taking meaningful action to reduce greenhouse gas emissions while simultaneously preparing for future climate impacts such as sea level rise. San Francisco has been a global climate action leader and should be recognized for its pioneering climate action that has resulted in achieving two important 2017 climate action goals. First, San Francisco has reduced its annual greenhouse gas emissions by 28 percent below 1990 levels which is impressive since the population has increased by 19.5 percent and gross domestic product (GDP) by 78 percent since 1990. Second, consistent with its Transit First policy, San Francisco has reached its 2017 mode share goal with more than fifty two percent of all trips to, from and within San Francisco using transit, bicycling and walking.

2017 Climate Achievements



San Francisco has reached its 2017 mode shift goal with more than

52% of all trips   

from and within San Francisco using transit, bicycling and walking.

However, there are significant challenges ahead and limited time for meaningful climate action. San Francisco's rapidly evolving transportation sector currently accounts for 46 percent of citywide emissions and while the sector's emissions have decreased since 1990 they have increased slightly since 2012. Of particular concern is that the recent increase in emissions does not account for emissions that are being generated by a rapid and significant increase in TNC trips. Therefore, in order to meet the mid-century climate goals the city's transportation sector must be transformed per the

implementation of the 2017 Transportation Sector Climate Action Strategy.

The city's mid-century climate goals are to reduce emissions by 40 percent from 1990 levels by 2025 and reduce emissions by 80 percent from 1990 levels by 2050. The Strategy proposes an update to the mid-century mode share goal which calls for shifting 80 percent of all trips to environmentally sustainable modes by 2030 and contains an updated definition of environmentally sustainable modes.

NEW GOAL

"Shift 80 percent of all trips to environmentally sustainable modes by 2030."

Realizing these mid-century climate goals are feasible but will require sustained leadership, bold policies, innovative projects and strategic investments. The 2017 Transportation Sector Climate Action Strategy creates the foundation for a financially, environmentally, and socially sustainable transportation system by targeting the most effective climate action strategies and identifying key actions that should be implemented over the next two years. Fortunately, many of the climate actions that are identified in the Strategy are actions that can also build a healthy, resilient and equitable city by:

- Improving public health through the reduction of harmful air pollutants by prioritizing transit and active transportation modes;
- Reducing economic costs associated with congestion
- Improving safety for all consistent with the city's Vision Zero policy
- Promoting dense, affordable and environmentally sustainable development
- Providing safe, reliable, efficient and affordable transit for all
- Building a more resilient transportation system in the face of a changing climate system

Executive Summary

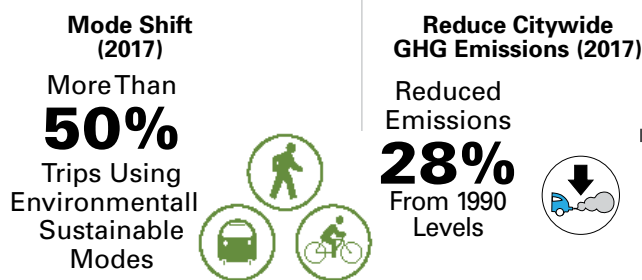
The Strategy contains seven climate mitigation program areas which contain a diverse array of implementable actions that aim to reduce greenhouse gas emissions across the sector and five climate adaptation program areas that provide the framework for building a more resilient transportation system.

For the city's transportation system to survive, flourish and deliver essential services, it must adapt to changing climatic conditions. Building a resilient transportation system will be important in the face of increased rates of sea level rise

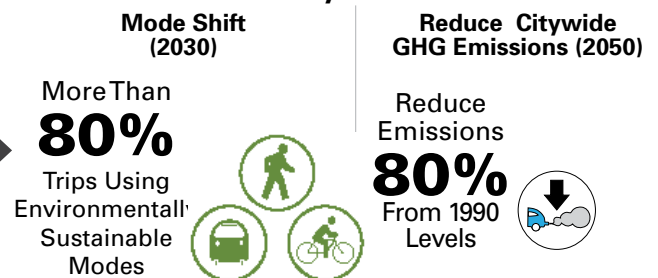
which have the potential to adversely impact the city, its communities and major coastal transportation corridors and facilities.

A changing climate system will redefine urban cities in the years ahead. This Transportation Sector Climate Action Strategy will allow San Francisco to prosper and grow in an ever changing world while taking meaningful and urgent climate action to comprehensively address this critical global issue.

2017 Climate Achievements:



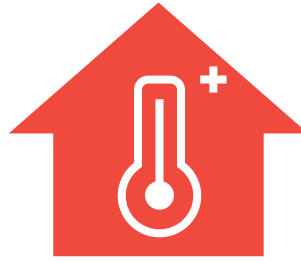
Mid-Century Climate Goals:



2017 Climate Dashboard



Carbon dioxide
406.69
parts per million



Global temperature
1.7°F
since 1980



Arctic ice minimum
13.3%
per decade

IMPACT

Heat Stress, Drought, Wildfire, Extreme Storms

IMPACT

Sea Level Rise, Coastal Erosion

Source: climate.nasa.gov



The Transportation Sector Climate Action Strategy-History, Purpose and Process

With the passage of Proposition A in 2007, the SFMTA was directed to develop a Climate Action Strategy every two years that identifies climate action strategies and describes the progress towards reducing greenhouse gas emissions from the transportation sector. This 2017 Transportation Sector Climate Action Strategy meets the 2007 directive by identifying seven comprehensive and integrated climate mitigation program areas.

Historically, the Transportation Sector Climate Action Strategy was focused solely on developing and implementing climate mitigation strategies that help to reduce greenhouse gas emissions from the transportation sector. However, as our awareness of climate change has increased, it is becoming clear that reducing greenhouse gases alone will not be sufficient and that efforts must also focus on increasing the resilience of San Francisco, its communities and the critically important multimodal transportation system. Therefore, the Strategy contains five new climate adaptation program areas.

The main purpose of the 2017 Transportation Sector Climate Action Strategy is to provide

a framework for 1) reducing greenhouse gas emissions from the San Francisco transportation sector and 2) increasing the resilience of the San Francisco transportation system to future climate impacts. The Strategy also does the following:

- reports on existing community wide and transportation sector greenhouse gas targets and trends;
- reports on progress toward reaching climate goals;
- identifies climate mitigation and adaptation goals, strategies and actions;
- highlights climate action success stories;
- prioritizes and guides the implementation of the climate actions over the next two years;

There are four primary city agencies, the SFMTA, the SFCTA, the Planning Department and the Department of the Environment, that manage the transportation sector. Each of these agencies play an important role in implementing the 2017 Transportation Sector Climate Action Strategy.



SFMTA: The SFMTA plans, designs, builds, operates, regulates, and maintains one of the most diverse transportation networks in the world. In addition to the four modes of transportation (transit, walking, bicycling and driving), the Agency directly oversees five transit modes (bus, trolley bus, light rail, historic streetcar, and cable car) and oversees paratransit service, which serves individuals unable to use fixed-route transit service. The SFMTA also partners with regional transit operators who connect the city with the Bay region using four additional transit modes (heavy rail (BART), commuter railroad, regional bus, and ferry).

In addition to being an operator and regulator, the SFMTA has a robust planning, design, and construction function that includes reviewing all proposed land use developments with our partners; planning, designing, and building the transportation modal networks (transit and paratransit, streets, signals, bicycle, pedestrian, taxi, commercial delivery, and loading); and providing long-range forecast analyses of the fleets, facilities, and right-of-way infrastructure in the city and their relation to the region.

The SFMTA also oversees on- and off-street public parking and manages it to complement the policy objectives of this Transit First city. Last but not least, the Agency creates and enforces rules on the city's streets, transit system, and parking. Combined, these efforts make an all-in-one transportation agency that directly impacts the daily life of everyone who moves about the city.

The projects and programs delivered by the SFMTA are guided by its 2013-2018 Strategic Plan which contains 4 overarching goals:

- 1. Create a safer transportation experience for everyone.**
- 2. Make transit, walking, bicycling, taxi, ridesharing, and carsharing the preferred means of travel.**

3. Improve the environment and quality of life in San Francisco.

4. Create a workplace that delivers outstanding service.

Goals 2 and 3 of the Strategic Plan confirm SFMTA's commitment to the city's Transit First policy, prioritizing environmentally sustainable modes, improving the environment and to reducing greenhouse gas emissions from the transportation sector. (Note. The SFMTA is in the process of updating its Strategic Plan and efforts have been made to ensure that there is consistency between this Strategy and the next Strategic Plan.)

San Francisco County Transportation

Authority: The San Francisco County Transportation Authority, SFCTA, is responsible for long range transportation planning for the City, and it analyzes, designs and funds improvements for San Francisco's roadway and public transportation networks. The SFCTA administers and oversees the delivery of the Prop K half-cent local transportation sales tax program and the Prop AA \$10 annual vehicle registration fee program, serves as the designated Congestion Management Agency (CMA) for San Francisco, under state law, and acts as the San Francisco Program Manager for grants from the Transportation Fund for Clean Air (TFCA). The SFCTA Board consists of the 11 members of the San Francisco Board of Supervisors, who act as SFCTA Commissioners.

San Francisco Planning Department: The San Francisco Planning Department, under the direction of the Planning Commission, plays a central role in shaping the future of our City by generating an extraordinary vision for the General Plan and in neighborhood plans; fostering exemplary design through planning controls; improving our surroundings through environmental analysis; preserving our unique heritage; encouraging a broad range of housing

and a diverse job base; and enforcing the Planning Code.

San Francisco Department of the

Environment: The San Francisco Department of the Environment (SFE) and its Commission on the Environment create visionary policies and innovative programs to improve, enhance, and preserve the urban and natural environment and ensure the city's long-term sustainability. SFE

advances their mission of providing solutions that advance climate protection and enhance quality of life for all San Franciscans through a diversity of programs and services including; Biodiversity, Climate Change, Eco Products and Services, Energy, Environmental Justice, Green Building, Green Business Program, School Education Program, Toxics Reduction, Transportation, Urban Forestry and Urban Agriculture, and Zero Waste.

An Urgent Call to Action

The planet's climate system is being fundamentally altered as the concentration of greenhouse gases in the atmosphere rises to unprecedented levels with grave consequences for cities worldwide, their inhabitants and that natural systems that sustain the planet. The burning of fossil fuels to power the transportation sector generates many of these harmful emissions. As of 2015, the San Francisco transportation sector generates approximately 46 percent of all greenhouse gas emissions within San Francisco. Unfortunately, emissions from the transportation sector have increased since 2012 and new transportation service providers including Transportation Network Companies (TNCs), are contributing new greenhouse

gas emissions into the atmosphere. In order to reduce these emissions and meet mid-century greenhouse gas reduction goals, the transportation sector must be transformed.

There is also growing recognition that an altered climate system will lead to myriad impacts to cities including sea level rise, droughts, wildfires and floods which will become more intense and frequent in the coming decades. As San Francisco is a coastal city, many critical elements of San Francisco's multimodal transportation system are vulnerable to sea level rise and adaptation strategies will need to be developed and implemented in order to increase the resilience of the city and its multimodal transportation system.



Few cities are as well suited as San Francisco to demonstrate bold and meaningful climate leadership and the city's ability to reach both of its 2017 climate goals demonstrates its pioneering climate leadership. However, urgent action is required in order to lay the foundation for a new transportation system. Therefore, this Strategy serves as a "call to action" for urgent

climate action across the city over the next two years. Realizing the mid-century goals is realistic and feasible but it will require sustained leadership and strategic investments. If actions in this Strategy are not implemented in the next two years, it is unlikely the city will be able to meet ambitious mid-century climate goals.

Urban Mobility and Climate Change

The earth's climate system has been more or less stable for the last 10,000 years, which has enabled cities to flourish across the planet. However, this era of stability is waning and cities are likely to be impacted significantly as a result of a changing climate system. Over half of the planet's population lives in urban cities which presents both opportunities and challenges in the face of changing climate conditions.

One of the opportunities for urban cities is that residents of dense urban cities with safe, reliable and environmentally sustainable public transit systems tend to have smaller carbon footprints than suburban dwellers¹. This is especially true in a city like San Francisco which has many attributes that reduce reliance

on private automobiles such as high land use density, diverse land uses, access to safe, reliable, affordable transit, interconnected and well-designed multimodal corridors, and walkable neighborhoods. San Francisco is also fortunate to have a transit agency, SFMTA, that is fueled by renewable diesel and renewable electricity which has allowed for significant economic and population growth without parallel growth in greenhouse gas emissions. As the city grows in the years ahead, the city's Transit First policy will need to be implemented and the defining and historic land use and transportation characteristics of San Francisco will need to be integrated into future planning efforts in order to meet mid-century climate goals.

¹ *Brookings Institute, 2008*



Figure 1.0



- A Improve pedestrian safety on major traffic streets
- B Enhance the existing cluster of cultural and institutional uses in the Civic Center area
- C Improve the quality, vitality and accessibility of the area's neighborhood commercial streets
- D Support new mixed use residential development on the former freeway parcels
- E Create a network of civic streets and open spaces, with new parks, street improvements and extensive tree planting
- F Support residential infill within the fine-grained physical pattern of existing residential neighborhoods
- G Encourage high density housing and supporting uses close to the transit services on Van Ness and Market Streets
- H Create a new mixed-use residential neighborhood the SoMa West area
- I Encourage more housing and intensified commercial activities along the area's core transit streets
- J Strengthen the role of Market Street as the city's cultural heart and most important transit street
- K Improve the intersection of Church and Market Streets as a major transit hub

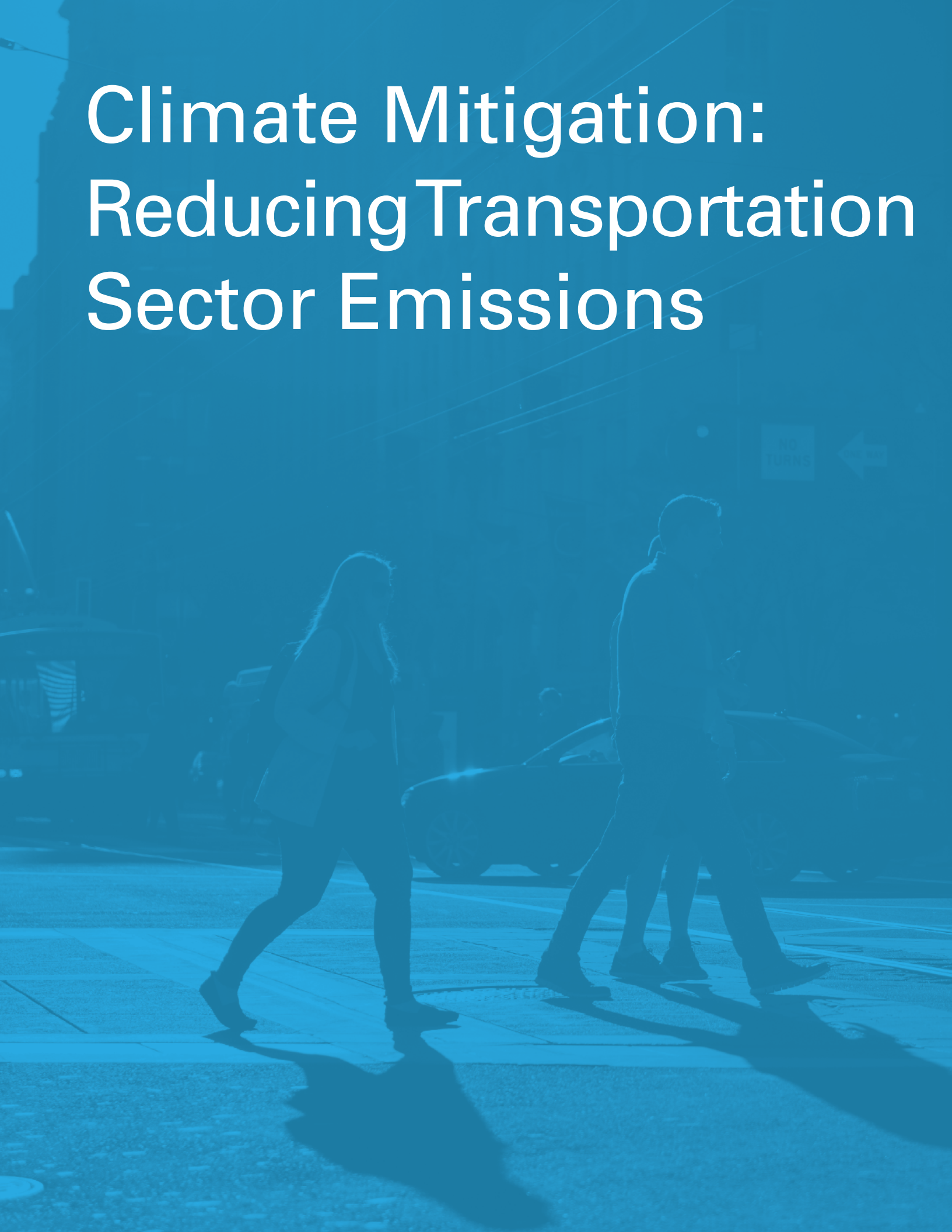
Increasingly, urban mobility and travel behavior is being shaped by rapid changes in technology. This technological change that is connecting residents with on demand mobility providers is fundamentally altering the transportation sector and urban mobility options. A 2017 SFCTA publication² indicates that transportation network companies, TNCs, make 170,000 vehicle trips within San Francisco on an average weekday, which represents 15 percent of all intra-San Francisco vehicle trips. The report also found that these private services generate approximately 570,000 vehicle miles within San Francisco on a typical weekday which accounts for 20% of all local daily vehicle miles traveled (VMT) in San Francisco. While the report does not estimate the greenhouse gas emissions from TNCs, it is likely to be a significant source of new emissions within the transportation sector. Currently, the SFCTA and the SFMTA are estimating the emissions generated from TNCs and also determining whether these are new vehicle trips or whether they are trips that used to be taken via other modes such as single occupancy vehicle, transit, biking or walking. In short, there is uncertainty about whether emerging urban mobility services will align or frustrate San Francisco's climate goals in the years ahead.

Ultimately, urban cities have the potential to leverage data and technology and implement plans, policies and projects to help transform the transportation sector to meet its transportation, climate and energy goals. While innovation and technological change are welcomed, the innovation will have to be in the context of the city's recently released Guiding Principles for Emerging Mobility Services and Technology. These principles provide a framework for evaluating emerging mobility services and guide future policy development, collaboration and partnerships. In summary, innovation and technology needs to yield a safer, more transit-friendly, environmentally sustainable, and equitable transportation system. Additionally, robust and comprehensive data collection, management and analysis will need to be improved in order to fully understand how the rapidly evolving transportation sector and its services are either aligning or frustrating the city's climate goals. In particular, improved data collection and analysis should build upon the SFMTA annual Travel Decision Survey and focus on capturing data such as travel mode, occupancy rate, fuel type, trip origin and destination, passenger demographics and vehicle type.

² *TNCs Today: A Profile of San Francisco Transportation Network Company Activity, 2016*



Climate Mitigation: Reducing Transportation Sector Emissions



Climate Mitigation

State, Regional and Local Climate Mitigation Policy Framework

Climate change is a global issue and will require action on behalf of every citizen. The 2015 Conference of the Parties, “COP” 21 Climate Change Conference in Paris, provides an international climate policy framework. Unfortunately, as of 2017, there is little political appetite for addressing this significant policy issue at the national level. Fortunately, an array of state, regional and local climate mitigation policies are being implemented that collectively aim to reduce greenhouse gas emissions.

Assembly Bill 32

The California Global Warming Solutions Act of 2006, AB 32, requires California to reduce greenhouse gas emissions to 1990 levels by 2020. Assembly Bill 32 also requires the California Air Resources Board to develop a “scoping plan” which contains goals and strategies to reduce emissions. The Air Resources Board oversees the **Cap-and-Trade** Program, which is a key element of California’s climate policy framework. The pioneering Cap and Trade Program sets a statewide limit on sources responsible for 85 percent of California’s greenhouse gas emissions, and establishes a price signal that will drive long-term investment in cleaner fuels and more efficient use of energy. This innovative program has made significant investments in enhancing and expanding San Francisco’s transit system through the Transit and Intercity Rail Capital Program (TIRCP) and the Low Carbon Transit Operating Program (LCTOP).

Senate Bill 350

S.B. 350, passed in 2015, builds upon the AB 32 target and established new greenhouse gas reduction targets: by 2030 reduce 1990 levels by 40 percent and by 2050 reduce 1990 levels by 80 percent. SB 350 also sets ambitious 2030 targets for energy efficiency and renewable electricity, among other actions aimed at reducing greenhouse gas emissions.

SB 375

This statewide policy aims to reduce greenhouse gas emissions through coordinated transportation and land use planning with the goal of more sustainable communities. **Plan Bay Area** is the Bay Area’s Sustainable Communities Strategy (SCS) / Regional Transportation Plan (RTP) and serves as the long range transportation and land use blueprint for the nine county Bay Area. Many important San Francisco transportation projects are identified in Plan Bay Area and, if funded, will



Climate Mitigation

serve as the backbone of the city's future transportation system. Plan Bay Area also identifies "Priority Development Areas" which are areas within existing communities that local city or county governments have identified and approved for future infill growth.

Low Carbon Fuel Standard

The California Air Resources Board manages the Low Carbon Fuel Standard (LCFS) program as part of a broader set of initiatives to reduce greenhouse gas emission and other smog-forming and toxic air pollutants. The LCFS program is focused on improving vehicle technology, reducing fuel consumption, and increasing transportation mobility options and aims to reduce the carbon intensity (CI) of transportation fuels in California by 10 percent from 1990 levels by 2020. The SFMTA has recently registered with the LCFS program and the agency anticipates generating revenue from the sale of LCFS credits which will help fund new sustainability and climate action projects.

San Francisco Climate Action Strategy

San Francisco has ambitious citywide greenhouse gas reduction targets which were included in the city's Charter in 2008: 25 percent

reduction from 1990 levels by 2017, 40 percent reduction from 1990 levels by 2025 and 80 percent reduction from 1990 levels by 2050. The 2013 San Francisco Climate Action Strategy also contains the "**0, 50, 100, Roots**" goals, which serve as San Francisco's overarching climate and sustainability framework. The "**0**" refers to generating zero waste which will require reductions in consumption and increased recycling and composting. The "**50**" refers to a citywide mode shift goal of having fifty percent of all trips being made by non – automobile modes (transit, walking and bicycling) by 2017 and 80 percent of trips being non-auto trips by 2030. The "**100**" refers to using 100 percent renewable energy for fueling all of the sectors within San Francisco. The "**Roots**" refers to greening the city with plants and green infrastructure projects which can help to capture and sequester carbon while also improving the public realm, urban habitat and biodiversity. (Note: The 2017 Transportation Sector Climate Action Strategy proposes to update the 0,50, 100, Roots framework with an updated mode shift goal that reflects a new goal - "Shift 80 percent of all trips to environmentally sustainable modes by 2030.")



Climate Mitigation

Proposition A

Proposition A was passed by the voters in 2007 and guides much of the work of the SFMTA Sustainability Program and the agency's efforts to reduce greenhouse gas emissions from the transportation sector. Proposition A mandates the development of a Climate Action Strategy that describes measures taken and progress made toward the goal of reducing greenhouse gas emissions from San Francisco's transportation sector while addressing progress toward the following goals:

- Zero greenhouse gas emissions for Municipal Railway transit vehicles
- Lowering energy consumption in Agency facilities and by non-transit vehicles
- Maximizing waste reduction in Agency operations
- Increasing transit trips and reducing private vehicle trips within the San Francisco
- Increasing the use of bicycling and walking as alternate forms of transportation; and
- Improving regional transit connections to reduce private vehicle use by commuters

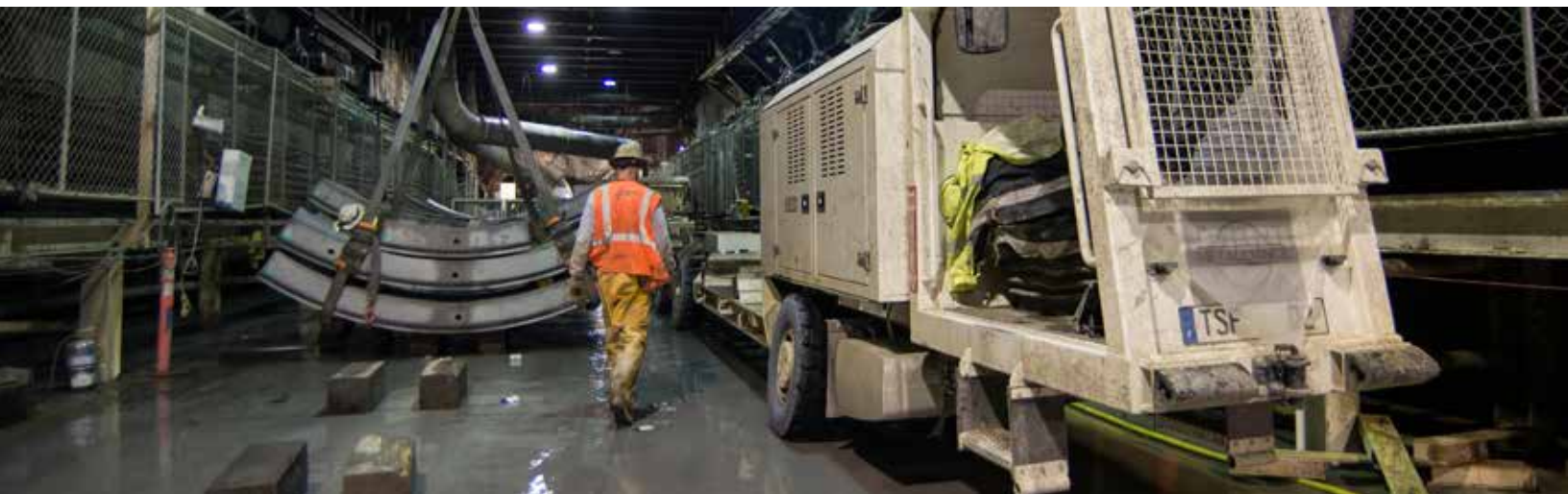
San Francisco's Transit First Policy

The San Francisco Board of Supervisors adopted a resolution in 1973 "declaring that Municipal Railway vehicles and other transit vehicles be given priority over other vehicles on San

Francisco streets." A key provision of the policy reads, "*Decisions regarding the use of limited public street and sidewalk space shall encourage the use of public rights of way by pedestrians, bicyclists, and public transit, and shall strive to reduce traffic and improve public health and safety.*" The Transit First policy serves an important role in guiding transportation, climate and energy actions across the city.

SFMTA Strategic Plan

The FY 2013-2018 SFMTA Strategic Plan calls for a 25 percent reduction in agency greenhouse gas emissions from 1990 levels by 2017, which has been reached, and aims to reduce agency emissions and resource consumption through the expansion of the biofuels program, reducing the emissions of non-revenue vehicle fleets, and identifying greener choices for private vehicles. The SFMTA Strategic Plan also commits to making San Francisco more inviting to live in, work in, and visit without needing or wanting to use a private vehicle. The current Plan has a mode share goal that calls for 50 percent of trips being made in private auto (single occupancy vehicle trips) and 50 percent in non-private modes (transit, bicycling, walking). Based on the findings from the FY 2017 Travel Decision Survey this goal has been reached. As of mid-2017, the next Strategic Plan is in the process of being updated and will establish new measures and targets consistent with this Strategy and the city's commitment to environmental sustainability and climate action.





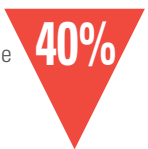
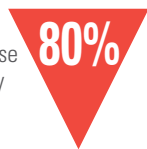
Measuring Progress Towards San Francisco's Climate Goals



Measuring Progress

San Francisco Greenhouse Gas Emissions: Targets and Trends

San Francisco has been a global leader in addressing climate change and its strong climate policy framework has been instrumental in the reduction of community or citywide greenhouse gas emissions. In 2008, the Board of Supervisors passed Ordinance No 81-08, which established San Francisco’s ambitious greenhouse gas emission targets:

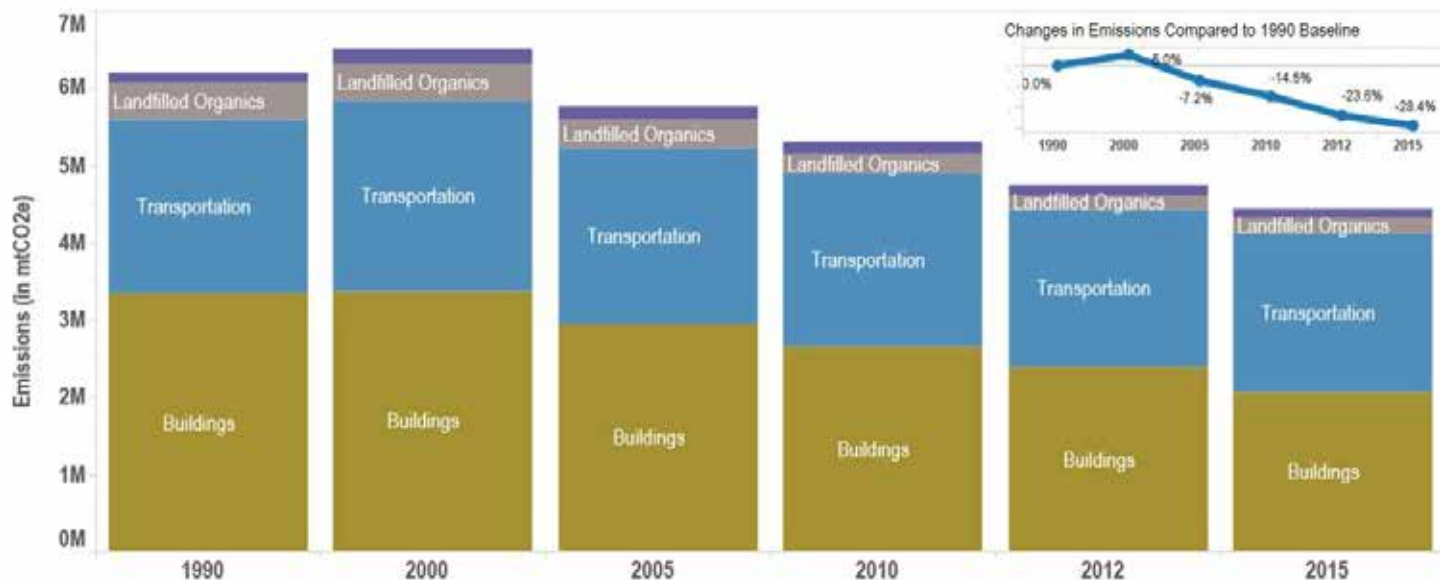
<p>By 2012, reduce greenhouse gas emissions by 20% below 1990 levels</p>		<p>By 2017, reduce greenhouse gas emissions by 25% below 1990 levels</p>	
<p>By 2025, reduce greenhouse gas emissions by 40% below 1990 levels</p>		<p>By 2050, reduce greenhouse gas emissions by 80% below 1990 levels</p>	

San Francisco’s Department of the Environment recently quantified “community” or citywide emissions for 2015 and found that community emissions have been reduced by 28 percent since 1990. This reduction is especially significant

as the city’s population has increased by 19.5 percent and its GDP has surged by 78 percent since 1990.

However, significant challenges remain. First, the transportation sector is heavily dependent on fossil fuels and has only been reduced 8 percent since 1990. Unfortunately, the sector has also increased by approximately 10,000 metric tons of carbon dioxide equivalent since 2012. Furthermore, new sources of emissions within the transportation sector, generated by TNCs, are likely to be significant sources of new greenhouse gas emissions once they are calculated at the end of 2017. Second, the city is projected to grow in the decades ahead and must grow in an environmentally sustainable manner. According to regional projections (Plan Bay Area)³ San Francisco is projected to add 104,00 new housing units and 260,000 new jobs between 2014 and 2040 and reducing emissions to achieve the mid-century climate goals will require a strong commitment from San Franciscans to address climate change and its impacts as the city grows in the years ahead.

(Fig 1.1) San Francisco greenhouse gas emissions trends since 1990.



Measuring Progress

While the 2017 Transportation Climate Action Strategy is only focused on reducing emissions from the transportation sector it is important to consider how emissions are quantified and defined across the city.

Community Greenhouse Gas Emissions:

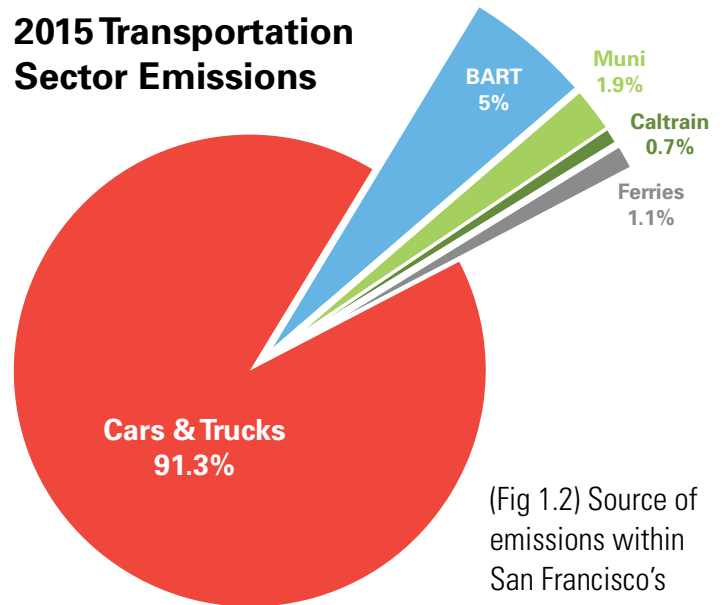
Community emissions refer to all of the greenhouse house gas emissions that are generated within San Francisco in a given year. Community emissions are generated by a range of activities such as the burning of fossil fuels that power the transportation sector, generation of electricity used to light and heat offices and homes (buildings sector), and the decomposition of waste in landfills (landfilled organics). As noted in Figure 1.1, these other sectors have been decreasing since 2000.

Transportation Sector Greenhouse Gas Emissions:

Within San Francisco, the largest single source of emissions is the transportation sector. As of 2015, transportation sector emissions are approximately 46 percent of all community emissions. The vast majority of the emissions from the transportation sector emissions, 91 percent, are generated by the combustion of fossil fuels that fuel the sector's cars, trucks and other private vehicles. Additional emissions, nine percent, are generated by regional transit operators such as BART, Caltrain, ferry operators and the SFMTA. The SFMTA transit operations make up less than two percent of the transportation sector's total emissions. (Fig 1.2).

Both community and transportation sector emissions were quantified in 2015 and are analyzed every year by the San Francisco

2015 Transportation Sector Emissions



(Fig 1.2) Source of emissions within San Francisco's transportation sector.

Department of the Environment. The Department of Environment followed guidance from the California Office of Planning and Research, California Environmental Quality Act Guidelines Section 15183.5, and the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, developed by ICLEI and published in 2012 U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions. In order to estimate transportation sector emissions, staff at the Department of the Environment use data derived from sources including SFMTA fuel consumption, regional transit such as BART, Caltrain, and Golden Gate Transit and WETA ferries fuel consumption via the National Transit Database (NTD), regional ridership trends, and outputs from the San Francisco County Transportation Authority's CHAMP model to estimate vehicle miles travelled which is then converted to greenhouse gas emissions.

³ Plan Bay Area. 2040.planbayarea.org

Measuring Progress

Implementing and Updating the San Francisco Climate Action Framework

Beyond the greenhouse gas emissions goals described above, the city also has mode share goals which measure how people move around San Francisco based on their mode choice (walking, bicycling, driving, transit) which can be correlated to environmental sustainability metrics. For example, transit, bicycling and walking are less carbon intensive per capita than a fossil fuel powered internal combustion single occupancy vehicle trip. The city's mode share goals are found in the following documents and policies; 2013 San Francisco Climate Action Strategy, the city's overarching "0, 50, 100, Roots" climate action framework and in the FY 2013-2018 SFMTA Strategic Plan.

2013 Climate Action Strategy:

The 2013 San Francisco Climate Action Strategy, called for shifting 50 percent of trips to non-automobile trips by 2017 and 80 percent by 2030. Based on the 2017 Travel Decision Survey, the city has realized the 2017 mode share goal as 52 percent of trips were non-automobile trips (transit, walk and bicycle) and 48 percent of trips were automobiles trips (drive alone, carpool and TNCs).

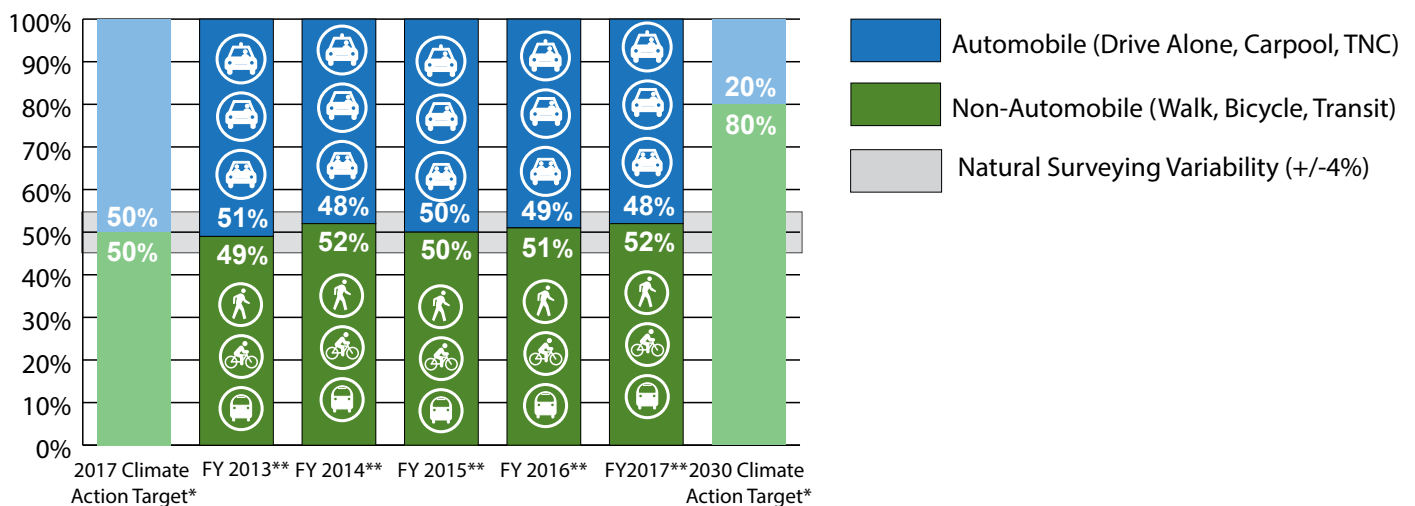
0-50-100-Roots Climate Action Framework:

0-50-100-Roots is San Francisco's climate action framework that will help the City meet the challenge of climate change through innovative policies, programs, and partnerships. The SFMTA and transportation agency partners have worked over the past decade to advance San Francisco's "0, 50, 100, Roots" climate action framework and have been particularly focused on the "0" which calls for zero waste and the "50" which calls for the city have a mode share wherein 50 percent of all trips are environmentally sustainable trips through reducing single occupancy vehicle trips and by making half of all trips on transit, walking, bicycling or carpooling.

SFMTA FY 2013-2018 Strategic Plan:

The SFMTA has incorporated the city's mode share goal into its FY 2013-2018 Strategic Plan. Goal 2 of the Strategic Plan captures the Transit First policy principles and the city's mode shift goal: "make transit, walking, bicycling, taxi, ridesharing, and carsharing the preferred means of travel". Per the Strategic Plan the mode share target is "private auto mode split goal: 50 percent; non-private auto modes: 50%". In order

(Fig 1.3). Mode share status and 2030 goal.



Measuring Progress

to measure progress towards this goal, the SFMTA has conducted a Travel Decision Survey since 2012 which defines “private auto” trips as those trips made alone and in carpools. Non-private auto trips include trips made by transit, walking, bicycling and TNCs. As depicted in Fig 1.3, San Francisco has reached its 2017 mode shift goal with more than fifty two percent of all trips to, from and within San Francisco using transit, bicycling and walking.

Updated Mode Share Goal:

The city has realized its 2017 mode share goal and it is important to update the 2030 mode share goal consistent with the 2013 Climate Action Strategy which called for shifting 50 percent of trips to non-automobile trips by 2017 and 80 percent by 2030. However, there is need to better define the mode share goal considering the changing mobility landscape.

Proposed Definition -Environmentally Sustainable Travel Modes:

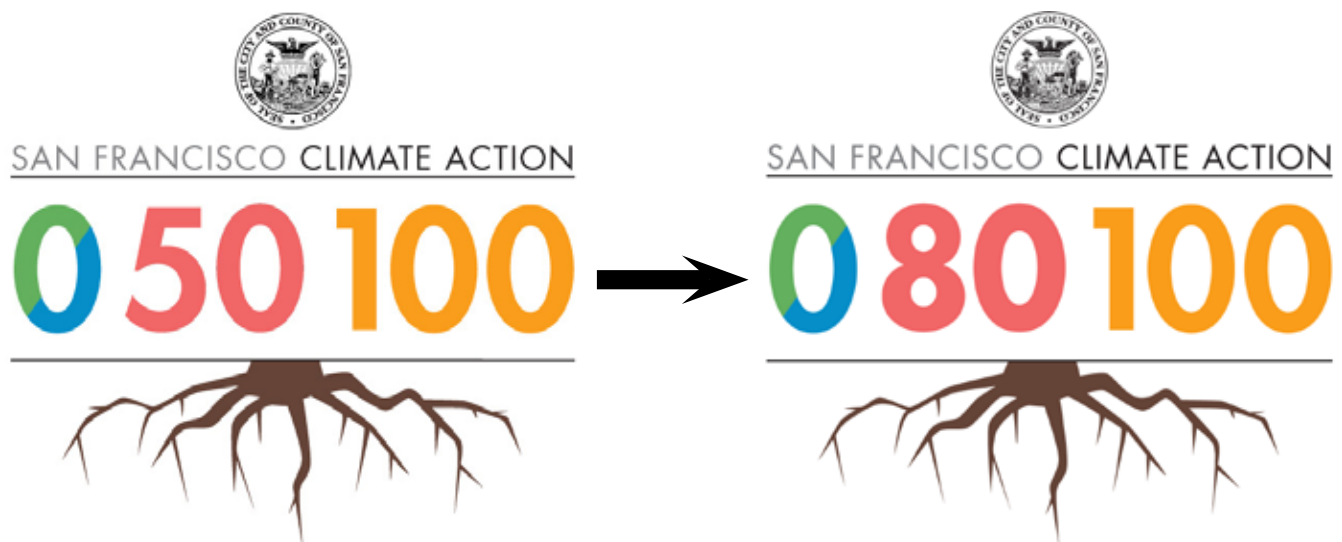
In an attempt for consistent goals and language across agencies, the SFMTA and SF Environment propose that an updated definition for environmentally sustainable travel modes.

An environmentally sustainable travel mode will:

1. Maximize the vehicle occupancy rate.
2. Reduce total vehicle miles traveled while maximizing passenger miles traveled per vehicle miles traveled for those traveling to, from, and within San Francisco.
3. Use low- and zero-emission fuels.

Using the criteria above, the most environmentally sustainable modes in San Francisco would be walking, bicycling and transit and the least environmentally sustainable mode would be a single occupancy vehicle trip using fossil fuel.

As noted earlier, The 2013 San Francisco Climate Action Strategy called for shifting 50 percent of trips to non-automobile trips by 2017 and 80 percent by 2030. However, the mobility landscape within San Francisco has changed dramatically since 2013 and an updated definition is merited at this time . Therefore, the proposed 2030 mode share goal is **“Shift 80 percent of all trips to environmentally sustainable modes by 2030.”**



Measuring Progress

Future efforts will determine how best to measure and monitor the environmental sustainability of the evolving transportation sector based on the updated definition and criteria above. Improved measuring will require improved data collection, management and analysis to keep pace with the rapidly evolving transportation sector. Discussions related to goals and performance measures will occur after the SFMTA Strategic Plan has been updated and approved in late 2017 / early 2018.

The Path Forward:

Realizing the proposed 2030 mode share goal is feasible and realistic but will require dedicated and sustained leadership and significant investments to transform the transportation sector. In particular, it will require that all of the Strategy's climate mitigation program areas are fully employed and implemented in the years ahead. This will require bold policies and innovative projects that maintain and grow the city's transit system and active transportation network. Without this shift to environmentally sustainable modes it is unlikely that the city will be able to realized its mid-century climate goals.



Commuter Trends

As San Francisco grows, the city’s investments in encouraging people to take transit, bike and walk are paying off.

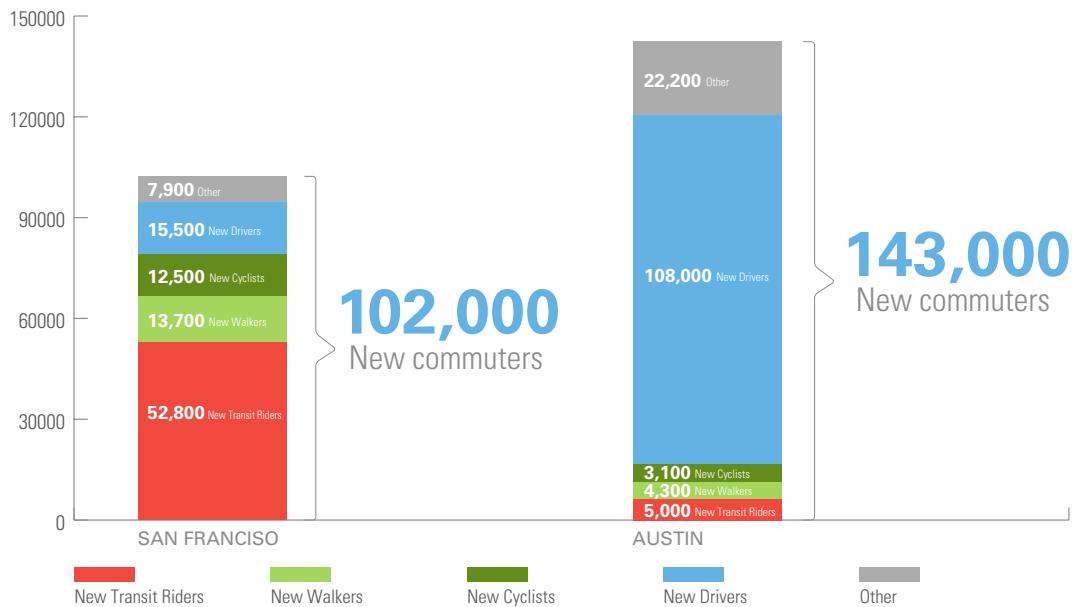
That’s the picture from the U.S. Census Bureau’s 2015 American Community Survey, which showed that as SF’s economy booms, the vast majority of new commute trips in the city are made without a car.

From 2006 to 2015, SF added roughly 100,000 commuters, and 85 percent of the additional trips are car-free. Just over half (53,000) are made by transit, and the combined growth in commutes by foot (13,000) and bike (12,000) is nearly double those by car (15,000).

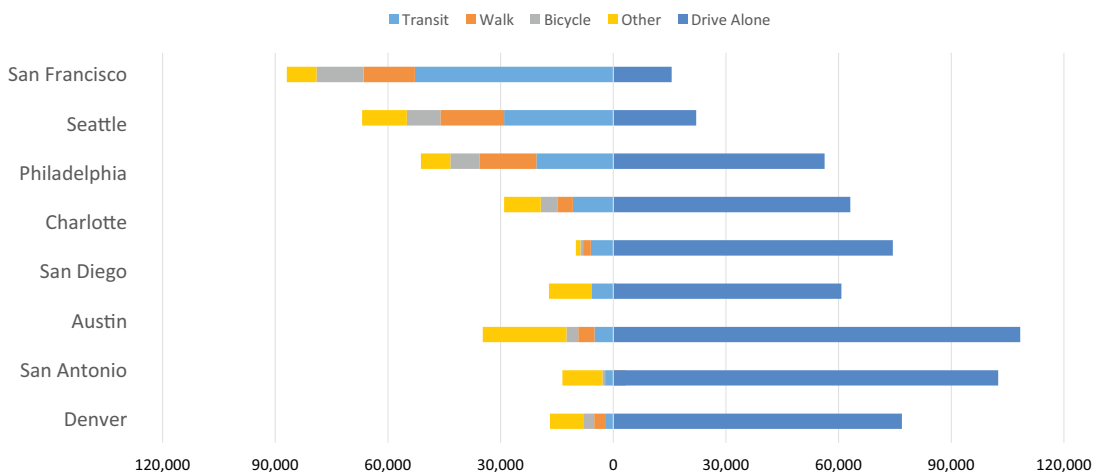
Prioritizing walking, bicycling and transit over private car usage is at the core of the city’s Transit-First Policy, which directs the SFMTA’s vision for a world-class, people-centered city.

(Fig 1.4). Commuter growth patterns.

Commuter growth in Austin and San Francisco (2006 - 2015)



Commuter Growth from 2006 through 2015



Climate Mitigation Program Areas



Climate Mitigation Program Areas

The Transportation Sector Climate Action Strategy contains seven integrated climate mitigation program areas. These program areas and the associated strategies and actions provide a framework for the accelerated reduction of emissions across the transportation sector which can be implemented by the four primary city agencies that oversee and manage the transportation sector including, San Francisco Municipal Transportation Agency (SFMTA), San Francisco County Transportation Authority, (SFCTA), the San Francisco Planning Department and the San Francisco Department of the Environment.

The seven climate mitigation program areas are:



TRANSIT



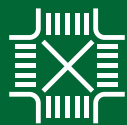
LAND USE & TRANSPORTATION



PRICING & CONGESTION
MANAGEMENT



TRANSPORTATION DEMAND
MANAGEMENT



COMPLETE STREETS



ZERO EMISSION VEHICLES &
INFRASTRUCTURE



EMERGING MOBILITY SERVICES
& TECH

Climate Mitigation Program Areas

Healthier, Safer, Resilient and more Equitable

Implementing the climate actions can also provide multiple important co-benefits including:

- Improving public health through the reduction of harmful air pollutants and through encouraging active transportation modes
- Reducing congestion and travel time
- Promoting dense and affordable development
- Providing safe, reliable, efficient and affordable transit
- Improving the public realm
- Creating green jobs
- Increase resilience
- Building a more equitable San Francisco

Therefore, each of the strategies are viewed in the context of these other co-benefits and the initial capital cost of implementing the strategies.



TRANSIT



Goal: By 2025, increase transit ridership by providing safe, reliable, accessible, equitable, rapid and environmentally sustainable transit service across San Francisco.

Providing safe, reliable and affordable public transit is one of the best ways for dense urban cities to reduce single occupancy vehicle trips and the associated greenhouse gas emissions. San Francisco adopted its Transit First Policy in 1973 to provide a strong policy foundation for investments in its transit system and multimodal transportation systems. The SFMTA transit system plays an important role in the local and regional economy by reducing traffic congestion, reducing commute times and energy consumption, and facilitating walking and bicycling trips which collectively reduces emissions. San Francisco has led the region and state in transit ridership growth with twenty five percent of trips in 2017 made using transit. The transit mode share has allowed San Francisco's economic and population growth to significantly outpace increases in transportation sector emissions.

Public transit in San Francisco is the cornerstone of the City's environmentally sustainable transportation system as it reduces greenhouse gas emissions in several ways:

- Public transit increases the energy efficiency of travel as it can move a large number of passengers in a shared vehicle;
- Public transit in San Francisco is fueled by renewable fuels with a low carbon intensity;

- Public transit, and the land use planning that supports it, can lead to dense neighborhoods where trips are short and often made by transit, walking and biking.

The SFMTA has been recognized as a national leader in providing sustainable transit options. While the transportation sector contributes approximately 46 percent of San Francisco's overall emissions, the SFMTA's energy-efficient fleet contributes less than two per cent of the sector's emissions. This is possible because the SFMTA transit fleet uses renewable diesel and renewable electricity provided by the San Francisco Public Utilities Commission and PG&E who are leaders in providing low carbon fuels and renewable energy. In short, the SFMTA transit system provides a clear example of how to provide safe, reliable, accessible, equitable, rapid and environmentally sustainable mobility for all San Franciscans.

In order to meet San Francisco's mid-century mode share and greenhouse gas reduction goals, the city must build on existing transit investments like the Van Ness Bus Rapid Transit project which will allow the City to grow and prosper without significant increases in emissions from the transportation sector.



TRANSIT

Long-Term Strategies:

		GHG REDUCTION POTENTIAL	CO-BENEFITS				COST
TRA-1	Maintain and expand local and rapid transit service and make system improvements that increases safety, reliability and accessibility.		✓	✓	✓	✓	
TRA-2	Expand regional transit core capacity to accommodate growth and encourage mode shift to transit, walking and bicycling.		✓	✓	✓	✓	
TRA-3	Secure Cap and Trade and other grant funds that can support fleet expansion, storage and maintenance needs that will help accommodate future growth and ridership demands.		✓	✓	✓		

LEGEND



Potential to reduce greenhouse gas emissions



Potential to advance equity



Potential to improve public health



Consistent with Transit First Policy



Potential to support jobs and prosperity



Initial Capital Cost (public)

2018-2020 Implementation Actions and Recommendations:

TRA Implementing Action 1.1: *Continue Muni Forward service improvements and initiate planning to support future service improvements.*

The Muni Forward Program has resulted in an array of service improvements across the transit system that increased the safety and reliability of the transit system. Looking forward, additional transit system improvements should be developed and implemented, including improvements identified through the Muni Service Equity Strategy. **Lead: SFMTA**

TRA Implementing Action 1.2: *Prioritize transit service within the public right-of-way.* In order to increase ridership, transit must be safe, efficient and reliable. Therefore, improvements should be made in the right-of-way that prioritize transit service. These improvements should include but not be limited to transit only lanes and signal synchronization. **Lead: SFMTA**

TRA Implementing Action 1.3: *Implement recommendations from the Core Capacity Transit Study.* Every day, transit operators move hundreds of thousands of people into and out of San Francisco’s core, which includes portions of the Financial District, South of Market, Mid-Market and Mission Bay neighborhoods. The study brought the major transit operators, BART, Muni, Caltrain, AC Transit, WETA, together to address this significant regional issue in a comprehensive and coordinated manner and recommendations should be implemented. Initial recommendations call for fleet and yard improvements, surface and light rail safety and capacity improvements, and the Geary Bus Rapid Transit project which, if funded, will help to meet future projected demand within the study area. **Lead: SFMTA and SFCTA**

TRA Implementing Action 1.4: *Apply for Cap and Trade funds from the various funding programs, including Transit and Intercity Rail Capital Program (TIRCP), Low Carbon Transit Operating Program (LCTOP), Affordable Housing and Sustainable Communities (AHSC), to support investments in the transit system and affordable housing.* California’s Cap and Trade program has been an important funding stream for expanding SFMTA’s transit system to meet mid-century population growth and efforts should be made to pursue Cap and Trade funds in the years ahead. **Lead: SFMTA**

SUCCESS STORIES

Muni Forward:

SFMTA has significantly expanded public transportation options through its Muni Forward Initiative. Informed by the Transit Effectiveness Project, the Muni Forward Initiative creates a rapid network that serves nearly 70% of all riders while providing a whole new level of more frequent and reliable service. Muni Forward is also improving the reliability of the transit fleet and making important safety and accessibility improvements across the city and is coordinating with WalkFirst to better accommodate the needs of families, seniors, and the disabled. Muni Forward is also using technology more effectively by improving the integration of our transit system with traffic signals and bringing more real-time information to our customers which is ultimately making our transit system smarter, safer, and more reliable. SFMTA is in the process of replacing over half of the transit signals in San Francisco with new signals that can detect an on-coming Muni bus or train and hold the green light. This allows the transit vehicle to make it to the next stop without having to wait at a red light which makes Muni a faster and more desirable travel option for San Franciscans.

Over the past two years, Muni Forward accomplishments include:

- **January 2015** - launched the new 55 16th Street line connecting 16th Street Mission BART to the new UCSF Medical Center and Mission Bay neighborhood.
- **April 2015** - rolled out the new "Rapid Network," prioritizing frequency and



reliability along San Francisco's most heavily used routes and launched the second of a series of four planned service increases which directly benefited 165,000 customers by increasing bus frequencies, longer AM hours, additional 40' buses, and Sunday service for the 38R.

- **September 2015** - launched the third round of service improvements which included brand new buses to make for a smoother and more comfortable ride, increased frequency and shorter wait times between buses on some of our most heavily used routes, larger buses on our crowded Express routes, expanded service hours in response to what we've heard from riders, and updated routes with new expanded connections across San Francisco. These Muni improvements are expected to provide more frequent transit service to 140,000 Muni riders.
- **April 2016** - rolled out the fourth and most robust package of improvements, which included service increases and expanded hours on 30 lines spanning the city.

LAND USE & TRANSPORTATION



Goal: By 2025, reduce vehicle miles traveled and single occupancy vehicle trips through robust and coordinated land use and transportation policies, plans and programming.

Coordinated transportation and land use planning is an effective long term strategy to reduce greenhouse gas emissions as it helps to shorten trip distances. Research has indicated that increasing the density and diversity of land use within transit rich urban areas can reduce emissions by up to 65 percent.⁴ Increased density and diverse land use helps shorten trip distances, reduces the need for parking and supports diverse and environmentally sustainable travel modes including transit, walking and bicycling. Dense and diverse land use and environmentally sustainable modes can also help to make San Francisco more affordable and healthier as more expensive car ownership wanes and residents make more active and affordable transit, biking and walking trips.

San Francisco's built environment has a number of attributes that can help to reduce vehicle miles traveled and single occupancy vehicle trips including- high density, diverse land uses, access to transit, interconnected and well-designed corridors and walkable neighborhoods. These attributes must be incorporated into the urban fabric of San Francisco as it grows in the coming years in order to reduce greenhouse gas emissions. This is especially important as San Francisco is in the midst of a construction boom and continues to be a regional housing and employment hub. Regional projections (Plan Bay Area) indicate that San Francisco will add 104,000 new housing units and 260,000 jobs between 2014 and 2040. Much of the projected growth is concentrated in the Priority Development Areas (PDA) which are located

in the financial district, SOMA and along the southeast waterfront, which are served by Muni and other regional transit operators such as BART, Caltrain and the regional ferry network.

Beyond the reliance on fossil fuels, local and regional land use patterns plays a large role in explaining why the transportation sector remains the single largest source of emissions in San Francisco. Currently, there is a mismatch between jobs centers and population centers. This problem has been exacerbated by the growth of regional jobs and housing centers areas that are not well served by public transit, or surrounded by dense and diverse land uses with well-connected active transportation networks. The local and regional housing crisis has also contributed to a mismatch in housing supply and demand and has led to longer automobile based commutes for many employees who work in San Francisco. Successful land use and transportation policies, planning and programming should reduce the potential of displacing existing residents into more carbon intensive suburban areas.

Looking forward, there remains critical work ahead and planning efforts should be focused on areas within the city where there are opportunities to increase the density and diversity of land uses while making investments in transit, the active transportation network and diverse housing stock that can sustain San Francisco's vibrant and diverse neighborhoods.

⁴ *Quantifying greenhouse gas mitigation measures, CAPCOA, 2010.*

LAND USE & TRANSPORTATION

Long-Term Strategies:

		GHG REDUCTION POTENTIAL	CO-BENEFITS				COST
LUT-1	Promote housing, job growth and infill development along transit corridors and within San Francisco's Priority Development Areas.		✓	✓	✓	✓	
LUT-2	Increase density, diversity of land uses and location efficiency across San Francisco.		✓	✓	✓		
LUT-3	Reduce off-street parking requirements for new development and re-development areas.		✓	✓	✓		
LUT-4	Increase the provision of affordable housing options across all income levels to reduce the commute shed of San Francisco workers.		✓	✓	✓	✓	

LEGEND



Potential to reduce greenhouse gas emissions



Potential to advance equity



Potential to improve public health



Consistent with Transit First Policy



Potential to support jobs and prosperity



Initial Capital Cost (public)

2018-2020 Implementation Actions and Recommendations:

LUT Implementing Action 1.1: *Identify new land use and transportation planning efforts and focus on areas that currently did not achieve the 2017 mode shift goals.* New planning efforts, such as the Balboa Reservoir Development Project, should consider opportunities for increased land use density and diversity, affordable housing, reduced or no parking minimums, and improved integration with transit and active transportation networks. **Lead: SF Planning, SFMTA and SFCTA**

LUT Implementing Action 1.2: *Implement innovative and robust land use and transportation plans, policies and projects.* Relevant city agencies should prioritize sustainable land use land use and transportation efforts that encourage higher density housing in proximity to transit, improves pedestrian and bicyclist safety and enhances the public realm. **Lead: SF Planning, SFMTA and SFCTA**

LUT Implementing Action 1.3: *Advance the Connect SF program.* The first phase of the Connect SF project will develop a 50-year vision that represents transportation priorities, goals and aspirations informed by land use. Connect SF, guided by the following principles: equity, safety and livability, environmental sustainability and economic vitality, will lay the foundation for San Francisco's 21st century low carbon and resilient transportation system. **Lead: SFMTA, SFCTA & SF Planning**

SUCCESS STORIES

Transportation Sustainability Program:

The Transportation Sustainability Program (TSP) is a collaborative and pioneering program that aims to keep people moving while San Francisco grows in the coming decades. The TSP involves the SFMTA, the Planning Department, the SF County Transportation Authority and the Office of Economic and Workforce Development and has a three pronged approach to implementation; “invest, shift and align”. The TSP will help invest in additional transit capacity, will lead to increased utilization of the multimodal transportation system and will result in smarter land use development in the coming decades which collectively will reduce greenhouse gases.

- **Invest** - The TSP would raise revenue from new development to maintain and expand the City’s transportation system. These funds have already contributed towards a signal priority project that will allow transit and rail vehicles to move efficiently throughout the city.
- **Shift** - The TSP would help manage demand on the transportation network

through a Transportation Demand Management (TDM) Program, making sure new developments are designed to make it easier for new residents, visitors, and workers to get around by sustainable travel modes such as transit, walking, and biking. The city passed an ordinance in Feb 2017 that requires developments to provide on-site amenities that support sustainable modes of transportation and reduce single-occupancy driving trips associated with new development.

- **Align** - The TSP will make the environmental review process align with the City’s longstanding environmental policies by changing how planners analyze the impacts of new development on the transportation system under the California Environmental Quality Act (CEQA). The new practice will emphasize travel options that create less traffic and will use vehicle miles traveled (VMT) instead of level of service “LOS” level of service as a new method of measurement regarding transportation analysis that recognizes the benefits of projects that reduce vehicular traffic.

SFpark:

SFpark, an innovative pilot project funded by the Department of Transportation Urban Partnership Program, aimed to improve the parking experience by integrating demand-responsive pricing and better information to make it easier to find a parking space. The 2014 evaluation report found that the project resulted in less congestion and circling which reduced the vehicle miles traveled associated with looking for a parking space. In particular, pilot areas saw a 30 percent decrease in vehicle miles traveled from 8,134 miles per day in 2011 to 5,721 miles per day by 2013 while control areas only saw a 6 percent decrease in vehicle miles traveled over the same time period. This

vehicle miles traveled reduction correlates to a reduction in over two metric tons of greenhouse gas emissions.

The SFMTA estimates that approximately 100,000 miles of driving are associated with the city’s 27,000 metered parking spaces every weekday which results in over 85 tons of greenhouse gases every day. As this innovative parking program is expanded throughout San Francisco in the years ahead it will help the metered blocks successfully meet parking availability goals and drivers will be able to find parking more efficiently which could help to reduce a significant source of greenhouse gas emissions while improving safety and overall efficiency of the transportation system.

SUCCESS STORIES

Partnerships for Climate Action

The City of San Francisco leverages partnerships to advance its climate action efforts. One particular effort, led by the Department of the Environment, involves C40 which is a global organization tasked with convening more than 80 of the world's most populous and influential cities who are taking action on climate change. The Department of Environment works with C40 to engage other megacities to exchange best practices and build local capacity. Climate action requires the use of data and tools to

help estimate greenhouse gas emissions and the cost-benefits of specific mitigation measures. C40 has been able to assist cities in developing data and tools to better understand climate impacts and help advance mitigation and adaptation goals.

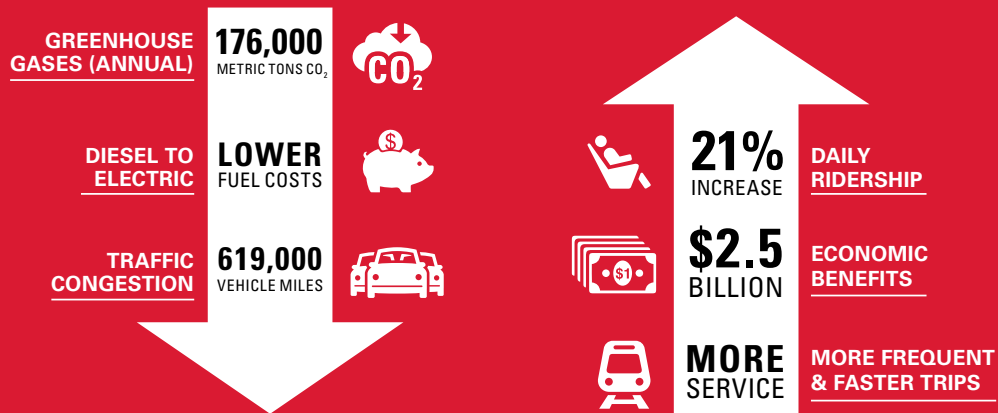
In one particular project, C40 is working with staff from across the city including the Department of Environment, Department of Public Health and the SFMTA to better understand how bicycle investments can improve public health and reduce greenhouse gas emissions.

Caltrain Electrification Project

Caltrain was recently awarded a \$ 647 million grant from the Federal Transit Administration to electrify its rail service which links the peninsula with San Francisco. An electrified Caltrain will help the region realize its climate goals and the electrified trains will substantially reduce air pollution.

Caltrain ridership was approximately 18,700,000 passengers in FY 16 and electrification will help to increase ridership by providing more frequent service along the 51 mile corridor. The electrification project is also a key component of the Caltrain Modernization Program and will help to reduce traffic congestion along the Highway 101 corridor.

KEY REGIONAL BENEFITS 2040



Caltrain Electrification Project. July, 2017

PRICING & CONGESTION MANAGEMENT



Goal: By 2025, reduce congestion, vehicle miles traveled and single occupancy vehicle trips through implementation of pricing and congestion management plans, policies and projects.

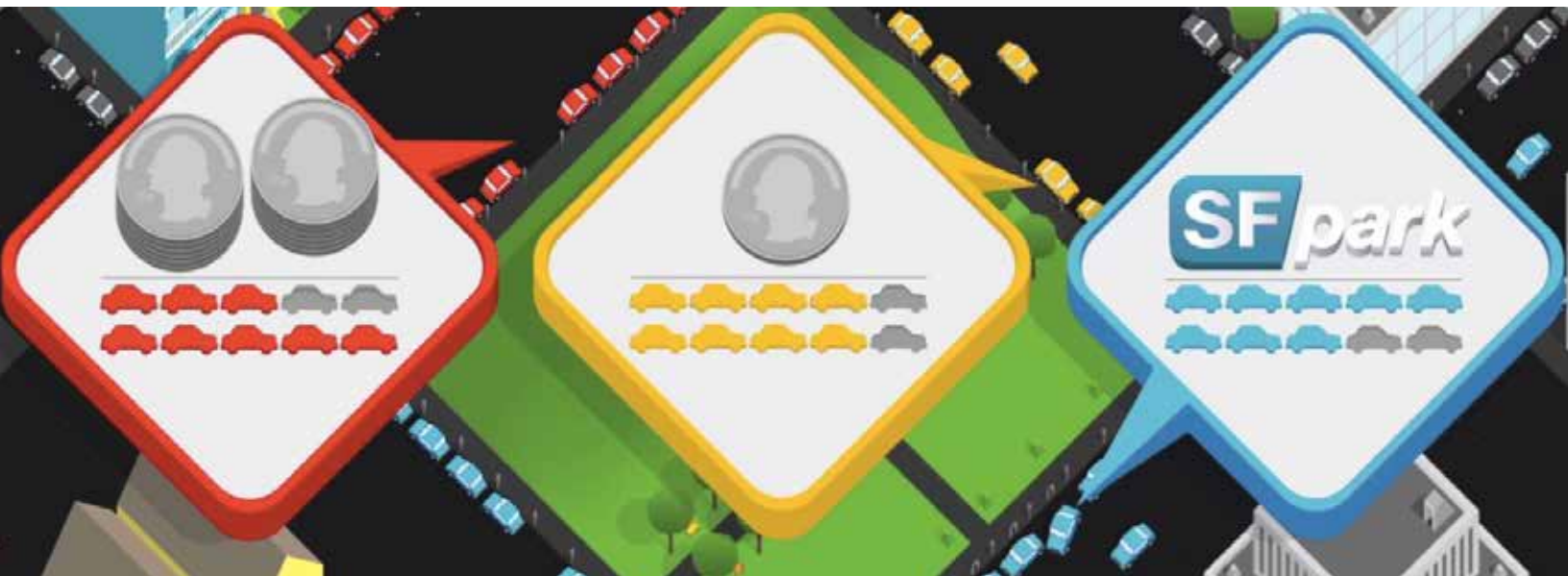
Pricing and congestion management measures are one of the most powerful and underutilized policy tools to help change travel behavior that could result in significant and rapid reductions of greenhouse gas emissions from the transportation sector. Recent research indicates that pricing and congestion management projects can reduce emissions by up to 25 percent.⁵ Effective utilization of pricing and congestion management plans, policies and projects can also encourage mode shift to transit and active transportation, reduce harmful pollution and congestion, save time and money, and can help generate stable revenue streams that can be used to fund public transit improvements and improve San Francisco's multimodal transportation system.

San Francisco has experience in the development and implementation of pricing and congestion management tools. The SFMTA and the SFCTA have been awarded numerous federal pricing grants from the Federal Highway Administration Value Pricing Pilot Program grant to evaluate the role of pricing in congestion and parking

management. The Value Pricing Program Pilot Program is intended to demonstrate whether and to what extent roadway congestion may be reduced through application of congestion pricing strategies, and the magnitude of the impact of such strategies on driver behavior, traffic volumes, transit ridership, air quality and availability of funds for transportation programs.

While there has been some progress implementing pricing and congestion management strategies and mechanisms, there continue to be challenges in widespread implementation of pricing strategies across San Francisco's transportation system. San Francisco is not alone in confronting challenges in this program area and only a few cities such as Singapore, London and Stockholm have been able to successfully implement programs such as congestion pricing programs in their downtown areas. At the regional level, pricing has been introduced on select corridors and bridges, such as the Bay Bridge, which has successfully reduced travel times and has encouraged mode shift from driving to public transit.

⁵ *Quantifying greenhouse gas mitigation measures, CAPCOA, 2010.*



PRICING & CONGESTION MANAGEMENT

Long-Term Strategies:

		GHG REDUCTION POTENTIAL	=	CO-BENEFITS			COST
PCM-1	Implement variable-rate road pricing in San Francisco and Treasure Island.			✓	✓		
PCM-2	Coordinate with partner agencies to implement toll pricing on the regional highway network within San Francisco.			✓	✓		
PCM-3	Integrate pricing principles into parking management and policies.			✓	✓		

LEGEND



Potential to reduce greenhouse gas emissions



Potential to advance equity



Potential to improve public health



Consistent with Transit First Policy



Potential to support jobs and prosperity



Initial Capital Cost (public)

2018-2020 Implementation Actions and Recommendations:

PCM Implementing Action 1.1: *Update pricing plans and strategies.* It has been seven years since the SFCTA led the Mobility, Access and Pricing Study and the time is ripe for an updated planning effort that leads to successful implementation of congestion pricing in San Francisco. Understanding equity issues and concerns and addressing them will be essential to successful implementation of pricing plans and policies. **Lead: SFMTA and SFCTA**

PCM Implementing Action 1.2: *Complete corridor pricing studies such as the San Francisco Freeway Corridor Management Study (FCMS) and implement recommendations in the next 3-5 years.* The FCMS is a performance-based assessment of strategies for improving the performance of, and managing the growth in demand for travel on, US-101 and I-280 in San Francisco and key recommendations should be fast tracked in order to reduce congestion on regional highway networks that connect San Francisco to the region. **Lead: SFCTA**

PCM Implementing Action 1.3: *Expand the SFpark program.* SFpark optimizes the use of existing parking resources to benefit drivers and everyone else who spends time in San Francisco. The pilot areas saw a 30 percent decrease in vehicle miles traveled from 8,134 miles per day in 2011 to 5,721 miles per day by 2013 while control areas only saw a 6 percent decrease in vehicle miles traveled over the same time period. Expansion of SFpark can help to reduce congestion, increase safety and reduce greenhouse gas emissions. **Lead: SFMTA**

TRANSPORTATION DEMAND MANAGEMENT



Goal: By 2025, reduce vehicle miles traveled and single occupancy vehicle trips through implementation of the Transportation Demand Management (TDM) Plan and Program.

Transportation Demand Management is a set of programs and policies that address and overcome barriers to using environmentally sustainable modes such as transit, bicycling, walking, and shared rides. TDM strategies include information and education, incentives, technology and physical improvements to the city's multimodal transportation system. The TDM strategies allow residents and visitors to make choices that are better for the environment, help manage congestion, help to reduce risks to pedestrians and cyclists, and improve the overall efficiency of the transportation network. The recently released TDM Plan contains 4 overarching goals:

- Goal 1: Make it easy for residents, employees and visitors to travel by transit, foot, bike, or shared rides when traveling to, from, and within San Francisco.

















- Goal 2: Institutionalize a culture in San Francisco that embraces walking, bicycling, taking transit and sharing rides.
- Goal 3: Collaborate on a wide variety of initiatives to leverage the impact of TDM.
- Goal 4: Ensure and prioritize effective programs through monitoring and evaluation.

San Francisco has a number of innovative TDM efforts underway. In February 2017, the SF Board of Supervisors approved an ordinance amending the Planning Code to establish a TDM program for new development across the city. This component of the TDM Program is designed to work with developers to provide more on-site amenities such as bike racks and transit passes, that will encourage smarter travel options so residents can get around more easily without a single occupancy vehicle which ultimately should result in fewer per-capita greenhouse gas emissions.



TRANSPORTATION DEMAND MANAGEMENT

Long-Term Strategies:

		GHG REDUCTION POTENTIAL	CO-BENEFITS				COST
							
TDM-1	Propose and advocate for strong policies that reduce single occupancy trips (SOV) trips into, through and within San Francisco.			✓	✓		
TDM-2	Encourage the use of transit, walking and bicycling through improved public information and engagement.		✓	✓	✓		
TDM-3	Improve integration with regional transit through coordinated programs, tools and services.		✓		✓		
TDM-4	Facilitate transportation equity through targeted provision of programs that encourage minority, low-income and senior populations to take transit, walk, bike, use rideshare or car share.		✓	✓	✓		
TDM-5	Propose and enhance programs that work with employers, residential and school communities to support people using non-SOV transportation options.		✓	✓	✓		

LEGEND



Potential to reduce greenhouse gas emissions



Potential to advance equity



Potential to improve public health



Consistent with Transit First Policy



Potential to support jobs and prosperity



Initial Capital Cost (public)

2018-2020 Implementation Actions and Recommendations:

TDM Implementing Action 1.1: *Support efforts for integrated and regional fare/pass development to maximize region-wide transit ridership and promote equity.* Many of the transit trips within San Francisco originate outside of the city on other transit operators. Ideally, transfers can be seamless and schedules can be coordinated to improved connectivity and reliability. **Lead: SFMTA and SF Environment**

TDM Implementing Action 1.2: *Develop an employer outreach program to encourage and support non-single occupancy vehicle travel to work outside of the downtown core.* In order to ensure that the city’s burgeoning work force will use environmentally sustainable modes it will be necessary to provide outreach and incentive programs. The environmentally sustainable travel modes, bicycling, walking, transit, should be the cornerstone of the city’s employer commuter programs. **Lead: SFMTA and SF Environment**

TDM Implementing Action 1.3: *Create a TDM program for K-12 schools in SF, especially SFUSD.* San Francisco already has program such as “Safe Routes to Schools” that encourage the city’s youth to use the multimodal transportation system. However, additional programs should be developed through the TDM program. **Lead: SFMTA and SF Environment**

SUCCESS STORIES

Coordinate Commuter Shuttles:

Many San Francisco residents travel throughout the region for employment opportunities. Over the past few years, the SFMTA has been working with privately operated commuter shuttles to help reduce single occupancy automobile trips, vehicle miles traveled and greenhouse gas emissions for a subset of these trips that link San Francisco with the region. The SFMTA conducted an 18-month pilot (August 2014-January 2016) to test sharing designated Muni zones with eligible commuter shuttles who paid a per stop fee and agreed to comply with permit terms and conditions. Based on an evaluation of the Pilot Program¹⁰ these shuttles are associated with reduced auto ownership and the increased use of transit, walking, and bicycling for non-commute trips. Nearly

half of all riders do not own cars and half of those cited shuttles as the main reason they did not own a car. Nearly half of all the riders also indicated that they would drive alone to work if a shuttle were not available which would increase emissions and congestion. The report finds shuttles removed nearly 4.3 million vehicle miles traveled from the region's streets. In addition, under the on-going program, in order to operate in the permit program any new shuttle vehicle must meet 2012 California emissions standards, ensuring that over time the percentage of vehicles year 2012 or newer will continue to increase, further reducing greenhouse gas emissions. The percentage of registered vehicles model year 2012 or newer has increased from 59 percent at the end of the pilot to 76 percent in the current program.²

Bay Area Bike Share:

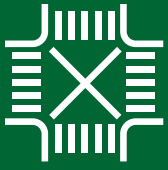
In 2013, the Bay Area Bike Share (BABS) program initiated a pilot project to test the viability of bike sharing throughout the Bay Area. The SFMTA, in partnership with the Bay Area Air Quality Management District, brought Bay Area Bike Share to San Francisco in August 2013 with 350 bikes and 35 stations. Bicycle sharing, similar to car sharing, allows members to check out a bicycle at a station and return to another station after use. The stations were located within the employment and transit rich Financial District and SOMA neighborhoods. As of early 2015, San Francisco has exceeded its usage projections with an average of 2.6 trips/bike/day which is higher than a number of other US cities that currently have bike sharing programs. San Francisco riders have taken approximately 540,000 trips over the pilot period and have purchased 25,000 memberships. As can be

expected the summer months have seen the highest number of trips. MTC's Climate Initiative Program Evaluation reports that 12% of all first year bike trips would otherwise have been drive-alone trips so bike share is an important element in reducing the number of drive-alone automobile trips which accounts for approximately 15,914 peak period vehicle trips that were reduced during the pilot period. Over the course of the first year of the pilot the bike share program was able to a net reduction of 71.4 tons of greenhouse gas emissions. After four successful years as a small-scale proof-of-concept, the service shut down on June 11th, 2017 in preparation for a major expansion and rebranding as Ford GoBike. In mid-2017, the GoBike system will begin a major expansion from 700 to 7,000 bikes, ultimately covering half of San Francisco with 320 stations and adding stations in the East Bay and San Jose.

¹ *Commuter Shuttle Pilot Program, 10/2015.*

² *Commuter Shuttle Program April – September 2016 Status Report, 11/2016*

COMPLETE STREETS



Goal: By 2025, increase the number of “complete streets” throughout the city which encourages sustainable mode shift, increases safety and improves the public realm.

Streetscapes design and amenities play a large role in determining mode choice and travel behavior, and thus per-capita greenhouse gas emissions. Past investments prioritizing the movement and storage of automobiles explain much of the transportation sector’s high percentage of greenhouse gas emissions. A 2014 study found that only 2.4 percent of street space in San Francisco was devoted to transit-only or bike-only lanes even though automobile trips account for fewer than half of all trips.⁵ In order to change this paradigm, urban centers such as San Francisco need to build “complete streets” which include pedestrian, bicycle, and streetscape improvements as part of any planning or construction projects in the public right-of-way. These changes will help advance mode shift goals, increase public safety and improve public health and the public realm. The San Francisco Better Streets Plan contains a definition of a “complete street”:

“..streets are designed and built to strike a balance between all users regardless of physical abilities or mode of travel. A Better Street attends to the needs of people first, considering pedestrians, bicyclists, transit, street trees, stormwater management, utilities, and livability as well as vehicular circulation and parking.”

San Francisco is a city of short trips with over fifty percent of them being made via environmentally sustainable modes like walking, biking and transit. For example, data from the American Community Survey found that between 2006 to 2015, San Francisco added roughly 100,000 commuters, and 85 percent of the additional trips are car-free. Just over half (53,000) are made by transit, and the combined

growth in commutes by foot (13,000) and bike (12,000) are nearly double those by car (15,000). Prioritizing walking, bicycling and transit over private car usage is at the core of the city’s Transit-First Policy, which guides the city’s vision for a world-class, people-centered city.

Complete streets are also safer streets. The City is working to eliminate traffic fatalities by 2024 through its Vision Zero policy framework. San Francisco adopted Vision Zero as a policy in 2014, committing to build better and safer streets, educate the public on traffic safety, enforce traffic laws, and adopt policy changes that save lives. The goal is to create a culture that prioritizes traffic safety and to ensure that mistakes on the city’s roadways do not result in serious injuries or death. In order to meet San Francisco’s Vision Zero goals and its ambitious 2030 mode shift goals (80 percent of trips using environmentally sustainable modes) a collaborative transformation of how the city’s streets are designed, built and managed is required.

Finally, one of the added benefits of a “complete street” is that “complete streets” can integrate green infrastructure into the city’s urban fabric which can help to sequester carbon dioxide from the atmosphere and also help improve habitat while enhancing the public realm. Green infrastructure can also help build a more resilient city as it provides a cost effective solution for addressing stormwater management issues and urban and coastal flooding issues. In short, incorporating green infrastructure into the city’s streets and public spaces can provides a unique opportunity to advance climate mitigation and climate adaptation actions simultaneously.

⁵ *Transportation Choices for Sustainable Communities Research and Policy Institute, San Francisco Modal Equity Study, October 2014*

COMPLETE STREETS

Long-Term Strategies:

		GHG REDUCTION POTENTIAL	CO-BENEFITS				COST
CST-1	Conduct community planning to support the building of a comprehensive protected bicycle network to support bicycle mode shift.		✓	✓	✓		
CST-2	Implement Vision Zero policy to create safer streets.		✓	✓	✓		
CST-3	Integrate “Pavement to Parks” concepts and green infrastructure into transportation plans and projects.		✓	✓	✓		

LEGEND



Potential to reduce greenhouse gas emissions



Potential to advance equity



Potential to improve public health



Consistent with Transit First Policy



Potential to support jobs and prosperity



Initial Capital Cost (public)

2018-2020 Implementation Actions and Recommendations:

CST Implementing Action 1.1: *Update the 2009 SFMTA Bike Plan.* San Francisco bike mode share has been increasing over the past few years but ridership needs to expand significantly in order to meet new mode shift targets. Research indicates that ample and safe bike infrastructure is the main determinant of a bicycle mode choice. San Francisco needs an updated plan to guide investments and decisions that will help increase bicycle mode share. **Lead: SFMTA**

CST Implementing Action 1.2: *Construct high priority components of the bicycle network.* San Francisco has a good bicycle network but improvements are needed to better connect and protect the network. Construction of high priority sections of the network should help to increase safety and bicycle ridership across the city. **Lead: SFMTA**

CST Implementing Action 1.3: *Identify and construct “complete streets” projects that will increase pedestrian and bicycle safety.* City agencies and partners should advance the Vision Zero policy and in particular, implement the action items identified in the 2017-2018 Vision Zero Action Strategy. **Lead: SFMTA and SF Planning and Vision Zero partners.**

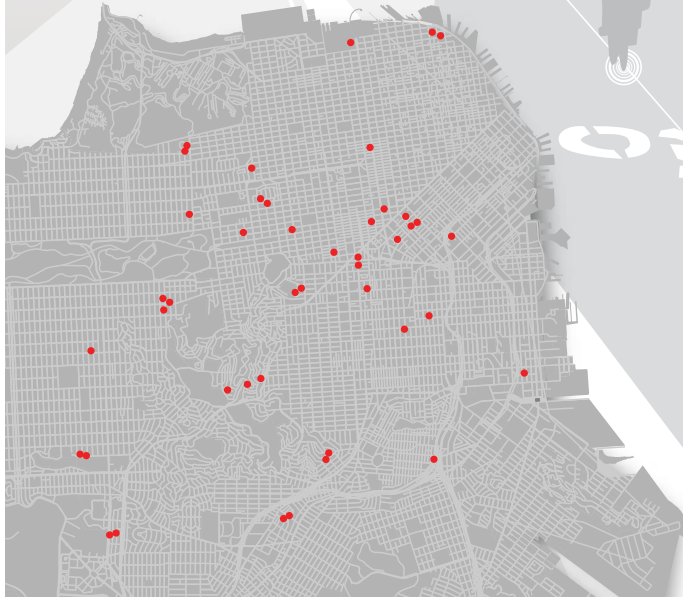
CST Implementing Action 1.4: *Improve agency integration of green infrastructure into “complete streets” projects.* Green infrastructure can serve a variety of important roles within the city’s urban fabric: enhancing the public realm, improving stormwater and flood management and providing habitat which can improve biodiversity. **Lead: SF Planning and SFMTA with partner agencies.**

BICYCLE RIDERSHIP DATA 2016 KEY FINDINGS

Interactive data now at
www.sfmta.com/bikecount

Each year, the SFMTA measures bike ridership in San Francisco by collecting data from a network of automated bike counters, which use sensors embedded in the pavement, and by conducting manual bike counts at key locations around the city.

The automated counter data used in 2016 came from 44 counters spread throughout the city.



At 19 locations where we conducted manual bike counts, bike trips increased **10%** from 2015 and **213%** from 2006

The U.S. Census Bureau estimated that **4.3%** of San Francisco residents commuted by bike in 2015.

Wet weather led to a **5% decrease** in bike counts logged at 24 counters in November and December.

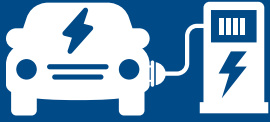
790,000 bikes were counted in May, the busiest bicycling month of the year.

More than **25,000 bikes** were counted at the **44** automated counters on an average weekday.

There are an estimated **82,000** bike trips in San Francisco per day.



ZERO EMISSION VEHICLES & INFRASTRUCTURE



Goal: By 2025, increase the number of zero emissions vehicles (ZEV) in both private and public vehicle fleets in San Francisco and improve access to charging infrastructure.

Strategic electrification of the transportation sector has the potential to rapidly reduce greenhouse gas emissions. A recent report by the Natural Resources Defense Council and the Electric Power Research Institute⁶ found that under a scenario in which 53 percent of U.S. vehicles are electric by the year 2050 transportation sector greenhouse gas emissions could be reduced by up to 60 percent. California is a leader in zero emission vehicle (ZEV) policies and programs and aims to have 1.5 million ZEVs on California's roadways by 2025 with support from a well developed network of charging infrastructure.

The transportation sector remains the largest single source of the city's emissions largely because the fossil fuel used to power cars, trucks and other vehicles is very carbon intensive and produces high amounts of greenhouse gas emissions. Additionally, fossil fuels like petroleum diesel emit criteria air pollutants like particulate matter which impact the health of community members. ZEVs, including battery electric and fuel cell electric vehicles, move people and goods using electricity or hydrogen and are significantly less carbon intensive than their internal combustion engine counterparts. Additionally, ZEV's within San Francisco have a less carbon intensive energy source because the San Francisco Public Utilities Commission (SFPUC) and PG&E provide significant amounts of renewable electricity to San Francisco's grid which helps the city, region and state achieve climate and air quality goals.

San Francisco has taken a number of steps recently to strategically electrify elements of the transportation sector. In 2015, Mayor Ed

Lee established the Electric Vehicle Working Group (EVWG) to identify actions and policies to continue electric vehicles (EV) growth in San Francisco. Its objective is to ensure that EVs are available, affordable and easy to use for all San Franciscans. Led by the Office of the City Administrator and SF Environment, the EVWG is tasked with development of recommendations and solutions that result in electrification of the city's municipal fleet, and market transformation of EVs in the private sector. In 2016, two ordinances were passed by the Board of Supervisors. The first requires the conversion of the city's light duty passenger vehicle fleet to ZEVs by 2022. The second helps San Francisco building owners meet the growing public demand for EV charging, requiring that all new residential, commercial, and municipal buildings to have sufficient electrical infrastructure to simultaneously charge vehicles in 20 percent of parking spaces.

While electrifying the transportation sector does have great potential, there remain challenges as San Francisco's overarching transportation policy is its Transit First Policy which prioritizes transit, bicycling and walking over single occupancy vehicle trips regardless of their fuel source. In addition, electrifying the transportation sector only addresses one of the many adverse impacts from the transportation sector: greenhouse gas emissions and pollution. The other adverse impacts including congestion and safety still exist in an electrified transportation sector. However, San Francisco is prepared to examine and address these challenges as it advances its zero emission vehicle planning efforts in the years ahead.

⁶ *Electric Power Research Institute and Natural Resources Defense Council, Environmental Assessment of a Full Electric Transportation Portfolio, 17 September 2015.*

ZERO EMISSION VEHICLES & INFRASTRUCTURE

Long-Term Strategies:

		GHG REDUCTION POTENTIAL	CO-BENEFITS				COST
EVI-1	Develop and implement plans and policies that support adoption of zero emission technology.		✓	✓		✓	
EVI-2	Develop pilot projects that can be used to demonstrate the role of zero emission vehicle technology.		✓	✓		✓	
EVI-3	Secure funds to help convert public and private vehicles to zero emission vehicles.		✓	✓		✓	

LEGEND



Potential to reduce greenhouse gas emissions



Potential to advance equity



Potential to improve public health



Consistent with Transit First Policy



Potential to support jobs and prosperity



Initial Capital Cost (public)

2018-2020 Implementation Actions and Recommendations:

EVI Implementing Action 1.1: *Develop a zero emission vehicle strategy or “roadmap” that supports the adoption of zero emission technology.* This strategy will prioritize and guide investments and decisions related to electrifying the transportation sector, in the context of the Transit First policy, and will engage city partners, the public and private sector and key stakeholders. **Lead: SF Environment, SFMTA and partners including the Mayor’s EV Working Group**

EVI Implementing Action 1.2: *Implement pilot projects and high priority recommendation of the zero emission vehicle strategy.* The strategy and appropriate pilot projects should be implemented in order to strategically advance ZEV adoption across San Francisco. The projects should be implemented in coordination with city partners, key stakeholders and the public. **Lead SFMTA and SF Environment**

EVI Implementing Action 1.3: *Develop actions plans that can guide the conversion of the taxi fleet, paratransit fleet, school buses and the non-revenue municipal fleet to zero emissions vehicles.* These actions plans should be developed to help guide the conversion of these fleets. **Lead: SFMTA and SF Environment.**

EMERGING MOBILITY SERVICES & TECH



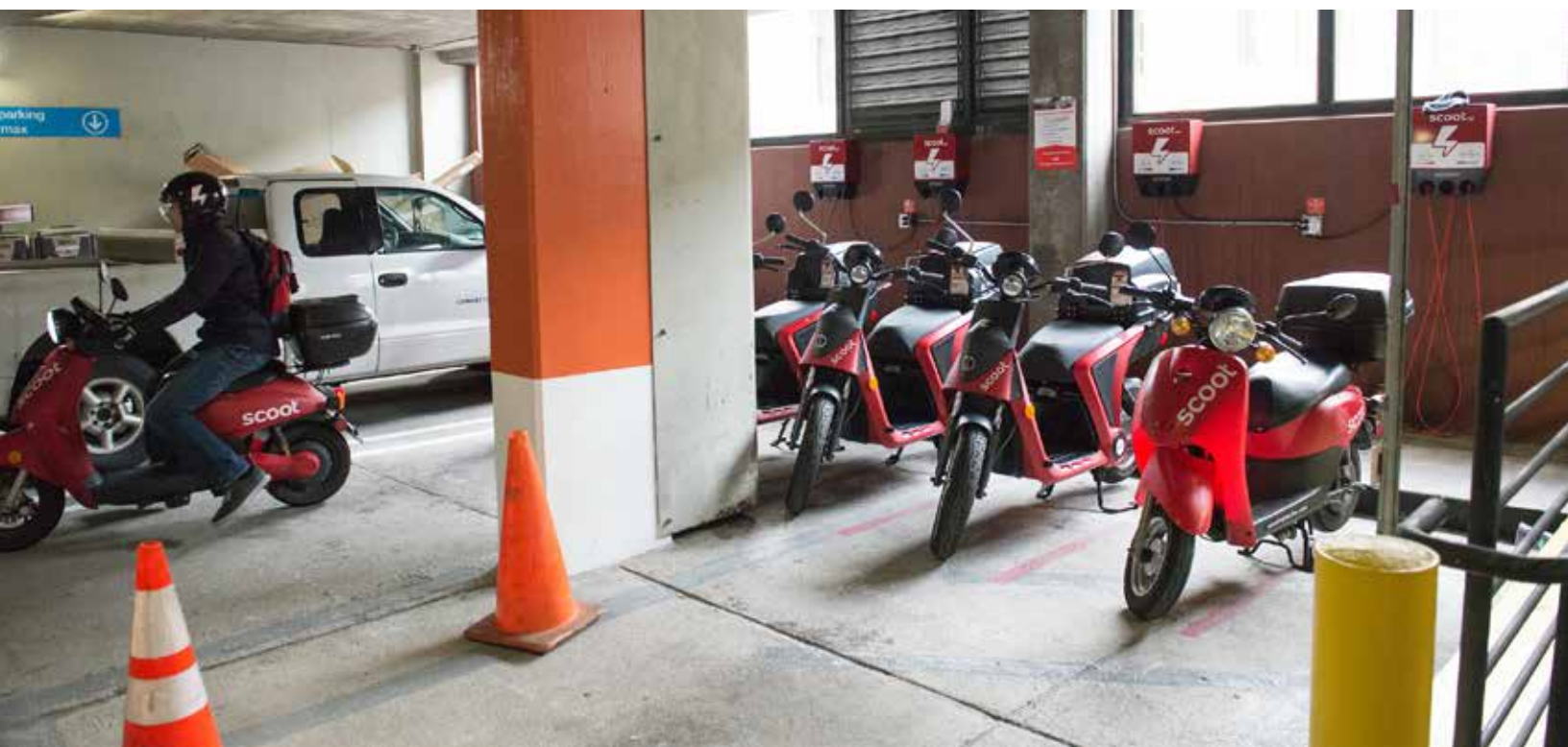
Goal: By 2025, lay the foundation for a healthy mobility ecosystem that appropriately integrates emerging mobility services and technologies that improves accessibility, affordability, safety, and environmental sustainability.

Technology is playing an increasingly large role in shaping how urban residents move throughout urban environments, from mobile applications that connect passengers with demand responsive transportation vehicles, to smart traffic signals that can prioritize both transit and pedestrians, to shared, electric, connected, and autonomous vehicles. However, these emerging mobility services present both opportunities and challenges as cities work to build accessible, affordable, safe, and environmentally sustainable transportation options for all.

Urban cities have the potential to leverage technology to help transform the transportation sector and reduce greenhouse gas emissions in the years ahead. San Francisco would like to find opportunities to collaborate with partners that offer mobility services and technologies, while also ensuring that the implementation of these new transportation services reflects broader core values and mission of the city and

its transportation agencies. In order to guide this public-private dialogue, the SFMTA and the SFCTA have developed Guiding Principles for Emerging Mobility Services and Technology which provides a framework for decision making as the transportation sector evolves.

Consistent with its Transit First policy, San Francisco will continue to prioritize walking, biking, and transit trips. Looking to the future, many trips that require vehicles could be made using shared- electric-connected and potentially autonomous vehicles, which have potential to decrease automobile ownership, greenhouse gas emissions, and vehicle miles traveled. In order to ensure that these future trips are made in ways that complement existing policies and principles, San Francisco must examine and engage the public to understand how emerging mobility service providers can help transform the sector to be safer and equitable while benefiting the environment and improving the quality of life.



EMERGING MOBILITY SERVICES & TECH

Long-Term Strategies:

		GHG REDUCTION POTENTIAL	CO-BENEFITS				COST
EMS-1	Establish an Innovation team at SFMTA that will build strategic partnerships and guide decision making on emerging mobility services and technology.		✓	✓			
EMS-2	Expand bicycle sharing throughout San Francisco.		✓	✓	✓		
EMS-3	Expand and support vehicle sharing services that use zero emission vehicles.			✓			

LEGEND



Potential to reduce greenhouse gas emissions



Potential to advance equity



Potential to improve public health



Consistent with Transit First Policy



Potential to support jobs and prosperity



Initial Capital Cost (public)

2018-2020 Implementation Actions and Recommendations:

EMS Implementing Action 1.1: *Develop and implement an Emerging Mobility Services Strategy.* The Strategy will integrate the Guiding Principles for Emerging Mobility Services and Technologies which recognize the importance of clean air and sustainability, transit, social equity and accessibility. **Lead: SFMTA and SFCTA.**

EMS Implementing Action 1.2: *Implement new technology driven pilot projects across the transportation sector.* Pilot projects such as the Smart Traffic Signals and Smart Carpools, that better manage the city’s streets, reduce greenhouse gas emissions, and prioritize transit, bicycling, and walking should be implemented. **Lead: SFMTA and SFCTA.**

EMS Implementing Action 1.3: *Quantify greenhouse gas emissions from emerging mobility service providers including TNCs.* At this time, there are no estimates of the greenhouse gas emissions from the TNC fleet. The SFCTA recently estimated the vehicle miles travelled (VMT) from the TNC fleet but there is a need for an estimation of emissions from the TNC fleet which ideally can be incorporated into the next Climate Action Strategy and can be used to inform policies and implementation actions. **Lead: SFCTA, SF Environment and SFMTA.**

EMS Implementing Action 1.4: *Collect, manage and analyze data from service providers and via improved technology that reflects the emerging mobility system in San Francisco.* Accessing data and information will be critical to understanding how the transportation sector is changing and will help build effective policies, plans and projects. **Lead: SFMTA, SF Environment, SF Planning and SFCTA.**

Climate Adaptation: Building A Resilient Transportation System



Climate Adaptation

The San Francisco Transportation Sector Climate Action Strategy has historically focused on identifying and implementing strategies that reduce harmful greenhouse gas emissions from San Francisco's multimodal transportation sector. However, there is broad recognition that reducing greenhouse gas emissions alone will not be sufficient to adequately address a changing climate system and that certain climate impacts such as sea level rise are inevitable in the coming decades. Climate impacts, such as sea level rise, have the potential to significantly alter the San Francisco shoreline and the city's multimodal transportation system. Potential impacts from sea level rise and coastal erosion could significantly disrupt transit service and damage key transportation corridors, assets and facilities.

In order to address these impacts, it is necessary to begin the process of adapting the transportation system to a changing climate. Climate adaptation principles are increasingly being integrated into transportation plans and

policies from the recently passed federal FAST Act to the region's Sustainable Communities Strategy. This pioneering adaptation section provides a background on climate change and sea level rise, an overview of San Francisco's and the SFMTA current climate adaptation program as well as the goals and strategies that will lead to a more resilient transportation system within San Francisco.

The costs of adaptation planning are far less than the potential damage from inaction. A recent economic analysis, conducted by the Office of City Administrator, examined the value of public and private property within areas potentially vulnerable to 66 inches of sea level rise which reflects the high end 2100 sea level rise scenario. The analysis found the value of the San Francisco transportation system within the vulnerable area to be valued at \$1.8 billion. This estimate reflects the property replacement value in 2016 and does not take into account any planned or anticipated adaptation efforts. It also does not reflect any economic costs associated with transportation system and transit service disruption.



Climate Adaptation

Projected Climate Impacts

As a result of altered atmospheric and climatic conditions, cities throughout the world are likely to experience significant climate impacts. The most significant and direct climate impacts for coastal cities such as San Francisco are likely to be sea level rise, coastal erosion, urban flooding, droughts and heatwaves. Recent coastal hazard events such as Superstorm Sandy and Hurricane Katrina serve as important reminders of the need to integrate climate risk management and hazard mitigation principles into relevant transportation plans, policies and operations before future significant climate impacts occur in the coming years.

Sea level rise and San Francisco's response to changing coastal conditions will fundamentally alter San Francisco's shoreline and will significantly redefine how people and goods move throughout San Francisco. In addition, sea level rise, coastal erosion and urban flooding have the potential to significantly disrupt local and regional transit service, damage critical assets and facilities and alter the City's vital coastal transportation corridors such as the Embarcadero, Great Highway, and the Third Street corridor along the Southeast Waterfront. Therefore, it will become increasingly important for the City, the region and state and federal partners along with private sector partners to work collaboratively and creatively to increase the resilience of the shoreline, coastal communities and the transportation system.

The SFMTA definition of resiliency comes from The National Academy of Science which defines resilience as "the ability to prepare and plan for, absorb, recover from and more successfully adapt to adverse events."

Sea Level Rise and Coastal Flooding

Sea level rise is associated with the melting of land based ice and thermal expansion of the ocean. As of 2016, San Francisco is using the following sea level rise projections to guide adaptation planning efforts, 6-12 inches of sea level rise (2030), 11-24 inches (2050), and 36-66 inches (2100). The lower end projections represent a "most likely" scenario, while the higher end projections represent an "unlikely but possible" scenario. San Francisco is also integrating the 1 percent coastal storm event into its long term planning and is considering up to 108 inches of sea level rise to reflect the upper end, "unlikely but possible" 2100 sea level rise scenario with a one percent coastal storm event.

It should be noted that the above projections do not include other forces such as storm surge or El Nino that can significantly increase the elevation of tidal waters during storm or ocean warming events. The maps (Fig 1.5) depicts the vulnerable areas along the San Francisco shoreline that could be impacted by the 108 inch sea level rise scenarios.

Year	Lower End of Range	Upper End of Range
2030	2 in	12 in
2050	5 in	24 in
2100	17 in	66 in

Fig 1.5. National Research Council Sea Level Rise Projections (2012)

Climate Adaptation

Coastal Erosion

Erosion is a significant issue for coastal cities and is driven by changes in water levels, sediment dynamics and storm events. The Pacific coast of San Francisco along Ocean Beach is susceptible to erosion and the southern extent of Ocean Beach has been impacted by erosion events in the past. Past erosion has led to loss of bluff top parking and closures of the Great Highway. The

Ocean Beach Master Plan provides a framework for addressing erosion and building a more resilient shoreline and transportation system along San Francisco's Ocean Beach. The Planning Department is also in the process of updating its Local Coastal Program to address sea level rise and coastal erosion which will also provide a policy framework for building a more resilient shoreline.



Figure 1.6. Map of areas impacted by 108 inch sea level rise.

Climate Adaptation

Urban Flooding

Urban (pluvial) flooding is associated with high precipitation events which can lead to localized flooding in upland locations. In San Francisco, urban flooding has occurred along Market Street and throughout portions of the Mission District, South of Market and Visitacion Valley. Urban flooding can impact transportation corridors and transit operations by flooding streets and subway stations. Sea level rise and urban flooding can occur simultaneously when high tide events occur during high precipitation events leading to widespread flooding in areas that may not be immediately adjacent to the shoreline. This problem will only worsen with sea level rise as it will be challenging for stormwater to drain efficiently to the Bay or Pacific Ocean under future sea level rise scenarios. Fortunately, the SFPUC has been actively studying the issue of urban flooding as it builds a more resilient stormwater and sewage system for the city.

Other Climate Impacts

Beyond sea level rise, coastal erosion and urban flooding there are other climate impacts, such as high heat and drought, that have the potential to impact San Francisco and its transportation system in myriad ways. In the coming decades, heat waves and extreme heat days are likely to occur with greater frequency in the region and could disproportionately impact seniors and low income residents who are less able to cope with heat stress and poor air quality. (Fig 1.6) In addition, heat waves and high temperatures can impact the energy grid, transportation infrastructure and transit vehicles resulting in outages, service disruptions and damage to critical components of the transportation system. Finally, drought conditions may impact agency facility operations such as bus washing and irrigation practices across the city.

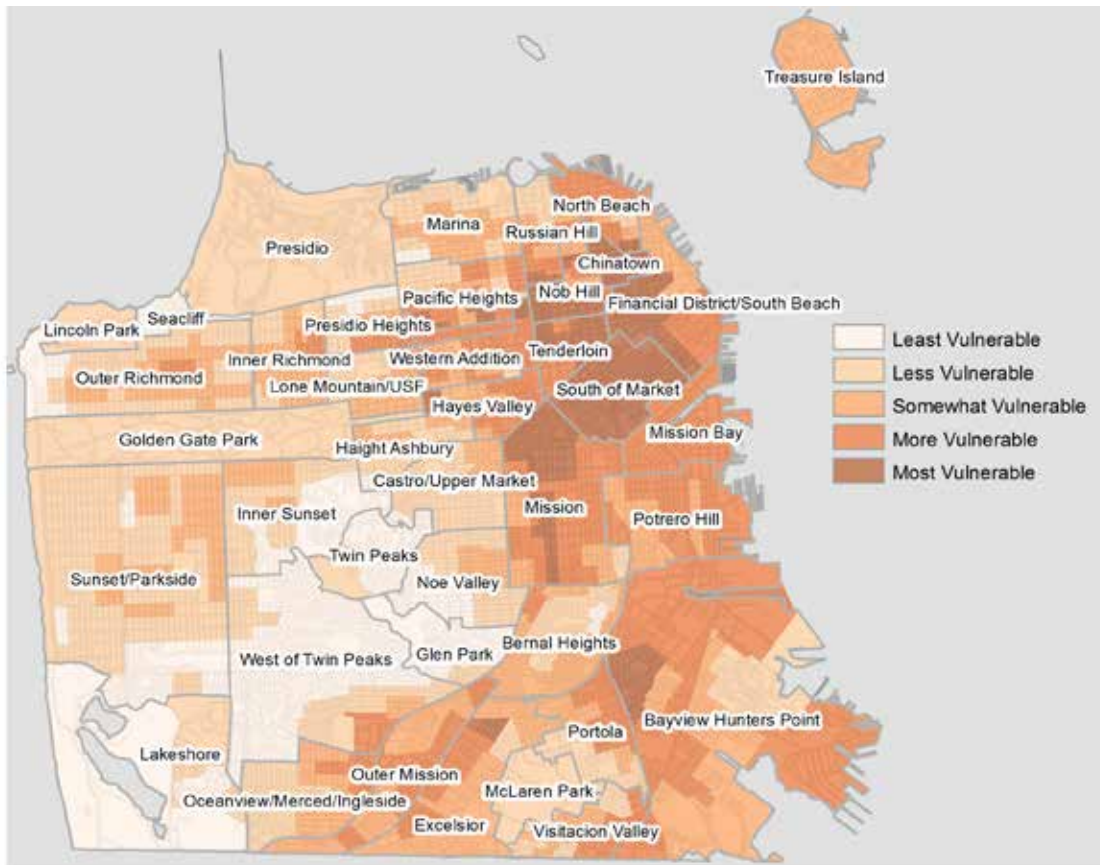


Fig 1.7 Heat vulnerability index (SFPDPH 2012)

Climate Adaptation

Climate Adaptation: From Regional to Agency Actions

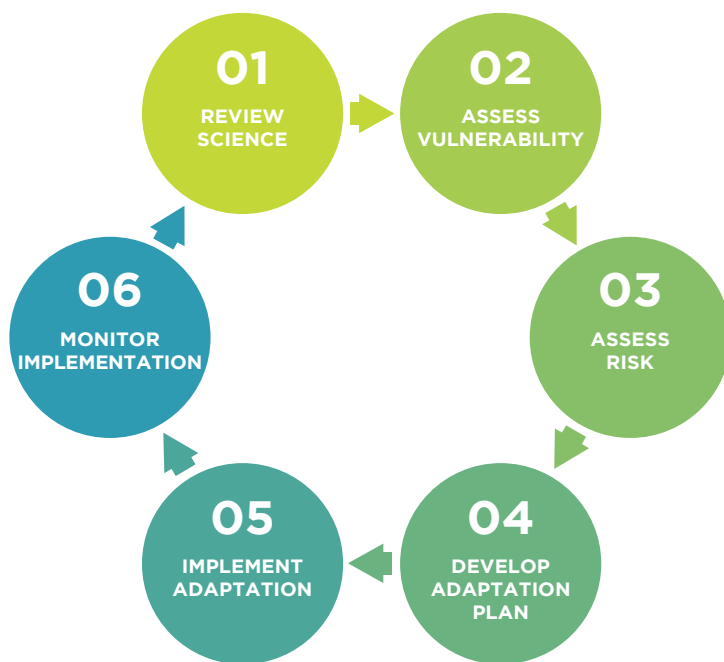
The SFMTA and partner agencies are poised to make important strides towards increasing the resilience of the transportation system in the coming years. Climate adaptation involves taking proactive actions to minimize the risks posed by climate change. The adaptation planning framework is a cyclical process that involves the steps identified in Fig 1.7. Currently, the SFMTA and city partners are at Step 2 and are currently conducting a citywide vulnerability assessment of the multimodal transportation sector.

Successful climate adaptation will require unprecedented coordination and collaboration involving local, regional, state and federal partners. In addition, private sector partners will also play a role in building a more resilient city and transportation system. Fortunately, climate adaptation efforts are occurring at multiple scales throughout the Bay region.

Bay Area

The San Francisco Bay Area has been a global leader in increasing the resilience of the region to seismic hazards. This increased resiliency has been developed through a coordinated approach involving an array of disciplines including engineers, architects, planners, educators, scientists and the public. Similarly, the region has developed an innovative and practical approach to increasing the resilience of the region to future sea level rise and flooding impacts. Led by the San Francisco Bay Conservation and Development Commission, the Adapting to Rising Tides (ART) Program, is advancing the region's pioneering resiliency efforts. The ART Program was initiated in 2010 and has worked with federal, regional and local planners and policy makers to increase the understanding of climate impacts and to orient partners to the fundamentals of the adaptation planning process. ART and the Bay

Area Regional Collaborative (BARC) were recently awarded funds from Caltrans to conduct a regional transportation system vulnerability assessment and the SFMTA will be active participants in this regional assessment. Additionally, the region is hosting the Bay Area Resilient By Design Challenge which is a collaborative research and design project that brings together local residents, public officials and local, national and international experts to develop innovative solutions that address sea level rise.



(Fig 1.8) Climate adaptation framework. (Source. San Francisco Sea Level Rise Action Plan, 2016)

Climate Adaptation

City of San Francisco

The city's adaptation planning efforts are being coordinated by the Mayor's Sea Level Rise Coordinating Committee which is chaired by the Port of San Francisco and the Planning Department. Over the past few years, the Coordinating Committee and city partners have initiated a number of citywide climate adaptation projects.

The 2016 **San Francisco Sea Level Rise Action Plan** accomplished the following tasks:

- Establishes an overarching vision, goals, and a set of guiding principles for sea level rise planning in San Francisco
- Summarizes current climate science, relevant policies and regulations, and vulnerability and risk assessments conducted to date
- Identifies data gaps and establish a framework for further assessment, adaptation planning, and implementation
- Provides the foundation and guidance to develop a future citywide Sea Level Rise Adaptation Plan

The 2015 **Capital Planning Committee Sea Level Rise Guidance and Checklist** provides direction from the Capital Planning Committee (CPC) to all departments, including the SFMTA, on how to incorporate sea level rise into new construction, capital improvement, and maintenance projects. The Checklist applies to all City projects that are within a defined "Vulnerability Zone" and cost more than five million dollars.

The San Francisco Planning Department is currently amending the **Local Coastal Plan (LCP)** and is utilizing the best available science to address sea level rise and erosion due to climate change. The LCP amendment aims to implement a number of recommendations from the Ocean Beach Master Plan⁸ and will provide the city's policy framework for long-term resiliency by balancing environmental resources, maintaining coastal access, addressing community needs, and protecting critical public infrastructure, such as wastewater treatment facilities.

The Port of San Francisco is advancing its **Seawall Resiliency Project** which will help prepare San Francisco's waterfront to withstand the next major earthquake and flood risk from sea level rise. The Seawall was constructed more than a century ago and is the foundation of over three miles of San Francisco waterfront

⁸ *Ocean Beach Master Plan, SPUR, 2012*



Climate Adaptation

stretching from Fisherman’s Wharf to Mission Creek. The Seawall supports historic piers, wharves, and buildings including the Ferry Building and underpins the Embarcadero Promenade which welcomes millions of people each year, serves as a critical emergency response and recovery area, and supports BART, Muni and ferry transportation and utility networks. The Seawall requires significant improvements to survive the next major earthquake and to address increasing flood risk from sea level rise and climate change.

SFMTA

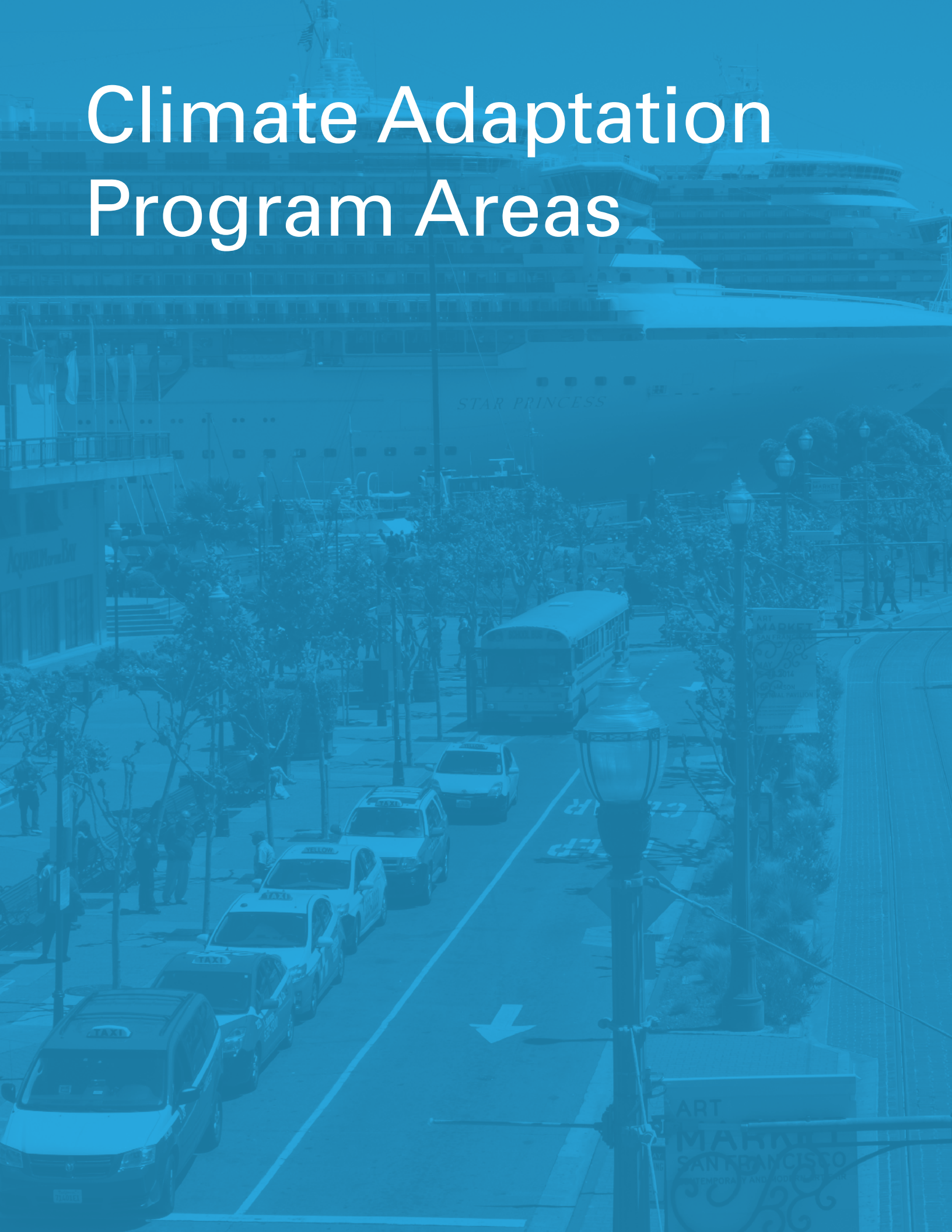
For the SFMTA and transportation agencies, changing climate conditions and climate impacts will be experienced as both chronic and gradual (ongoing) and discrete and episodic (isolated) coastal flood hazard events. For example, sea level rise rates are projected to increase rapidly over the coming decades which will pose both chronic and gradual threat to San Francisco and the transportation system. In addition, increased storm frequency and intensity and the associated urban flooding will pose more of a discrete and episodic threat to the transportation system. Therefore, effective climate adaptation

strategies for the SFMTA will need to respond to both chronic and discrete climate impacts. Therefore the SFMTA will need to work across a variety of scales from the region, to the city and at the parcel level to increase the resilience of the transportation system. The four examples below highlight how the SFMTA is working to increase the resilience of the transportation system.

- Updating the Transportation Sector Climate Action Strategy which includes a new climate adaptation section.
- Conducting a sea level rise vulnerability and risk assessment to identify system wide vulnerabilities and consequences of impacts (Summer / Fall 2017).
- Using the city’s Capital Planning Committee Guidance and Checklist to ensure that large capital projects are evaluated for vulnerability to sea level rise.
- Developed the El Nino / Winter Weather Plan in Winter 2015 to guide SFMTA operations in the event of coastal flooding and storm impacts.



Climate Adaptation Program Areas



Climate Adaptation Program Areas

This section contains five climate adaptation program areas that provide a framework for building a more resilient transportation system. The mission of the climate adaptation program is to increase the overall resilience of San Francisco's transportation system by managing the risks posed by climate impacts and natural hazards in a cost effective way while providing safe, reliable and environmentally sustainable transportation options for all San Franciscans.

The five climate adaptation program areas are:



**EDUCATION CAPACITY &
COMMUNICATION**



CAPITAL PLANNING



VULNERABILITY ASSESSMENT



**ADAPTATION STRATEGIES,
PLANS & POLICIES**



PARTNERSHIPS & COLLABORATION

EDUCATION, CAPACITY & COMMUNICATION



Goal: By 2020, increase awareness of climate impacts and capacity of agency staff, the public and decision makers to address climate change impacts.

In order to inspire climate action, it will be important to ensure that all San Franciscans and city staff are aware of climate change and its impacts upon San Francisco. This will require a coordinated community engagement and public outreach effort that will help to raise the awareness and capacity to deal with climate impacts such as sea level rise. San Francisco

has recently established a working group that is focused on climate change communication and it will be important for the transportation agencies to be actively involved in this working group. In addition, efforts such as the Bay Area Resilient By Design Challenge will help raise awareness of climate impacts in San Francisco.



EDUCATION, CAPACITY & COMMUNICATION

Long-Term Strategies:

		POTENTIAL TO INCREASE RESILIENCE	CO-BENEFITS				COST
ECC-1	Coordinate with city partners to establish a climate change communication working group.		✓	✓	✓		
ECC-2	Engage local communities and stakeholders on climate change and its future impacts on the transportation sector.		✓	✓	✓		

LEGEND

Potential to increase resilience	Potential to advance equity	Potential to improve public health	Consistent with Transit First Policy	Potential to support jobs and prosperity	Initial Capital Cost (public)
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2018-2020 Implementation Actions and Recommendations:

ECC Implementing Action 1.1: *Make targeted presentations to internal and external audiences that raise awareness of climate impacts to the transportation system.* Raising awareness across transportation agencies and with key stakeholders and partners will help to raise awareness of sea level rise which should increase the ability of agency staff to address this important issue. **Lead: SFMTA**

ECC Implementing Action 1.2: *Increase the ability of transportation agency staff to access and interpret climate change information including relevant data and maps.* Information, maps and data should be centralized in a climate clearinghouse or website that can be easily accessed. **Lead: SFMTA and SF Planning**

ECC Implementing Action 1.3: *Establish and maintain a sea level rise working group that spans units and divisions within the SFMTA.* This diverse working group will provide strategic guidance and direction on key tasks and projects and will ensure that adaptation and resilience efforts are coordinated across the agency. **Lead: SFMTA**

ECC Implementing Action 1.4: *Engage communities and stakeholders who rely upon the transportation system via public outreach efforts including the Bay Area Resilient By Design Challenge.* This yearlong effort will engage communities across the region and will provide a forum for developing adaptation strategies and innovative solutions that address sea level rise. **Lead: SF Planning and SFMTA**

CAPITAL PLANNING



Goal: By 2020, integrate climate risk principles and resiliency features into capital planning efforts.

Integrating risk management principles into the capital planning process is an important step in building a more resilient city and transportation system. San Francisco has a number of opportunities to ensure that future capital projects and investments consider and evaluate climate risks. Processes, such as San Francisco’s Capital Planning Committee’s Sea Level Rise Guidance and Checklist are an important first step in ensuring that large capital projects consider future

climate risks and will ensure that decision makers are aware of climate risks as financial investments are made. The SFMTA also has a robust capital planning process which presents opportunities to ensure that risk management and capital planning are linked processes. Finally, adapting to a changing climate system will require significant capital investments and may require new financial mechanisms to support innovative adaptation strategies.

Long-Term Strategies:

		POTENTIAL TO INCREASE RESILIENCE	CO-BENEFITS				COST
			=	♥	🚌	🔧	\$
CPL-1	Integrate climate risk management principles into capital planning processes		✓	✓	✓		
LEGEND		Potential to increase resilience	Potential to advance equity	Potential to improve public health	Consistent with Transit First Policy	Potential to support jobs and prosperity	Initial Capital Cost (public)

2018-2020 Implementation Actions and Recommendations:

CPL Implementing Action 1.1: Conduct a pilot project that examines the resiliency and environmental sustainability of transportation projects to sea level rise identified in the SFMTA Capital Improvement Program (FY17-21 CIP). This effort has the potential to orient project managers to climate risks as they develop their projects. **Lead: SFMTA**

CPL Implementing Action 1.2: Provide technical assistance and support to transportation staff that are using the Capital Planning Committee Sea Level Rise Guidance and Checklist. This Checklist will help inform project managers of climate risks at the project level. **Lead: SFMTA**

CPL Implementing Action 1.3: Understand the variety of financial tools and mechanisms such as resilience bonds that can be used to fund the development of a climate resilient transportation system. **Lead: SFMTA**



VULNERABILITY ASSESSMENT



Goal: By 2020, conduct a sea level rise vulnerability and risk assessment of the multimodal transportation system.

The 2016 San Francisco Sea Level Rise Action Plan mandates that all agencies conduct a robust vulnerability and risk assessment of their sector and systems. The SFMTA has been leading the

assessment of the multimodal transportation system which includes the shared BART/Muni subway system.

Long-Term Strategies:

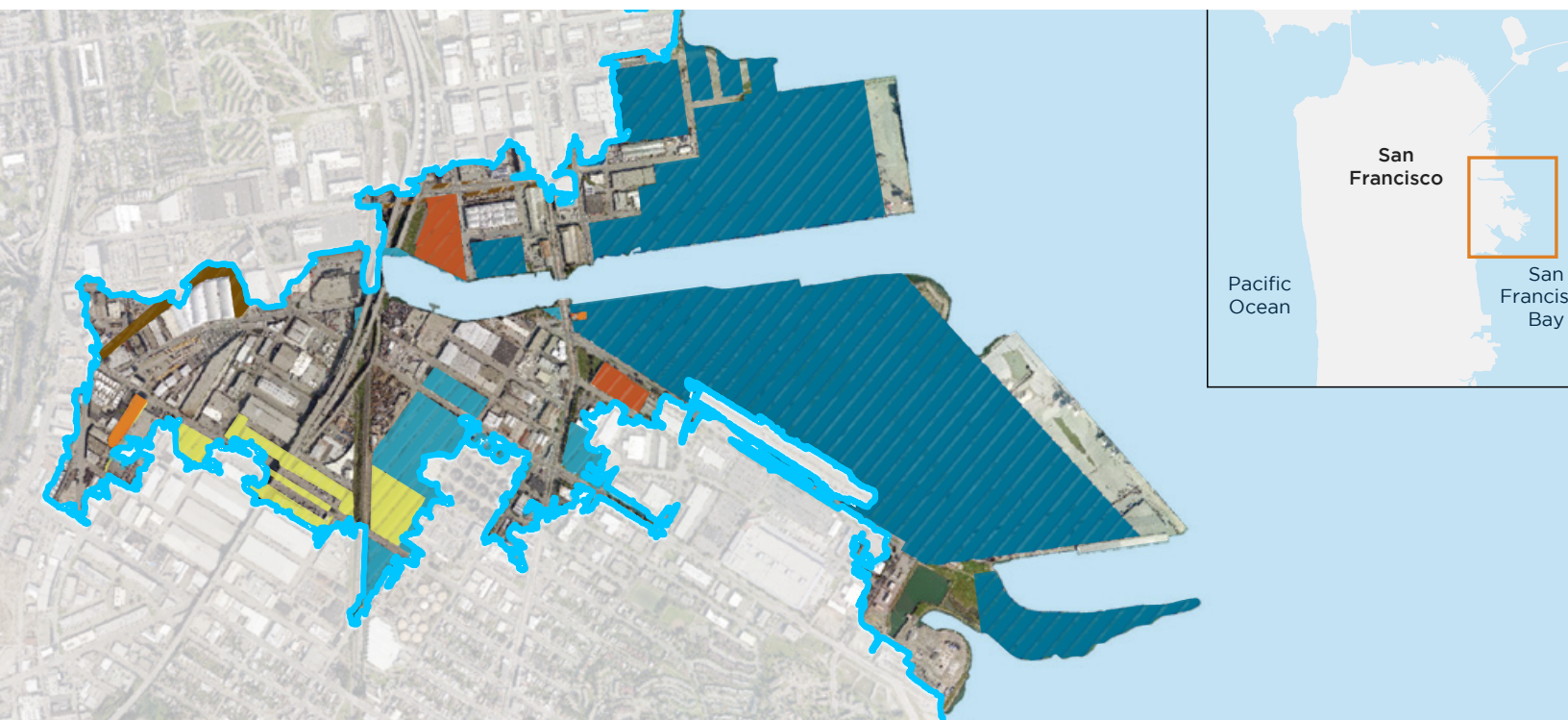
	POTENTIAL TO INCREASE RESILIENCE	CO-BENEFITS				COST
VAS-1 Conduct a sea level rise vulnerability and risk assessment that identifies vulnerable elements of the multimodal transportation system.						

2018-2020 Implementation Actions and Recommendations:

VAS Implementing Action 1.1: *Identify system wide vulnerabilities and risks associated with sea level rise and flooding.* **Lead: SFMTA**

VAS Implementing Action 1.2: *Identify impacts to disadvantaged communities who rely upon the transportation system.* **Lead: SF Planning and SFMTA**

VAS Implementing Action 1.3: *Identify and address transportation system data and information gaps (facilities, assets, real estate, and infrastructure).* **Lead: SFMTA**



ADAPTATION STRATEGIES, PLANS & POLICIES



Goal: By 2020, develop adaptation strategies and integrate into transportation plans, policies, projects and operations.

Once the vulnerability and risk assessment is complete, it will be necessary to develop adaptation strategies that can address the vulnerabilities and be integrated into relevant plans, policies and projects. These strategies may

be specific to departments or citywide and will need to be developed in close coordination with public and private partners, community members and stakeholders.

Long-Term Strategies:

	POTENTIAL TO INCREASE RESILIENCE	CO-BENEFITS				COST
ASP-1 Develop effective adaptation strategies that support the development of a more resilient transportation system.						

LEGEND

- Potential to increase resilience
- Potential to advance equity
- Potential to improve public health
- Consistent with Transit First Policy
- Potential to support jobs and prosperity
- Initial Capital Cost (public)

2018-2020 Implementation Actions and Recommendations:

ASP Implementing Action 1.1: *Lead and collaborate on planning efforts that develop and implement climate adaptation, resilience planning and climate risk principles.* There have been a number of planning efforts such as the SFMTA El Nino and Winter Weather Plan, SF Sea Level Rise Action Plan, Local Coastal Program Amendment and SF Port Seawall Resiliency Project that have effectively integrated climate risk principles. Future planning efforts need to build upon these initial planning efforts. **Lead: SF Planning and SFMTA.**

ASP Implementing Action 1.2: *Monitor and document climate related impacts to the transportation system from urban flooding and sea level rise.* There have been flooding events that disrupted the transportation system during past storms. Looking ahead, efforts need to be advanced that document the impacts to better understand existing and future climate risk. **Lead: SFMTA.**



PARTNERSHIPS & COLLABORATION



Goal: By 2020, build strong and diverse partnerships that enable the development of a more resilient transportation system.

Partnerships and collaboration will be essential to building a more resilient transportation system. This complex work cannot be done in isolation and will benefit from partnerships, diverse skills and innovative perspectives. Efforts

such as the Resilient by Design Challenge and the assessment of the region’s transportation network, led by BCDC, MTC and the Bay Area Regional Collaborative (BARC), should help build meaningful and valuable partnerships.

Long-Term Strategies:

Long-Term Strategies:		POTENTIAL TO INCREASE RESILIENCE	CO-BENEFITS				COST
PAC-1	Build strong and diverse partnerships that enable the development of a more resilient transportation system.						
LEGEND	Potential to increase resilience	Potential to advance equity	Potential to improve public health	Consistent with Transit First Policy	Potential to support jobs and prosperity		Initial Capital Cost (public)

2018-2020 Implementation Actions and Recommendations:

PAC Implementing Action 1.1: *Maintain active role on relevant climate adaptation working groups and committees such as the Mayor’s SLR Coordinating Committee.* **Lead: SFMTA**

PAC Implementing Action 1.2: *Build and maintain strong working partnerships with other city departments, such as the Port of San Francisco, the Planning Department, San Francisco Public Utilities Commission, San Francisco Public Works Department, San Francisco International Airport and the Mayor’s Office, that support the development of a resilient transportation system.* **Lead: SFMTA and SFCTA.**

PAC Implementing Action 1.3: *Build and maintain strong working partnerships with public transit operators and transportation agencies, such as Bay Area Rapid Transit (BART), Water Emergency Transportation Authority (WETA), Caltrain, that support the development of a resilient transportation system.* **Lead: SFMTA and SFCTA**

PAC Implementing Action 1.4: *Build and maintain strong working partnerships with regional and state agencies, such as the Metropolitan Transportation Commission, San Francisco Bay Conservation and Development Commission, Coastal Commission, Bay Area Regional Collaborative (BARC) and Caltrans, that support the development of a resilient transportation system.* **Lead: SFMTA, SF Planning and SFCTA.**

PAC Implementing Action 1.5: *Build and maintain partnerships with domestic and international transit operators, transportation planners, designers, engineers and architects that support the development of a resilient transportation system.* **Lead: SFMTA and SFCTA.**

Implementation of the 2017 Transportation Sector Climate Action Strategy



Implementation

Reducing greenhouse gas emissions and adapting to changing climate conditions will require collective action at the local, regional, state, federal and international level. It will also require sustained political leadership, innovative projects, bold policies and strategic investments and community support that are consistent with climate action goals. If San Francisco is to maintain its leadership position on climate action it will need to lead by example on this challenging global issue. The guiding principles for implementing the 2017 Transportation Sector Climate Action Strategy are:

- prioritize strategies and actions that build an equitable city,
- measure and monitor progress and update goals and strategies accordingly,
- identify where there are opportunities to bundle mitigation and adaptation actions,
- partner with agencies, business community and the public to address climate change,
- embrace innovation and creative approaches to problem solving- the past may not be a prologue for the future,
- build on past successes.

Implementation Actions & Next Steps

Table 1 identifies the implementation actions from the seven climate mitigation program areas and the five climate adaptation program areas. In the next two years, these high priority actions should be implemented by the lead agencies in order to meet the city's near term and long term climate action goals. There will be regular meetings of key staff across relevant city agencies to ensure that coordination is occurring and to track progress of the implementation actions.

All actions recommended herein do not commit the City to a definite course in implementing any individual proposal; these actions may be considered and finally approved or disapproved individually by the applicable decision-making body at a future time.



A Holistic Approach:

While, the implementation actions are organized within their respective climate program areas, it is important to recognize that mitigation and adaptation actions should not be advanced in isolation. The following examples highlight the need for a holistic approach to advancing climate mitigation and adaptation efforts:

- The “Vulnerability Assessment” program area is in the Climate Adaptation Section but as “Transit”; “Complete Streets” and “Land Use” decisions are made it will be important that they are informed by the work occurring within the “Vulnerability Assessment” program area.
- The “Partnerships and Collaboration” program area is in the Climate Adaptation Section but partnerships and collaboration will also be essential for effective climate mitigation efforts as well.

Data and Performance Measures:

Looking ahead, future updates of the Transportation Sector Climate Action Strategy should strive to be based on improved data, quantitative information and performance measures. In the years ahead, the SFMTA and its partner agencies will need to collect, manage and analyze relevant data and develop performance measures to effectively measure progress towards reaching its near term and long term climate goals. Data collections efforts will need to be improved to capture important variables such as mode, occupancy, fuel type and trip distance. In addition, developing performance measures will help decision makers understand how different actions and policies are shaping the transportation system which will ultimately help San Francisco build more robust climate actions.



Summary of Implementation Actions



TRANSIT

- **Continue Muni Forward service improvements and initiate planning to support future service improvements.**
Lead: SFMTA
- **Prioritize transit service within the public right of way.**
Lead: SFMTA
- **Implement recommendations from the Core Capacity Transit Study.**
Lead: SFMTA
- **Apply for Cap and Trade funds from the various funding programs, including Transit and Intercity Rail Capital Program (TIRCP), Low Carbon Transit Operating Program (LCTOP), Affordable Housing and Sustainable Communities (AHSC), to support investments in the transit system and affordable housing.**
Lead: SFMTA

MITIGATION



LAND USE & TRANSPORTATION

- **Identify new land use and transportation planning efforts and focus on areas that currently did not achieve the 2017 mode shift goals.**
Lead: SF Planning, SFMTA, and SFCTA
- **Implement innovative and robust land use and transportation plans, policies and projects.**
Lead: SF Planning, SFMTA, and SFCTA
- **Advance the Connect SF project.**
Lead: SF Planning, SFMTA, and SFCTA

MITIGATION

Summary of Implementation Actions



PRICING & CONGESTION MANAGEMENT

- Update pricing plans and strategies.
Lead: SFMTA and SFCTA
- Complete corridor pricing studies such as the San Francisco Freeway Corridor Management Study (FCMS) and implement recommendations in the next 3-5 years.
Lead: SFCTA
- Expand the SFpark program.
Lead: SFMTA

MITIGATION

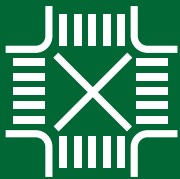


TRANSPORTATION DEMAND MANAGEMENT

- Support efforts for integrated and regional fare/pass development to maximize region-wide transit ridership and promote equity.
Lead: SFMTA and SF Environment
- Develop an employer outreach program to encourage and support non-single occupancy vehicle travel to work outside of the downtown core.
Lead: SFMTA and SF Environment
- Create a TDM program for K-12 schools in SF, especially SFUSD.
Lead: SFMTA and SF Environment

MITIGATION

Summary of Implementation Actions



COMPLETE STREETS

- Update the 2009 SFMTA Bike Plan.
Lead: SFMTA
- Construct high priority components of the bicycle network.
Lead: SFMTA
- Identify and construct “complete streets” projects that will increase pedestrian and bicycle safety.
Lead: SFMTA and City Partners
- Improve agency integration of green infrastructure into “complete streets” projects.
Lead: SFMTA and City Partners

MITIGATION



ZERO EMISSION VEHICLES & INFRASTRUCTURE

- Develop a zero emission vehicle strategy or “roadmap” that supports the adoption of zero emission technology in the context of its Transit First policy.
Lead: SF Environment, SFMTA and City Partners
- Implement pilot projects and high priority recommendation of the zero emission vehicle strategy.
Lead: SF Environment and SFMTA
- Develop actions plans that can guide the conversion of the taxi fleet, paratransit fleet, school buses and the non-revenue municipal fleet to zero emissions vehicles.
Lead: SFMTA and SF Environment

MITIGATION

Summary of Implementation Actions



EMERGING MOBILITY

- **Develop and implement an Emerging Mobility Services Strategy.**
Lead: SFMTA and SFCTA
- **Implement new technology driven pilot projects across the transportation sector.**
Lead: SFMTA and SFCTA
- **Quantify greenhouse gas emissions from emerging mobility service providers including TNCs.**
Lead: SFCTA, SF Environment and SFMTA
- **Collect, manage and analyze data from service providers and via improved technology that reflects the emerging mobility system in San Francisco.**
Lead: SFMTA, SF Environment, SF Planning, and SFCTA

MITIGATION

Summary of Implementation Actions



EDUCATION CAPACITY & COMMUNICATION

- **Make targeted presentations to internal and external audiences that raise awareness of climate impacts to the transportation system.**
Lead: SFMTA
- **Increase the ability of transportation agency staff to access and interpret climate change information including relevant data and maps.**
Lead: SFMTA and Planning
- **Establish and maintain a sea level rise working group that spans units and divisions within SFMTA.**
Lead: SFMTA
- **Engage communities and stakeholders who rely upon the transportation system via public outreach efforts including the Bay Area Resilient By Design Challenge.**
Lead: SF Planning and SFMTA

ADAPTATION



CAPITAL PLANNING

- **Conduct a pilot project that examines the resiliency and environmental sustainability of transportation projects to sea level rise identified in the SFMTA Capital Improvement Program (FY17-21 CIP).** *Lead: SFMTA*
- **Provide technical assistance and support to transportation staff that are using the Capital Planning Committee Sea Level Rise Guidance and Checklist.**
Lead: SFMTA
- **Understand the variety of financial tools and mechanisms such as resilience bonds that can be used to fund the development of a climate resilient transportation system.**
Lead: SFMTA

ADAPTATION

Summary of Implementation Actions



VULNERABILITY ASSESSMENT

- Identify system wide vulnerabilities and risks associated with sea level rise and flooding.
Lead: SFMTA
- Identify impacts to disadvantaged communities who rely upon the transportation system.
Lead: SF Planning and SFMTA
- Identify and address transportation system data and information gaps (facilities, assets, real estate, and infrastructure).
Lead: SFMTA

ADAPTATION



ADAPTATION STRATEGIES, PLANS & POLICIES

- Lead and collaborate on planning efforts that develop and implement climate adaptation, resilience planning and climate risk principles.
Lead: SFMTA and SF Planning
- Monitor and document climate related impacts to the transportation system from urban flooding and sea level rise.
Lead: SFMTA

ADAPTATION

Summary of Implementation Actions



PARTNERSHIPS & COLLABORATION

- **Maintain active role on relevant climate adaptation working groups and committees such as the Mayor’s SLR Coordinating Committee.**
Lead: SFMTA
- **Build and maintain strong working partnerships with other city departments, such as the Port of San Francisco, the Planning Department, San Francisco Public Utilities Commission, San Francisco Public Works Department, San Francisco International Airport and the Mayor’s Office, that support the development of a resilient transportation system.**
Lead: SFMTA and SFCTA
- **Build and maintain strong working partnerships with public transit operators and transportation agencies, such as Bay Area Rapid Transit (BART), Water Emergency Transportation Authority (WETA), Caltrain, that support the development of a resilient transportation system.**
Lead: SFMTA and SFCTA
- **Build and maintain strong working partnerships with regional and state agencies, such as the Metropolitan Transportation Commission, San Francisco Bay Conservation and Development Commission, Coastal Commission, Bay Area Regional Collaborative (BARC) and Caltrans, that support the development of a resilient transportation system.**
Lead: SFMTA, SF Planning and SFCTA
- **Build and maintain partnerships with domestic and international transit operators, transportation planners, designers, engineers and architects that support the development of a resilient transportation system.**
Lead: SFMTA and SFCTA

Definition of Key Terms

Climate Mitigation: An intervention or action that reduces greenhouse gas emissions or enhances sinks for capturing greenhouse gas emissions.

Climate Adaptation: Adjustments or actions that reduce the vulnerability of built and natural systems and human communities to existing or predicted climate change impacts.

Vulnerability: The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes.

Risk: is the combination of two elements; (1) the likelihood of an event occurring (e.g. flooding, hurricane, heat wave, etc), and (2) the consequence of such an event (e.g. subway system flooding resulting in disruption in transit service.)

Resilience: A capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment.

Hazard: A natural or human natural threat that has the potential to cause loss of life, injury, property damage, socio-economic disruption or environmental degradation.

Greenhouse Gases: the six main greenhouse gases are carbon dioxide, sulfur hexafluoride, nitrous oxide, methane, hydrofluorocarbons, and perfluorocarbons.

Transportation network company (TNC): vehicles that use an online-enabled platform to connect passengers with drivers using their personal, non-commercial, vehicles.

Vehicle miles travelled (VMT): is defined by the U.S. government as a measurement of miles traveled by vehicles within a specified region for a specified time period.

Emerging Mobility Service and Technology: “emerging mobility service or technology” is any private or nonprofit transportation services that automates at least three of the following characteristics: driving, routing, reservations/orders, vehicle tracking, billing, customer feedback, matching/sharing, crowd-sourced routing, and/or (un)locking.

