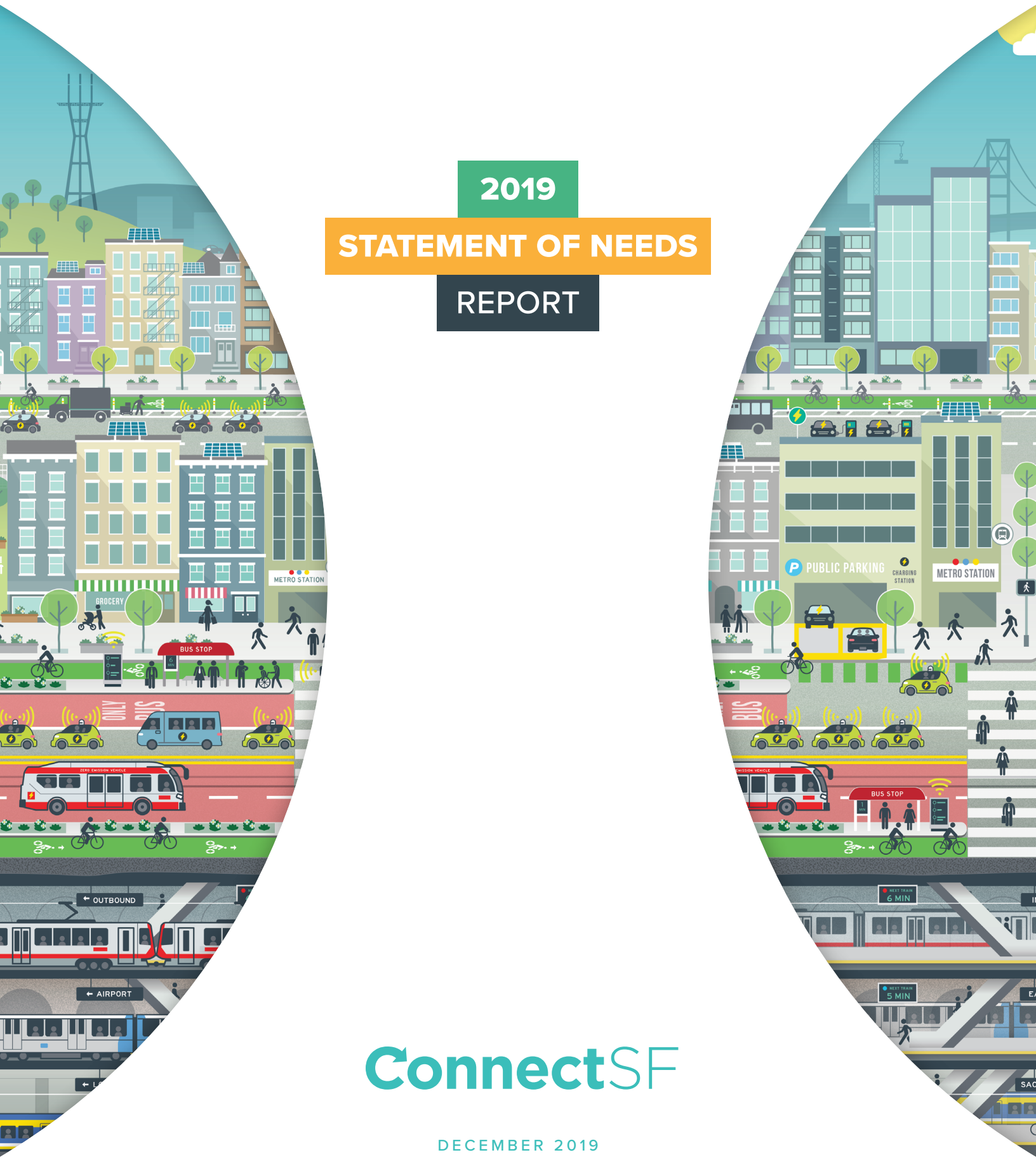


2019 STATEMENT OF NEEDS REPORT

ConnectSF

DECEMBER 2019

Contents

Executive Summary

ConnectSF is a collaborative multi-agency process to build an effective, equitable, and sustainable transportation system for San Francisco's future. It seeks to ensure coordination across a suite of long-range planning efforts that will identify major transportation investments and policies that offer improved options for everyone traveling by all modes. It aims to help San Francisco reach its priorities, goals, and aspirations as a city.

VISION

ConnectSF's 2065 Vision will serve as the framework for how San Francisco makes transportation decisions and investments in the future. Collaboratively developed with the community, the program's Futures Task Force, and leadership from City agencies, the Vision depicts San Francisco as a growing, diverse, and equitable city with a multitude of transportation options that are available and affordable to all.

CONNECTSF GOALS

These goals form the basis of ConnectSF and the city's long-range transportation planning work moving forward.

Equity

Economic Vitality

Environmental Sustainability

Safety and Livability

Accountability and Engagement

KEY FINDINGS FROM SAN FRANCISCO'S STATEMENT OF NEEDS

The Statement of Needs describes San Francisco's existing conditions and the transportation deficiencies that must be addressed to reach the ConnectSF vision. It incorporates information on planned land use changes and transportation investments to identify transportation system needs today and in the future.

The Statement of Needs shows that planned transportation investments and policies will not achieve the ConnectSF Vision by 2050. The challenges that the transportation network faces today are typical of older cities with an aging population and infrastructure that are also experiencing population and economic growth. Without new investments and policies, San Francisco will not meet the equity, environmental sustainability and economic vitality goals articulated in the Vision.

The analysis in the Statement of Needs relies on land use assumptions through 2050 and the Bay Area's currently planned transportation investments. The analysis of current and future conditions from 2015 to 2050, illustrates several key findings, summarized in the table below.

We are making progress towards the Vision in some ways:		Unfortunately, we are falling short in multiple ways:
■ Planned growth increases housing choice and more jobs ■ San Francisco residents have increased transportation access to jobs ■ Residents of Communities of Concern have shorter commutes and more transit access than other households	Average commute times are staying the same	■ **Inequitable trends for Communities of Concern (CoC) relative to non-CoCs** Commute times worsen Access to high-quality transit drops Access to jobs by both auto and transit lags behind ■ **Sustainable modes are not expected to increase relative to automobile travel** San Francisco will not reach its 80% non-auto mode share goal Total miles driven increases ■ **Increased congestion and transit crowding**

The Statement of Needs raises concerns about reaching the equity, environmental sustainability, and economic vitality goals. To achieve San Francisco's Vision and Goals requires investing in existing infrastructure, building new projects, and implementing policies that address these challenges.

HOW WILL THE STATEMENT OF NEEDS BE USED?

The ConnectSF Transit Corridors Study and Streets and Freeways Study will identify and evaluate major transportation concepts and policies to address the identified needs beyond those currently planned. The recommendations from these two studies, along with other studies and plans from city agencies, regional transit operators and other San Francisco stakeholders will be prioritized within the San Francisco Transportation Plan (SFTP) to develop a financially constrained transportation investment strategy and policy recommendations to help achieve the ConnectSF Vision. This information will also inform an update of the San Francisco General Plan Transportation Element.

The two prior SFTP updates demonstrate that San Francisco cannot achieve its goals with existing revenue sources alone. Consequently, the SFTP also includes an aspirational investment plan that demonstrates how new revenue sources can help close the gap toward reaching the ConnectSF Vision. San Francisco and the Bay Area have successfully passed new funding measures, such as the Traffic Congestion Mitigation Tax approved by San Francisco voters in November 2019 and Regional Measure 3 approved by Bay Area voters in June 2018, but a substantial funding gap remains. The ConnectSF process is also positioning San Francisco projects to secure funding by submitting the SFTP investment plan to the Metropolitan Transportation Commission (MTC) for inclusion in the regional transportation plan/sustainable communities strategy, known as Plan Bay Area 2050. Inclusion in the regional plan helps to ensure eligibility for state and federal funding.

GET INVOLVED

ConnectSF's outreach process is centered on engaging numerous voices from across the City. The current phase of outreach is focused on addressing the needs and challenges described in the Statement of Needs. This includes gathering input on potential solutions and community member priorities for future projects and policies.

Visit the ConnectSF website (www.connectsf.org) to:

- Explore data visualizations on key metrics and provide feedback
- Learn more about ConnectSF
- Subscribe to the ConnectSF email list

Attend an upcoming presentation on the statement of needs

Check the ConnectSF website, www.ConnectSF.org, for the latest schedule on presentations and briefings to Boards, Commissions, and community groups.

In-person outreach by emailing ConnectSF@sfgov.org to request a presentation to your community group

NEXT STEPS

Transit Corridors Study

This study will identify, develop, assess and prioritize the next generation of transit investments for San Francisco.

Streets and Freeways Study

This study will identify a set of policies and major investments for San Francisco's arterials and freeways.

Regional coordination

The Transportation Authority is coordinating City priorities for regionally significant projects and policies for Plan Bay Area 2050, the region's long-range transportation planning effort led by the Metropolitan Transportation Commission.

EXPLORE THE DATA

Data from the Statement of Needs are also available online at connectsf.org/transportation-needs, both in an interactive format and for download. Six maps show data related to:

- **Jobs and housing growth**
- **Jobs accessibility**
- **Commute times**
- **Transit crowding**
- **Vehicle miles driven**
- **Trip-making patterns**

Introduction

CONNECTSF PHASE I: A VISION FOR SAN FRANCISCO

San Francisco's land use and transportation planning agencies are collaborating on a long-range transportation planning program called ConnectSF to identify major policies and investments needed for the future. In the spring of 2018, the program team completed the first phase of work for ConnectSF: developing a Vision for San Francisco in 50 years. This included an extensive outreach process, with over 5,000 individuals and more than 60 organizations contributing their thoughts on the future of San Francisco as a place to live, work, and play.

Briefly, the Vision is one where:

- San Francisco is a growing, diverse, equitable city.
- A multitude of non-auto transportation options are available and affordable to all.
- Infrastructure is well maintained and managed as a result of strong civic and governmental engagement.

The Vision was adopted and/or endorsed by the Planning Commission, San Francisco County Transportation Authority (SFCTA) Board, and SFMTA Board. The ConnectSF Vision includes five goal areas that guide the planning process: equity, environmental sustainability, economic vitality, safety and livability, and accountability and engagement. These goals guided the creation of the Vision in Phase 1 and will continue to guide analysis, design and evaluation of the Phases 2 and 3 transportation planning process and products shown in Figure 1.

CONNECTSF PHASES 2 AND 3

As the first step of Phase 2, the Statement of Needs identifies needs and challenges for the future, taking into account the current transportation system, planned transportation projects and policies, and locations for anticipated growth. The next step is to develop project concepts that respond to identified needs for the City's transit, streets and freeway networks through two modal studies — the Transit Corridors Study and the Streets & Freeways Study.

Phase 3 of ConnectSF will lead to the development of two important City planning documents — the San Francisco Transportation Plan (SFTP) and the Transportation Element of the General Plan. The information used throughout this project will also be used to inform the development of Plan Bay Area, the regional long range transportation plan. The SFTP will incorporate the recommendations from the two modal plans along with other studies and plans from city agencies, regional transit operators, and other stakeholders to develop a fiscally constrained transportation investment strategy and policy recommendations.

Figure 1. *ConnectSF Transportation Planning Program*

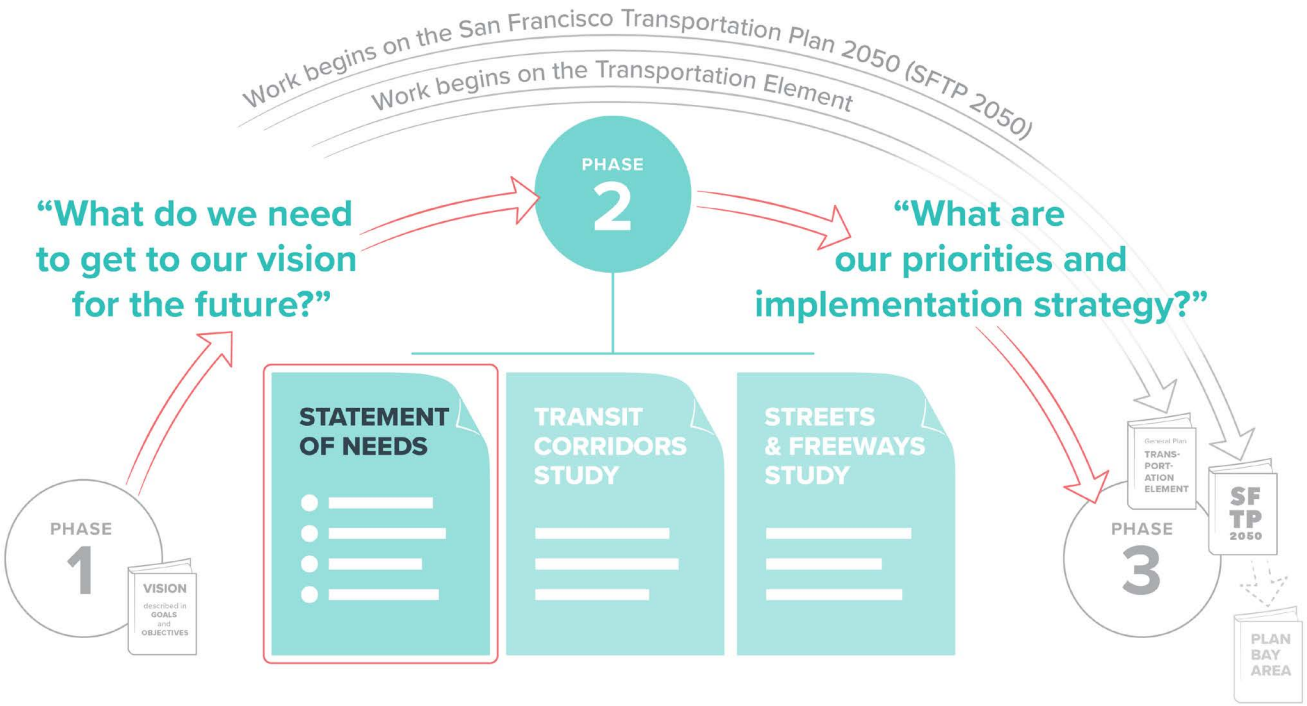


Photo by Sergio Ruiz, flic.kr/p/o6xn1E

WHAT IS THE PURPOSE OF THE STATEMENT OF NEEDS?

The Statement of Needs provides an understanding of how the transportation system performs today and how it may perform in the future. It does this by answering two key questions:

- **Does the City's transportation system performance meet the goals and aspirations set out in the ConnectSF Vision?**
- **If not, what is needed to reach that Vision?**

A set of metrics that align with ConnectSF's goals were identified to assess the City's transportation system performance in both 2015 and 2050. Many of these metric results were derived from the San Francisco Chained Activity Modeling Process (SF-CHAMP), a travel demand model developed by SFCTA that predicts how people travel in the region based on future growth and transportation system changes. Other metrics were based on current available data and research produced by various city agencies.

All these metrics were developed and analyzed considering a context of potential significant changes. The advent of autonomous vehicles may radically change how people travel and where they live and work. Sea-level rise, extreme weather and storm events resulting from climate change will reshape how and where San Franciscans live and travel. These topics and others will be the subject of more detailed analysis and study to help shape the ConnectSF plans. This report focuses on the best available information to estimate both land use and transportation changes that will impact how people travel in 2050. The ConnectSF website Futures Primer page provides more detailed information on potential changes that may affect how people travel (https://connectsf.org/futures-primer/).

Evaluating Transportation Needs in the Context of Growth

Before describing future transportation system needs, it is helpful to contextualize San Francisco's future growth. Using forecasts from state planning agencies, the Metropolitan Transportation Commission, Association of Bay Area Governments, and the San Francisco Planning Department, the study team developed future scenarios for how San Francisco may grow and change in the coming years. This section reviews expected changes to land use patterns and the transportation network, setting the stage for the 2050 transportation needs analysis. More detailed information about these modeling assumptions can be found in Appendix C.

Table 1. *Current and Projected Population and Employment in San Francisco*

	2015	2050	Change	% Change
Population	880,000	1,245,000	365,000	41%
Jobs	745,000	924,000	179,000	24%

SAN FRANCISCO WILL CONTINUE TO GROW

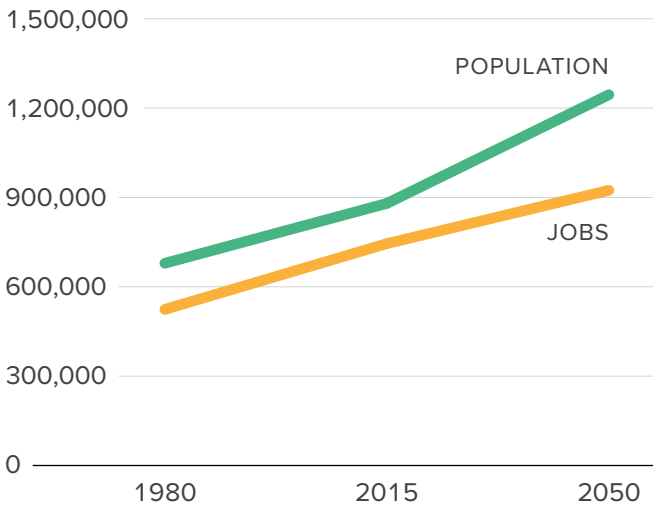
San Francisco is expected to grow because it is and will continue to be an attractive place to live and work. Employment is expected to grow at historic rates (around 5,000 jobs annually), reaching 924,000 jobs in San Francisco by 2050. Population is expected to grow faster than it has in the past. Over the previous 35 years, San Francisco added just under 6,000 people per year. In the future, San Francisco is projected to add more than 10,000 new residents annually, reaching a population of 1,245,000 by 2050 (Table 1 and Figure 2).

Population and employment growth assumptions are based on development capacity including adopted plans, zoning, and policies, such as:

- Large developments and plan areas, such as Candlestick Point, Central SoMa, The Hub, and Park Merced.
- Projects that would add residential units or commercial space for which applications have been formally submitted to the Planning Department or the Department of Building Inspection
- Soft site potential, where existing development is 30% less than the maximum allowed by existing zoning
- HOME-SF, the City's local density bonus program which incentivizes building more affordable and family-friendly housing in neighborhood commercial and transit corridors through zoning density bonuses.
- State density bonuses
- Accessory dwelling units (ADUs) program
- Production, Distribution and Repair (PDR) programs

San Francisco's current zoning capacity is anticipated to be entirely consumed given current growth projections shortly after 2040. This will necessitate future planning to allow for increased density to achieve the expected 2050 population and employment growth, as shown in Figure 3.

Figure 2. *Historic and Projected Population and Employment in San Francisco*



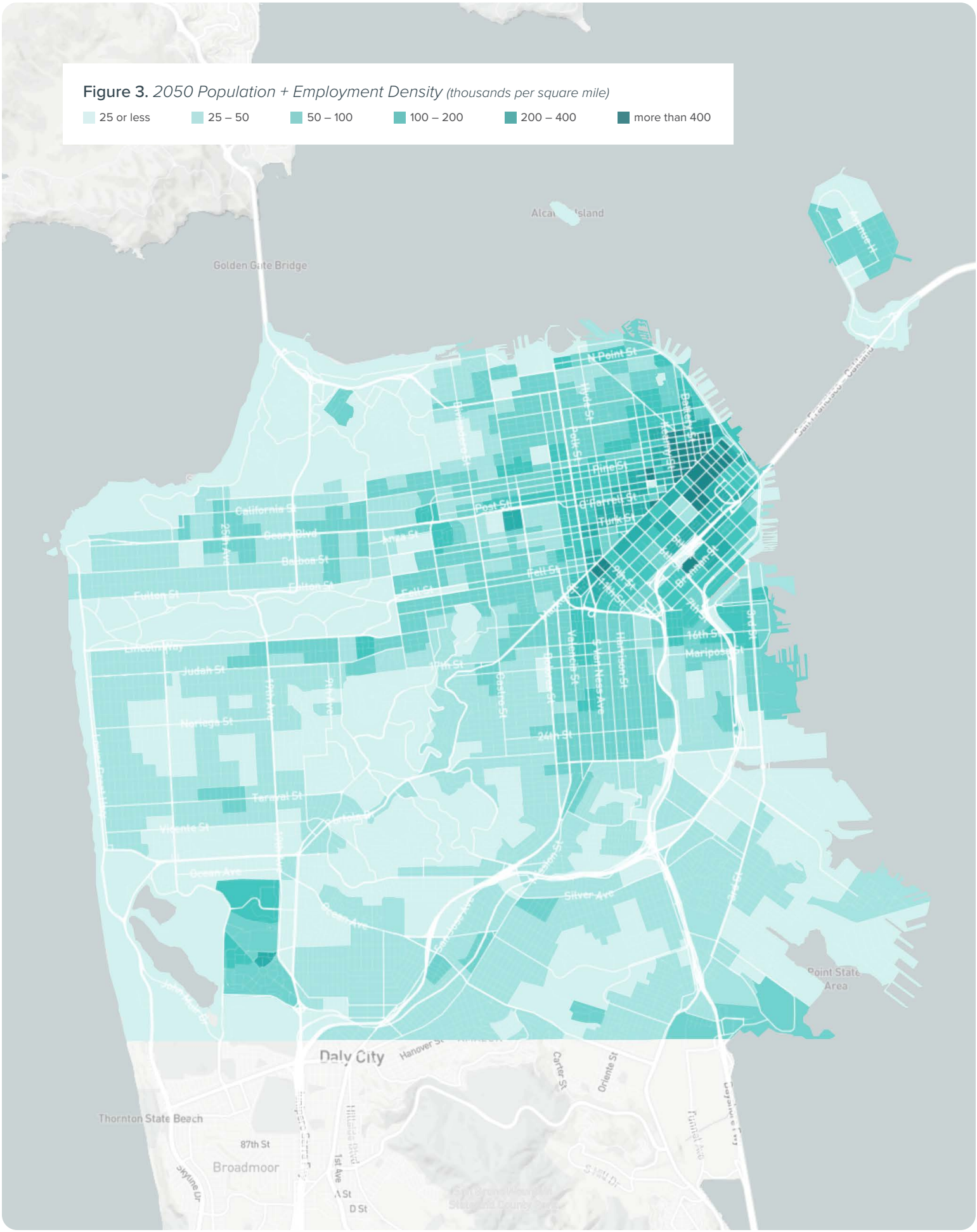
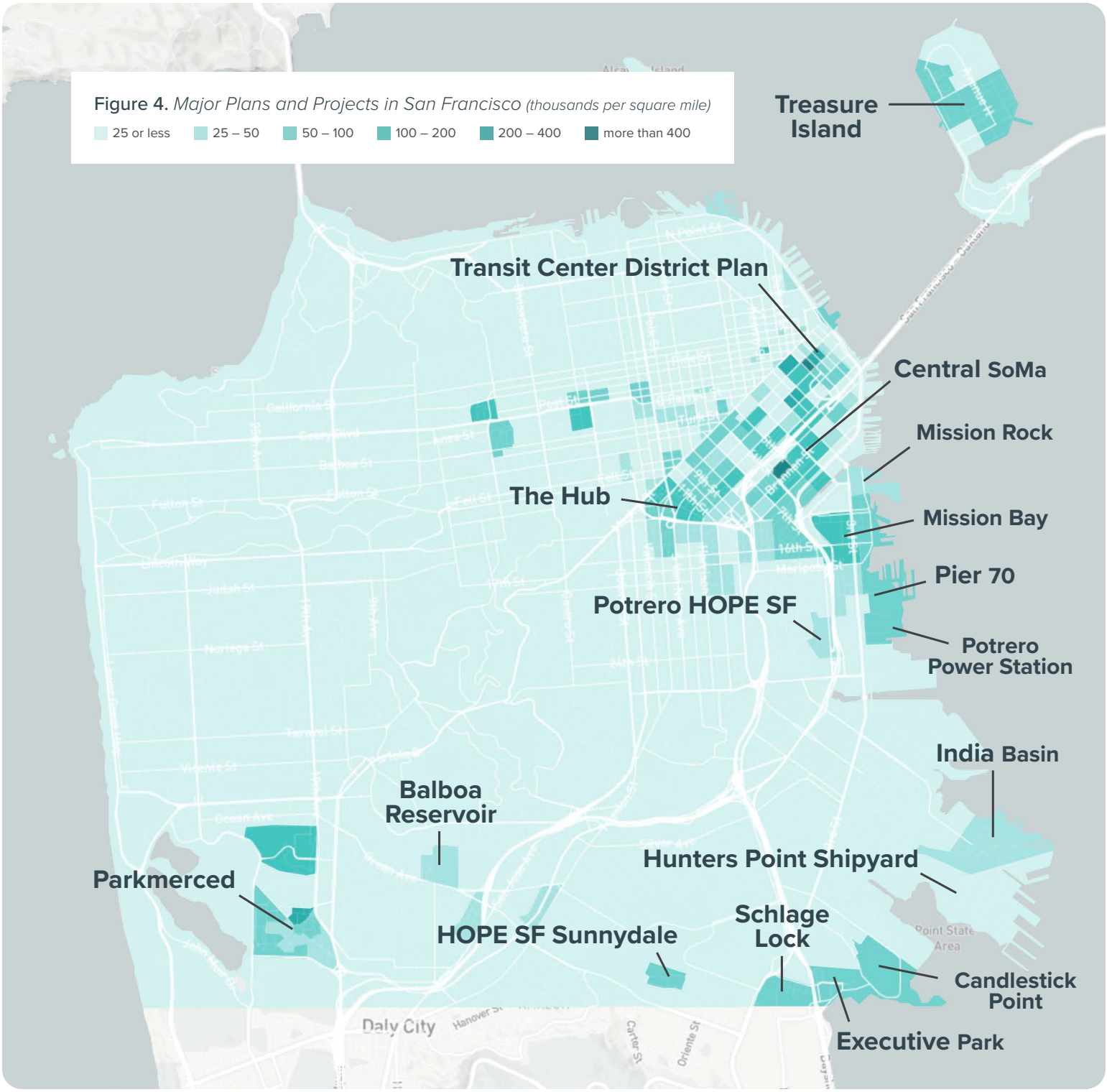


Figure 3. 2050 Population + Employment Density (thousands per square mile)
25 or less
25 – 50
50 – 100
100 – 200
200 – 400
more than 400
Golden Gate Bridge
Daly City
Thornton State Beach
Broadmoor
Point State Area

Where Will The Growth Go?

Most of the planned increased growth will occur in the eastern parts of the City (Figure 4). San Francisco has over 60,000 new housing units in its development pipeline, with 20% permanently affordable (Table 2). Nearly all of San Francisco's current and future development is planned to be near transit. Increasing the density of development in those areas also increases the number of trips that can be made by walking and biking.



The Region Also Continues to Grow

The population of the Bay Area is also expected to increase by 41% between 2015 and 2050 (Table 3), and the relative growth in jobs is expected to be higher for the entire Bay Area (33%) than for San Francisco (24%).

At a regional level, Plan Bay Area (the regional land use and transportation planning framework for the nine-county Bay Area) has developed a growth strategy that promotes compact development in established communities with access to existing and new transit networks. Household and employment growth are expected to be concentrated in the region's three largest cities: San Jose, San Francisco, and Oakland.

Table 2. *New housing units and Jobs from Plan Areas, Major Developments and Programs*

Plan Areas and Major Developments	Housing Units	Jobs
Central SoMa	8,800	32,000
Mission Rock	1,330	5,200
Mission Bay	2,100	500
The Hub	11,800	11,300
Transit Center District Plan	4,000	25,000
Potrero PowerStation	2,600	5,100
India Basin	1,575	600
Hunters Point Shipyard & Candlestick	11,000	12,500
Schlage Lock	1,680	65
Executive Park	1,700	0
HOPE SF Sunnydale & Potrero	1,850	230
Park Merced	5,700	1,300
Balboa Reservoir	1,300	50
Treasure Island	7,400	3,090
Total for Developments	**62,800**	**96,900**

Citywide Policies	Housing Units	Jobs
Accessory Dwelling Units	18,000	N/A
HOME-SF (local density bonus program)	5,000	N/A
Total for all	**85,800**	**96,900**

Table 3. *Current and Projected Population and Employment in the Bay Area*

	2015	2050	Change	Percent Change
Population	7,330,000	10,350,000	3,020,000	41%
Jobs	3,798,000	5,059,000	1,261,000	33%

Photo by SFMTA Photography Department

PLANNED INVESTMENTS IN THE TRANSPORTATION NETWORK

To conduct the Statement of Needs analysis, the ConnectSF team analyzed a transportation network that represents the City today (as of 2015)[1] and one that represents the City in 2050. The 2015 network includes all local and regional transit services, all roadways, tolled facilities, parking costs, and bicycle infrastructure as they existed in 2015.

The 2050 network includes the 2015 network plus several projects derived from the most recent SFTP and Plan Bay Area (both updated in 2017), some of which are currently under construction. The 2050 transportation network includes:

- Planned SFMTA bus improvements including bus rapid transit on Van Ness, Geary, 16th Street, and Geneva-Harney and implementation of Muni Forward
- Planned SFMTA rail transit service expansion, including the Central Subway and the Historic Streetcar Extension to Fort Mason
- Planned regional transit projects, including Caltrain Downtown Extension and increased service from electrification, increased BART service through the Transbay Tube and San Francisco's core (30% increase in frequency), and additional ferry and regional express bus service
- Highway managed lanes and road pricing projects, including express lanes on parts of US-101 and I-280, and congestion pricing on Treasure Island
- Planned bike network projects

Downtown congestion pricing and a second transbay rail crossing were not included in the 2050 transportation network. This is because further detail for each of these projects is currently undergoing a significant planning and evaluation process led by SFCTA and BART, respectively. The current analysis also does not include substantial new Muni bus or rail service beyond the routes listed above and assumes consistent ownership of personal cars for residents and workers in the future.

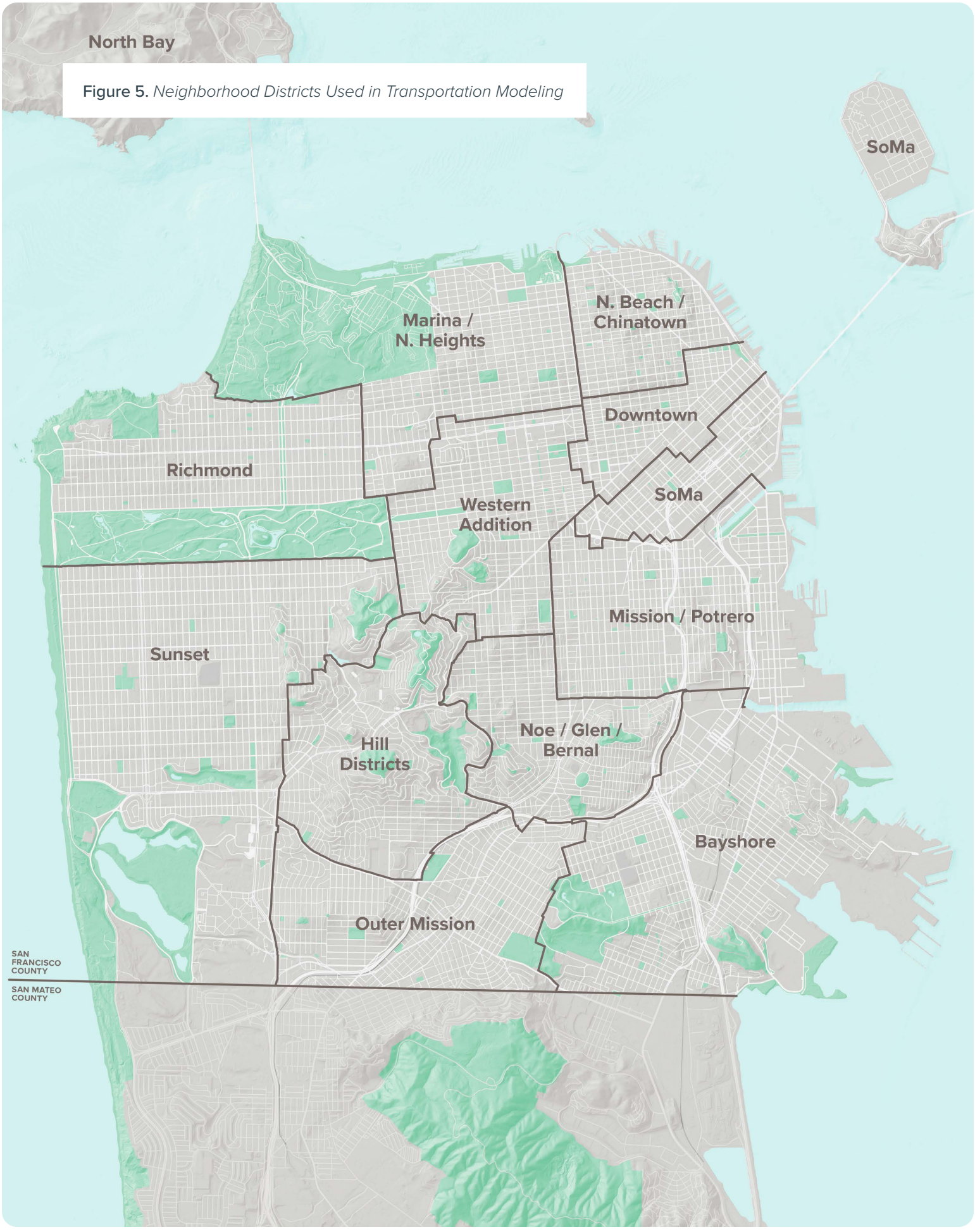
1 For the purposes of the Statement of Needs Analysis, 2015 was chosen as the base/current year because this was the most current year with available comprehensive land use data when the analysis was conducted.

Key Findings

The ConnectSF study team produced a set of metrics to evaluate transportation needs in the City. Most of these metrics used the above information on land use and transportation network changes expected between 2015 and 2050, along with the SF-CHAMP model outputs and data from other city agencies, to assess how well San Francisco will meet ConnectSF's goals and objectives without any additional project or policy changes. For several of ConnectSF's Goals and Objectives, it was not possible to develop a meaningful forecast future performance (e.g., safety). For these metrics, the most recent available data were used to help describe the transportation need.

The results for all metrics represent conditions for a typical weekday. They are presented for the City as a whole and, in some cases, for the neighborhoods shown in Figure 5.

Figure 5. *Neighborhood Districts Used in Transportation Modeling*



SAN FRANCISCO'S GROWTH MEANS MORE TRAVEL OF ALL TYPES

The anticipated growth in people living and working in San Francisco in 2050 yields a significant increase in the total number of trips to, from, and within the City. In 2015, there were 4.3 million daily trips of all types being made to, from, and within San Francisco by all modes of travel. By 2050 that number is expected to grow to 5.9 million — a 36% increase in trips (Table 4).

Trips of all types increase, but trips for personal and social purposes (errands, shopping, meals out, etc.) are expected to grow at a faster rate than other purposes (Figure 6). This reflects a demographic transition towards an older population affecting the entire U.S. In San Francisco, California's Department of Finance forecasts that the share of the population over the age of 65 is expected to double over the next 35 years, from 14% in 2015 to 28% in 2050.

Regional and Local Travel Patterns

As mentioned previously, total daily trips to, from and within San Francisco are expected to grow by 36%. Five of the twelve San Francisco neighborhoods are expected to capture 75% of these new trips through 2050 — SoMa, Mission/Potrero, and Downtown each add over 200,000 trips and Bayshore and the Sunset each add over 150,000 trips (Table 5). Trips between San Francisco and other parts of the region grow as well, with trips to and from the South Bay and East Bay increasing by 184,000.

Figure 6. *Trip Purpose for Trips with an Origin or Destination in San Francisco*

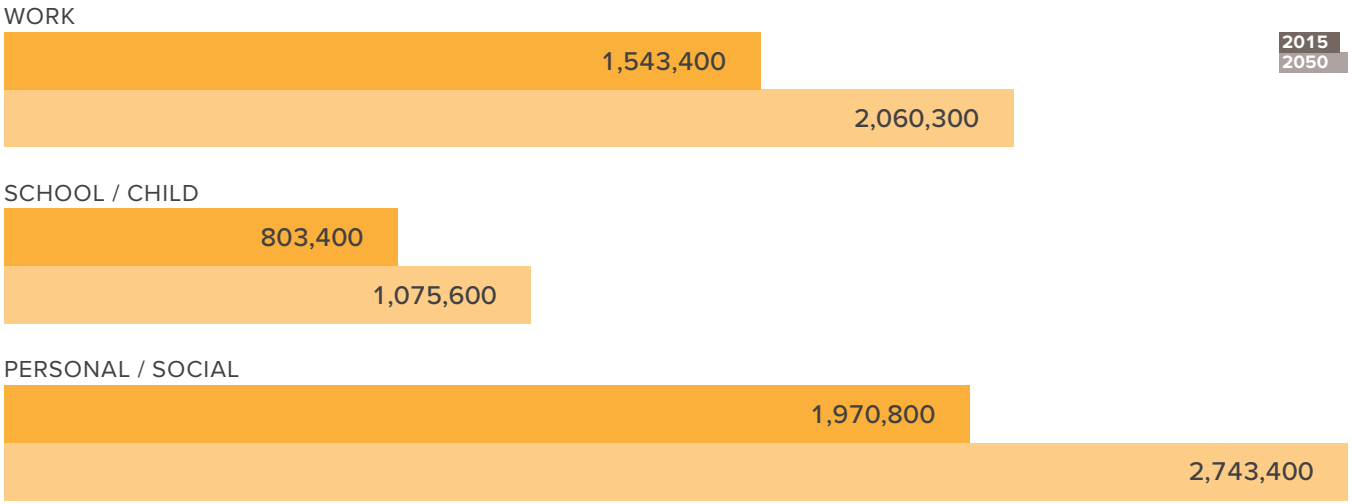


Table 4. *Change in San Francisco Population, Jobs and Trips*

	2015	2050	Change	% Change
Population	880,000	1,245,000	365,000	41%
Jobs	745,000	924,000	179,000	24%
Trips	4,300,00	5,900,00	1,600,00	36%

Table 5a. *Total Trips With at Least One Trip End in San Francisco by District*

	2015		2050	
	TRIPS	SHARE	SHARE	TRIPS
Bayshore	223,700	5%	6%	379,600
Downtown	754,400	17%	16%	956,700
Hill Districts	158,100	4%	3%	198,200
Marina/N. Heights	285,700	7%	6%	324,900
Mission/Potrero	399,400	9%	11%	642,200
N. Beach/Chinatown	315,400	7%	6%	365,400
Noe/Glen/Bernal	168,400	4%	3%	192,600
Outer Mission	211,400	5%	5%	281,400
Richmond	203,500	5%	4%	240,900
SoMa/Treasure Island	252,600	6%	9%	526,500
Sunset	390,800	9%	9%	557,800
Western Market	348,800	8%	7%	421,000
East Bay	229,900	5%	5%	314,700
North Bay	65,200	2%	1%	67,400
South Bay	310,400	7%	7%	409,900
Total Trips	**4,317,700**			**5,879,200**

MORE JOBS WILL BE ACCESSIBLE

Job accessibility is based on where people live, where jobs are, and the transportation network configuration. All three of these factors contribute to an expected increase in the number of jobs accessible by a 30-minute car trip or by a 45-minute transit trip (Figure 7). These travel times approximate the average commute times for Bay Area residents using these modes. In 2050, there will be more jobs accessible to San Francisco residents than in 2015, and there is a greater improvement in job accessibility by transit than by auto (Figure 7) based on the planned location of most of the city's growth. However, despite this improvement in job accessibility by transit, auto modes still provide better overall job accessibility in 2050.

Table 5b. *Increase in Trips With at Least One Trip End in San Francisco by District*

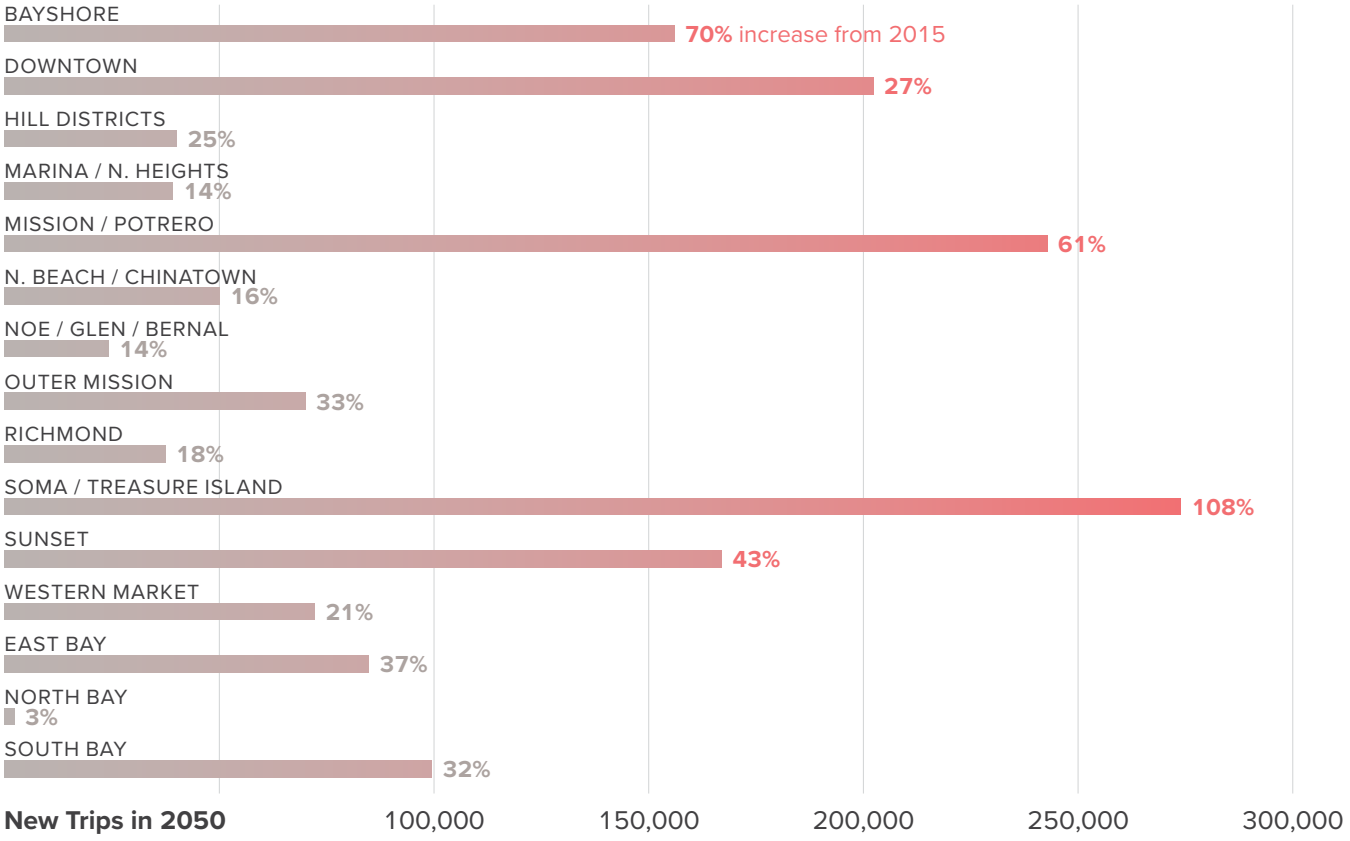
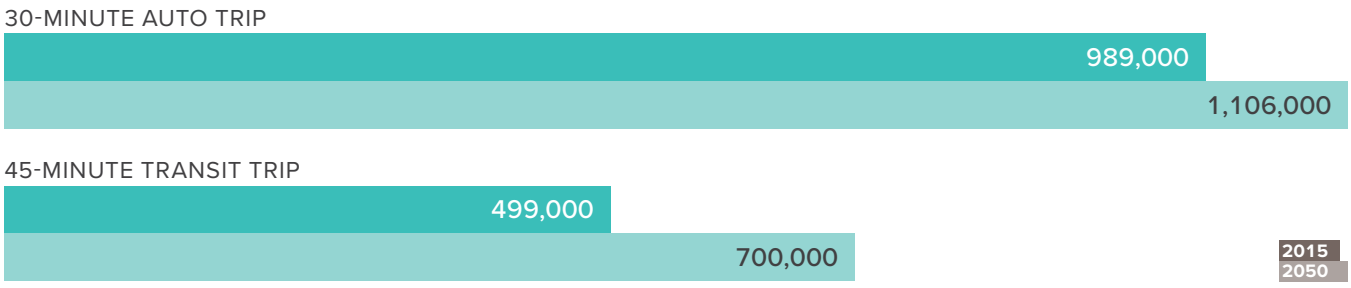


Figure 7. *Number of Jobs Accessible by Mode*



Figures 8 and 9 present the change in accessibility by auto (Figure 8) and transit (Figure 9).

Figure 8. *2015 – 2050 Change in 2050 Jobs Accessible by Auto in 30 Minutes*

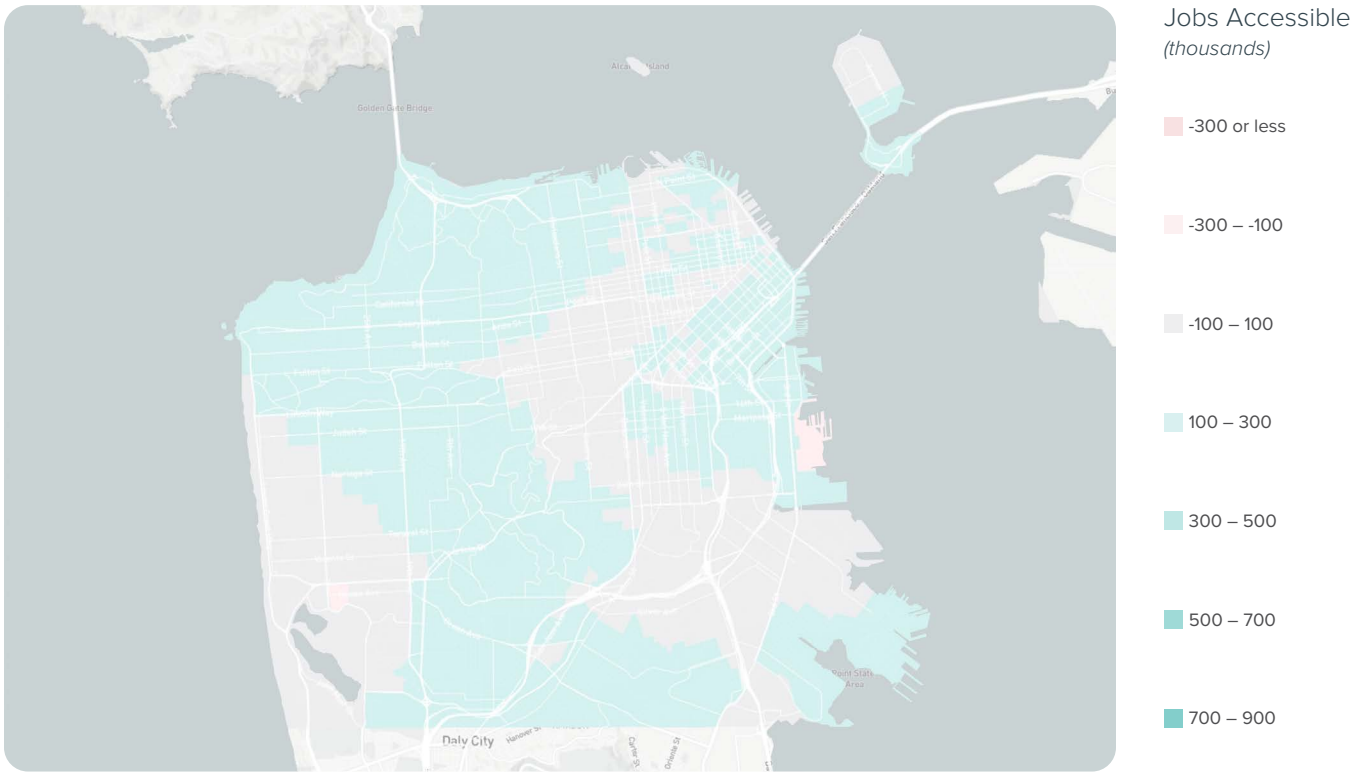
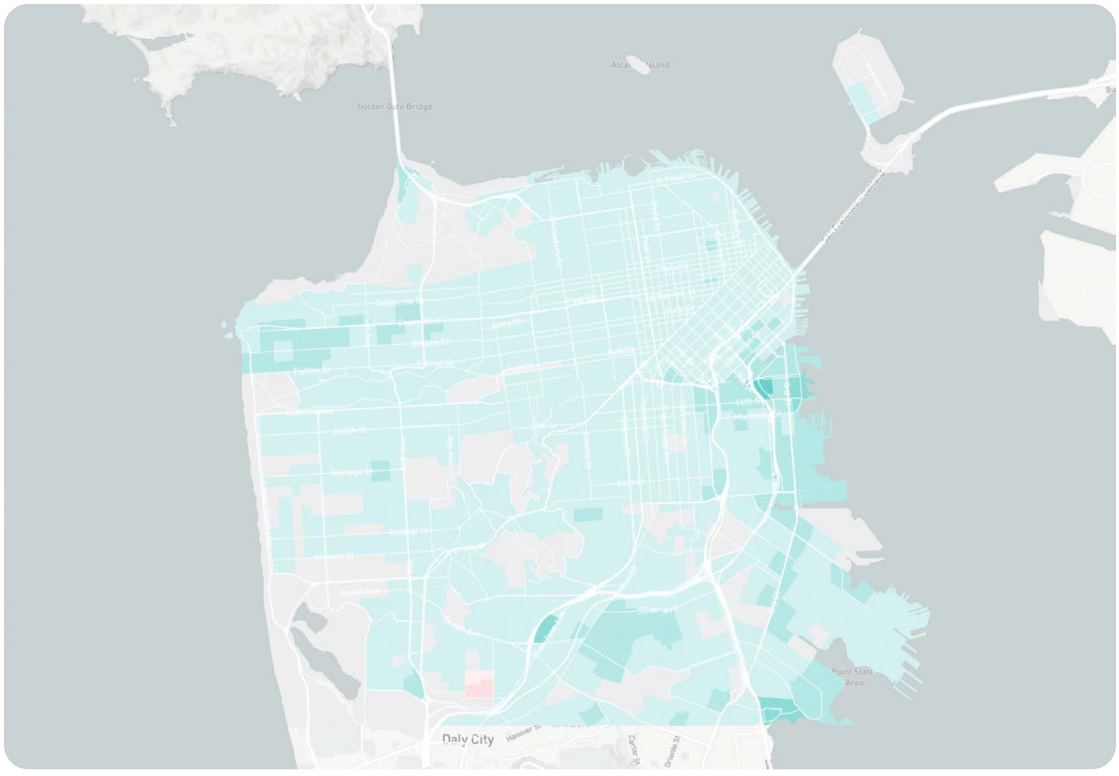


Figure 9. *2015 – 2050 Change in Jobs Accessible by Transit in 45 Minutes*



COMMUTE TIMES AND TRAVEL PATTERNS STAY THE SAME

The anticipated population and job growth increase commuting, growing from 740,000 daily commuters in 2015 to 982,000 in 2050. Commute trips will grow the most to SoMa, Downtown, and Mission/Potrero, which collectively account for 60% of new commute trips.

Despite this growth, average commute times are expected to remain unchanged at a City level from 2015 to 2050. As in 2015, residents who live on the outer edges of the city may continue to have longer commutes in 2050 compared to more centrally located residents (Figure 10). Significant population growth near Downtown and SoMa and the continued growth of employment in these locations keeps average commute times down, even while some areas of the City show increases in commute time.

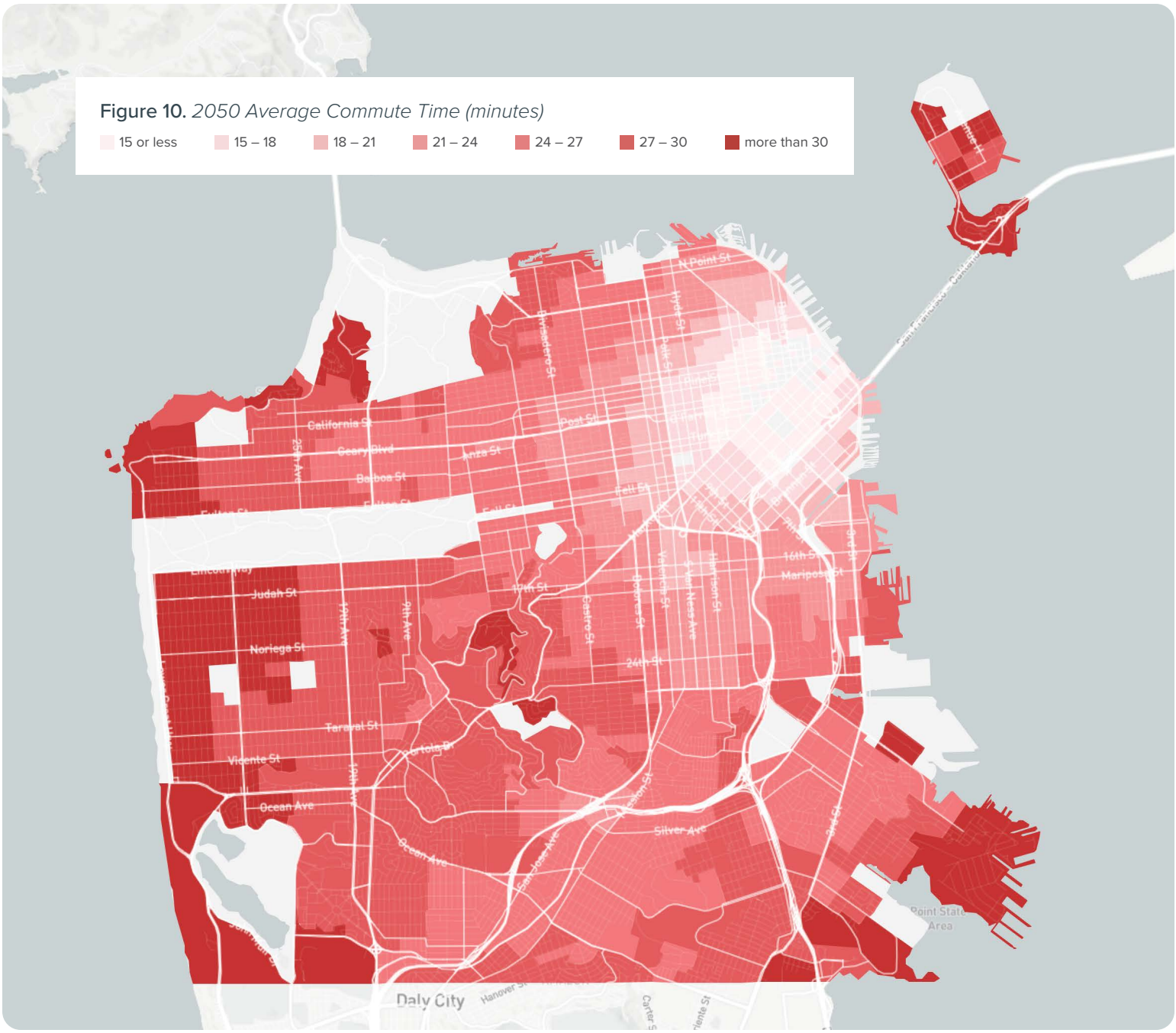
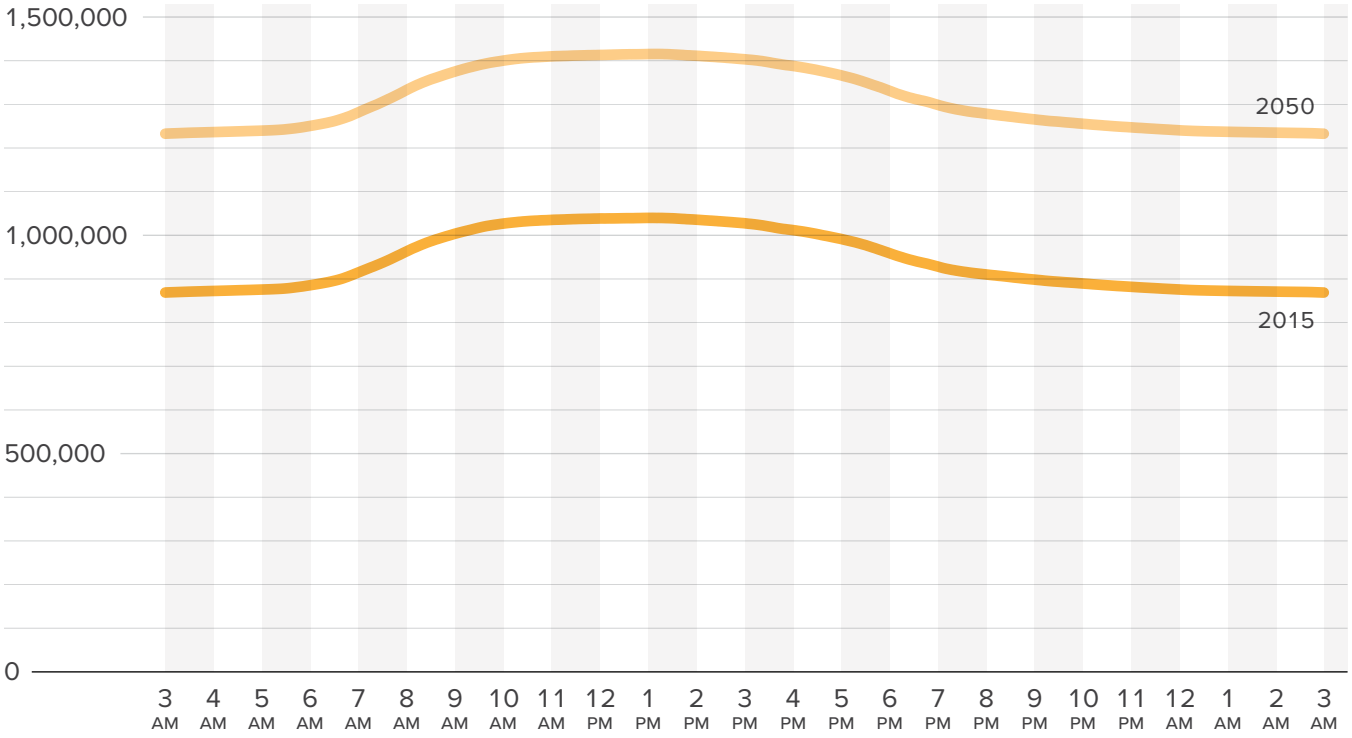


Figure 10. *2050 Average Commute Time (minutes)*

Table 6. *Commute Trips by Origin*

Number of commute trips (Percentage of total commute trips)	2015	2050	Percent change
Intra-San Francisco	419,400 (56.7%)	574,500 (58.5%)	37%
Region to San Francisco	254,900 (34.5%)	302,500 (30.8%)	19%
San Francisco to Region	65,400 (8.8%)	104,800 (10.7%)	60%
All Commutes	**739,700**	**981,800**	**33%**

Figure 11 *San Francisco Daytime Population*



Commute travel by geography increases but the patterns see only modest changes. The share of workers commuting to San Francisco from the region declines somewhat (but not the absolute number of commutes), while the share of San Franciscans commuting out increases (Table 6). While most commute trips start and end in San Francisco in both 2015 and 2050, planning for the more than 40 percent of commute trips that travel between San Francisco and the region is a critical element of this planning process.

The significant number of people who commute to San Francisco boosts the daytime population of the City. In 2015, the daytime population of the City was over 1 million people, or about 200,000 people greater than the number that live in the City (Figure 11). With significant growth in new City residents, the daytime population increases to over 1.4 million, continuing trend of an influx of people coming into San Francisco during the day.

COMMUTE AND JOBS ACCESSIBILITY OUTCOMES ARE UNEQUAL

While overall commute patterns are not projected to change significantly, outcomes are different for various San Francisco communities and populations. By 2050, commute times in southern neighborhoods are expected to increase while commutes in SOMA and some eastern neighborhoods get shorter (Figure 12).

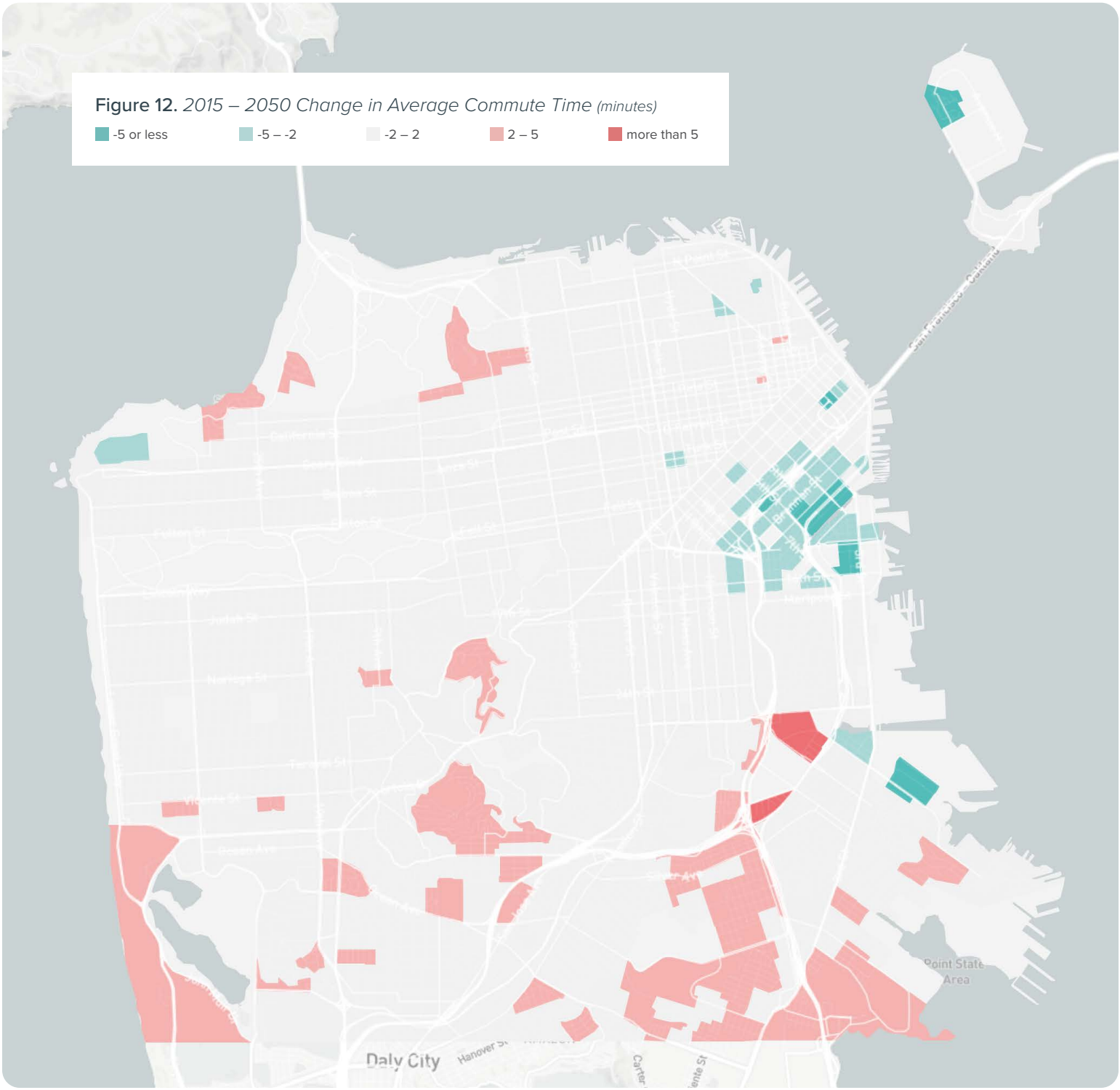


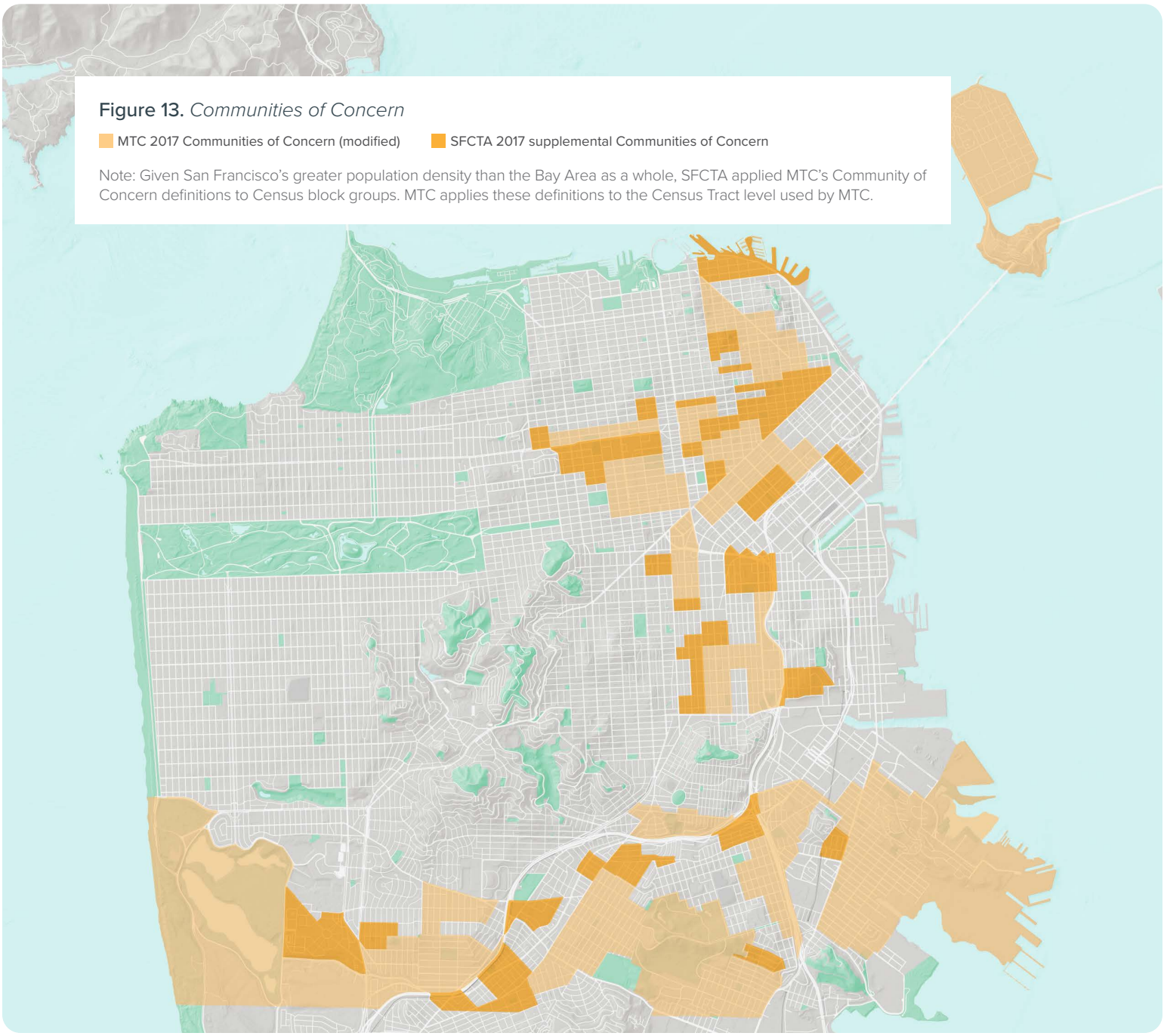
Figure 12. *2015 – 2050 Change in Average Commute Time (minutes)*

To evaluate whether outcomes are equitable, the study team used MTC's Communities of Concern (CoC) criteria to identify communities with high populations of seniors, people with disabilities, people with limited English proficiency, single-parent households, zero-car households, low-income households, cost-burdened renters or minority households (Figure 13). CoC and non-COC areas in the City each include a mix of neighborhoods close to downtown and neighborhoods on the southern and western edges of the City. The SF-CHAMP model was used to estimate how the planned future transportation network and future population and job locations affect these CoCs. Note that because the study team and CHAMP cannot estimate with any certainty where CoCs will be in 2050, the same geographies as in 2015 were used.

Figure 13. *Communities of Concern*

MTC 2017 Communities of Concern (modified) SFCTA 2017 supplemental Communities of Concern

Note: Given San Francisco's greater population density than the Bay Area as a whole, SFCTA applied MTC's Community of Concern definitions to Census block groups. MTC applies these definitions to the Census Tract level used by MTC.



In both 2015 and 2050, people who live in areas identified as a CoC have shorter commute times than people who live in non-CoC areas (Table 7). However, the commute times for people who live in non-CoC areas are not expected to increase by 2050, while the commute times for residents of CoCs are expected to increase by 6%.

Similarly, in both 2015 and 2050, areas identified as a CoC have a higher share of the population with access to high-quality transit than people who live in non-CoC areas (Table 8). Access to high-quality transit is defined as living within either 0.25 miles of a rapid bus stop or light rail stop without dedicated right-of-way or within 0.5 miles of a rail stop with dedicated right of way with frequencies better than or equal to 10 minutes. While the share of the non-CoC population with access to high quality transit increases by 2050, the share of the CoC population with access to high-quality transit declines. This may be due to one of two factors: 1) expected population growth in CoCs is not near high quality transit or 2) future planned additional high-quality transit are not near CoCs.

These patterns are also consistent when considering household income. Commutes for moderate, low, and very low-income households are increasing while commutes for high- and middle-income households are getting slightly shorter.

Additionally, job accessibility for San Francisco residents is expected to improve, but residents of CoCs see smaller increases compared to those who live in non-CoCs, whether on transit or by car (Table 9 and Table 10). Again, this pattern holds when considering household income.

Table 7. *Average Commute Travel Time (minutes) by Community of Concern Status*

	2015	2050	% Change
CoC	21.7	23.0	6%
Non-CoC	25.1	25.0	0%

Table 8. *Share of Population with Access to High-Quality Transit by Community of Concern Status*

	2015	2050	% Change
CoC	94.1%	90.5%	-3.9%
Non-CoC	85.3%	88.6%	+3.9%

Table 9. *Number of Jobs Accessible by 45-minute Trip on Transit*

	2015	2050	% Change
CoC	512,800	674,000	31%
Non-CoC	492,300	712,000	45%

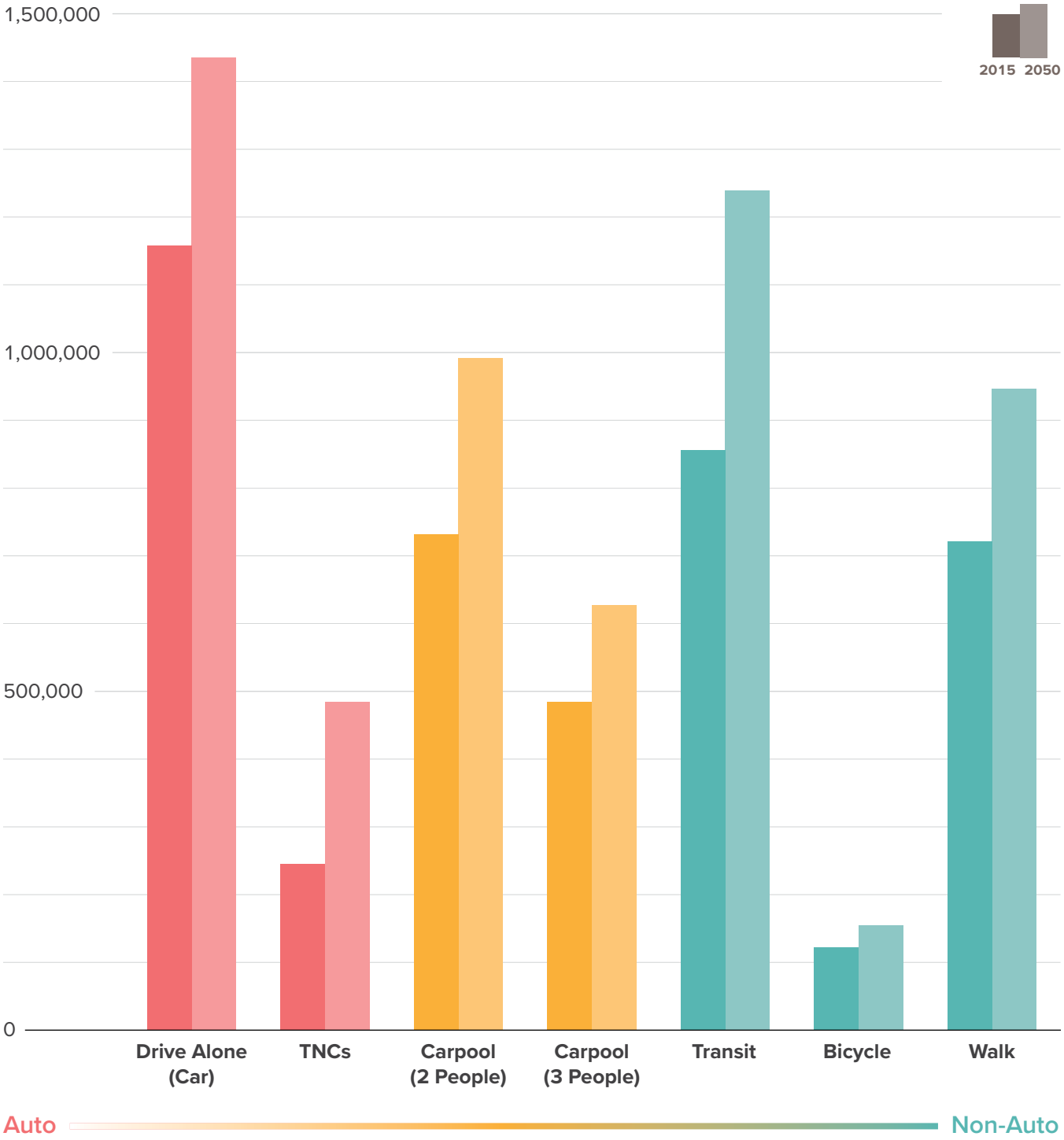
Table 10. *Number of Jobs Accessible by 30-minute Trip by Car*

	2015	2050	% Change
CoC	996,700	1,072,600	8%
Non-CoC	985,800	1,122,300	14%

WE WILL BE CHALLENGED TO MEET OUR MODE SHIFT GOALS

Trips are expected to increase by all modes of travel between 2015 and 2050, and the greatest absolute increase in trips by mode is on transit (Figure 14). However, auto modes also see significant growth through 2050, including a doubling of trips made using transportation network companies (TNCs, such as Lyft and Uber).

Figure 14. *More Trips on All Modes of Travel*



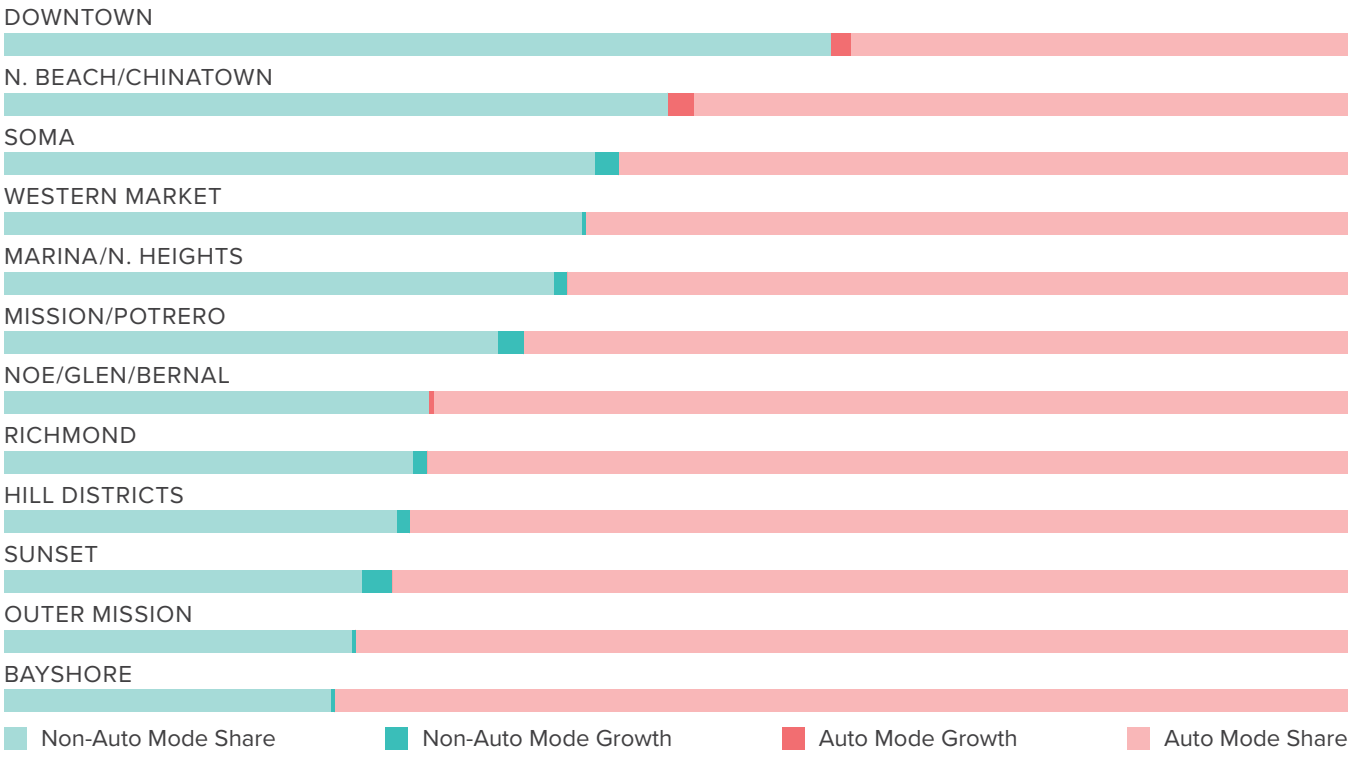
The "0-80-100-Roots" climate action policy framework for the City of San Francisco has set a goal for 80% of trips to use non-auto modes by 2030.[2] Today, almost 40% of trips are by foot, bike, or transit and another 28% are by carpool. The high non-auto mode share today is anticipated to hold steady through 2050. In fact, except for a shift from driving alone to TNC use, most mode shares remain the same in 2050 as they were in 2015 (Table 11). Without further intervention, however, San Francisco will find it difficult to meet the 80% target.

At a neighborhood level, non-auto mode shares shift slightly in 2050 (Figure 15). Neighborhoods that have historically had the highest non-auto mode share — Downtown and North Beach/Chinatown — are expected to see declines. Some of this change may be attributable to TNCs, which appear to be diverting active transportation and transit trips in some of the densest parts of the city. In addition, while the auto mode share exceeds 50% in all other neighborhoods both today and in the future, there are increases in non-auto mode share in several neighborhoods outside of the downtown core, such as the Sunset, Mission/Potrero, Marina/N. Heights and Richmond districts.

Table 11. *Mode share of trips*

	2015		2050	
	Trips	Mode Share (%)	Trips	Mode Share (%)
Drive Alone	1,157,400	27%	1,435,800	24%
TNC	245,500	6%	483,900	8%
Carpool	1,215,800	28%	1,618,800	28%
Transit	856,100	20%	1,239,600	21%
Walk/Bike	842,900	20%	1,101,200	19%

Figure 15. *Auto Mode Share Remains High Outside Downtown*



2 City of San Francisco goal of zero waste, 80 percent non-auto trips, 100 percent renewable energy, and increasing urban greening by 2030.

Person Miles Driven Per Capita is Unchanged in the City, But Declines in the Region

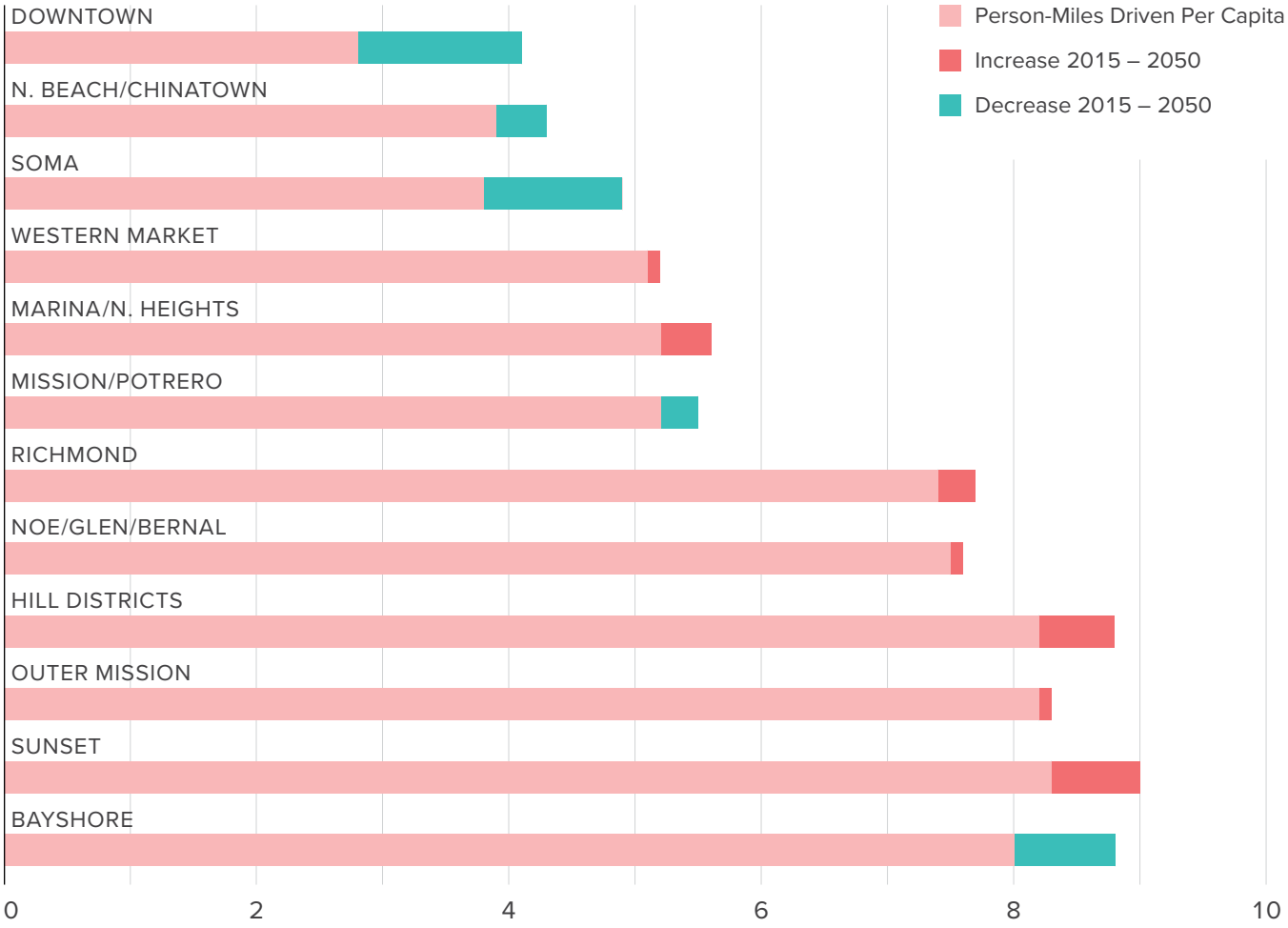
Person miles driven per capita measures the average number of miles a person drives, rides as a passenger in a private vehicle, or takes a TNC/ride-hail service. It does not include trucks or commercial vehicles. San Francisco residents have far lower person miles driven per capita than other Bay Area residents, but person miles driven per capita will remain flat in San Francisco while dropping in the rest of the Bay Area (Table 12). Even with the improvement, other Bay Area residents are expected to produce more than twice as many person miles driven as San Francisco residents.

Table 12. *Change in Personal Miles Driven per Capita (SF vs Region) (2015 – 2050)*

	2015	2050	% Change
San Francisco	6.5	6.6	1%
Rest of Bay Area	16.4	14.9	-9%

At a neighborhood level, person miles driven per capita is expected to increase in 2050 in neighborhoods with the lowest person miles driven per capita in 2015, such as Downtown, North Beach/Chinatown and SoMa, as well as in Bayshore (Figure 16). Most other neighborhoods with higher person miles driven per capita, such as the Hill Districts and the Sunset, show declines.

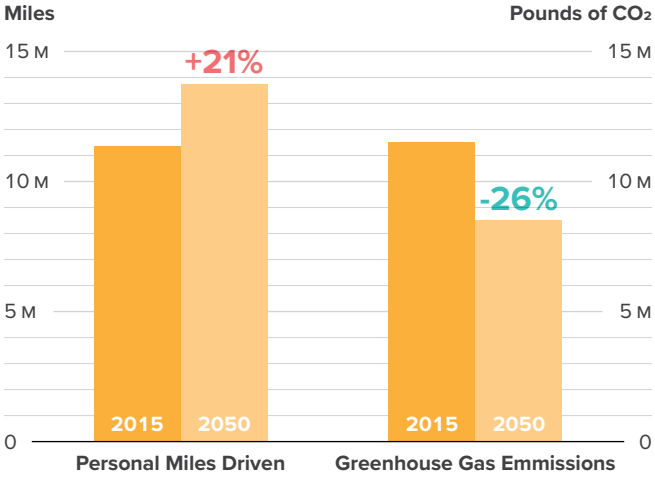
Figure 16. *Change in Person-Miles Driven per Capita by District (2015 – 2050)*



There is an Opportunity to Shift Short Trips to Active Modes

Achieving an 80 percent non-auto mode share will require a concerted effort to address travel of all types — work, school, personal — in all areas of the City. Short automobile trips (defined here as three miles or less) present ready opportunities for mode shift to walking, bicycle or transit. Of the approximately 3.5 million auto trips estimated to start and end in San Francisco in 2050, about 47% are three miles or shorter. The neighborhoods that are projected to have the highest number of auto trips that are three miles or less are Downtown, Mission/Potrero, and the Sunset (Table 13).

Figure 17. *Total Person Miles Driven and Greenhouse Gas Emissions, 2015 and 2050*



Making Progress on Greenhouse Gas Emissions

While overall person miles driven is projected to increase in San Francisco due to the growth in auto trips, greenhouse gas (GHG) emissions are anticipated to fall (Figure 17). This reflects an expected decline in emission rates from vehicles due to ongoing changes in the fuel mix of vehicles (e.g., increasing share of electric vehicles) and continued fuel efficiency gains for gas-fueled vehicles based on adopted state law.[3] In the City's Climate Action Plan, San Francisco has set an ambitious goal of reducing GHG emissions to 80% of 1990 levels by the year 2050. This will be a tremendous challenge considering half of existing emissions comes from the transportation sector.

Table 13. *Auto Trips Three Miles or Shorter with an Origin or Destination in San Francisco by District*

	Number of Trips			Share of Trips (%)	
Origin District	2015	2050	Change (%)	2015	2050
SoMa	58,800	178,400	203%	47%	62%
Downtown	105,800	246,600	133%	49%	67%
N. Beach/Chinatown	52,000	119,400	130%	50%	65%
Mission/Potrero	126,500	225,600	78%	53%	57%
Bayshore	71,000	117,700	66%	42%	42%
Sunset	118,900	187,000	57%	45%	48%
Hill Districts	44,400	65,300	47%	47%	48%
Western Market	102,500	146,000	42%	58%	61%
Marina/ N. Heights	80,900	109,200	35%	55%	58%
Richmond	61,200	80,000	31%	47%	49%
Noe/Glen/Bernal	51,500	67,000	30%	52%	51%
Outer Mission	75,000	84,400	13%	48%	44%

3 California's statutory authority to require lower vehicle emissions is currently the subject of legal action by the federal government

TRANSPORTATION NETWORK PERFORMANCE WORSENS

Growth in population, employment and trips through 2050 will yield reduced transportation network performance for people traveling by transit and in vehicles. This section highlights the extent of those impacts.

Roadway Congestion Increases

With increased growth, the transportation improvements as currently planned and the ongoing reliance on privately owned automobiles, congestion will get worse. Through 2050, roadway speeds are expected to drop during the morning peak (7 – 10 A.M.), evening peak (3:30 – 6:30 P.M.) and mid-day (10 A.M – 3:30 P.M.) periods, indicating continued spreading of congestion beyond traditional commute times (Figure 18). With a few exceptions, speeds remain the same or decline on most major streets and freeways, with the greatest speed declines on freeways and in neighborhoods experiencing the most growth (Figure 19). Note that the increase in auto speeds on Mission Street occurs due to a significant reduction in vehicle traffic corresponding with the installation of bus-only lanes.

Regional automobile travel will contribute to this growth in congestion. Overall, the daily crossings of county lines by automobile will be 19% higher in 2050 than in 2015 (Table 14). The largest increase is at the San Mateo County line, which will see an additional 167,000 daily vehicles (25% increase). The vast majority of crossings now and in the future are in single-occupancy vehicles (SOV). Transportation planning in San Francisco will need to consider transportation networks in surrounding counties, provide alternatives for people traveling to and from San Francisco, and evaluate a range of congestion management techniques such as pricing, tolling, and carpooling.

Figure 18. *Change in Speed by Time of Day for all Roadways in San Francisco*

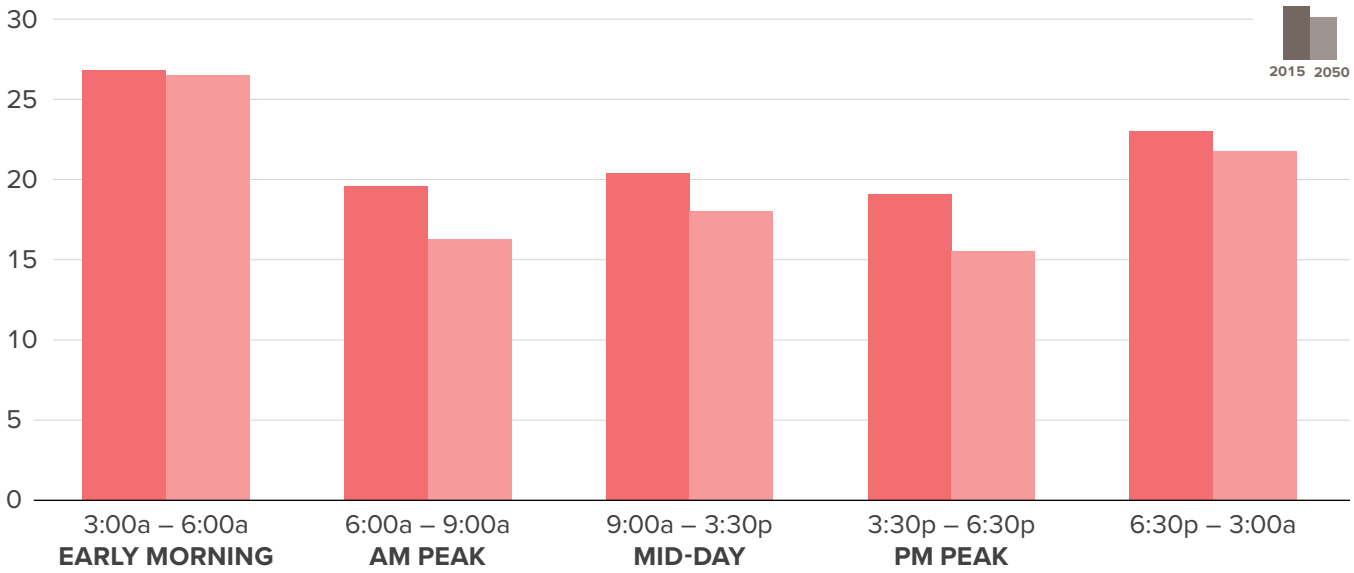


Table 14. *County Line Vehicle Crossings*

	2015	2050	Difference	Percent change
Bay Bridge	282,000	317,000	+35,000	12%
Golden Gate Bridge	133,000	138,000	+5,000	4%
San Mateo County Line	662,000	829,000	+167,000	25%
Total	**1,078,000**	**1,284,000**	**+206,000**	**19%**

Figure 19. *Change in AM Speeds by Road Segment*

Transit Crowding Increases

Transit is considered crowded when the number of passengers on a vehicle is 85% or greater than a bus or train car's capacity. This conservative definition allows for normal variance in day-to-day transit use and the varying perceptions of transit riders. The study team looked at passenger hours (the total number of hours spent by riders on all transit systems) and the share of those hours expected to be spent in crowded conditions.

Transit is expected to grow more crowded through 2050, despite large planned service and capacity increases on BART and Caltrain in particular and smaller increase to SFMTA service. The share of passenger hours on Muni that are crowded increases from 18% to 23% (Figure 20), while BART holds steady at 11%, in part due to service capacity increases. However, the most crowded segments of BART's system continue to be in San Francisco. BART ridership data from September 2019 shows that two-thirds of all BART trips enter or exit at a station along Market Street. AC Transit also sees substantial increase in crowding on regional bus service to the Salesforce Transit Center.

Muni bus lines carry about twice the number of passenger hours as Muni rail lines. However, about 32% of passenger hours on Muni rail are estimated to be crowded in 2050, compared to 19% of passenger hours on Muni buses (Figure 21). For all Muni services, crowding worsens during all time periods (early AM, AM peak, mid-day, PM peak, and evening).

Figures 22 through 24 illustrate estimated 2050 transit crowding during the AM peak period for Muni Bus, Muni Rail, and regional transit, respectively. Transit crowding persists in Downtown, on Market Street and Mission Street, in the Central Subway and Transbay corridors, and on many major corridors within the City. While some significant projects are planned for key corridors (such as Better Market Street and Caltrain Electrification) and both BART and Muni are purchasing new vehicles which increases capacity, demand for transit services is anticipated to grow faster than these current planned investments. On the other hand, the City's western neighborhoods generally experience lower levels of crowding.

Figure 20. *Average Weekday Passenger Hours by Crowding Level*

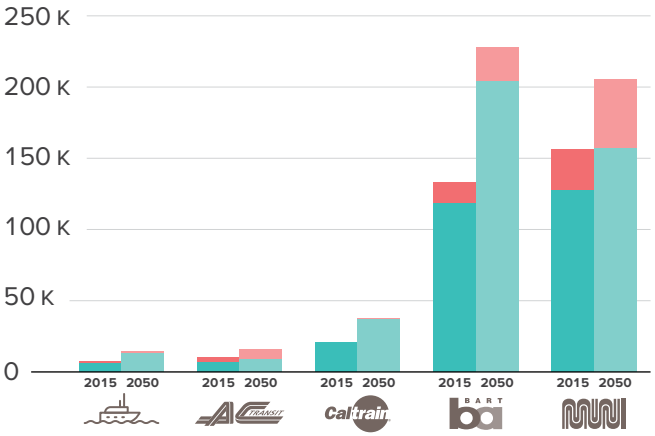


Figure 21. *Average Weekday Passenger Hours by Crowding Level – Muni*

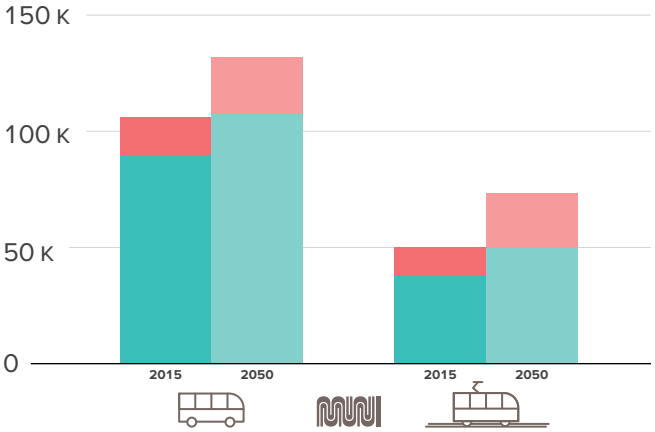


Figure 22. *2050 AM Muni Bus Passenger Crowding Level*

Crowding (V/C)	0.5 or less	0.5 – 0.85	0.85 – 1	0.85 – 1	more than 1
Volume	less than 500	500 – 2,500	2,500 – 5,000	5,000 – 10,000	10,000 or more

Figure 23. *2050 AM Muni Rail Passenger Crowding Level*

Figure 24. *2050 AM Regional Transit Passenger Crowding Level*

Transit Reliability is an Ongoing Concern

While transit accessibility is expected to improve over time, increasing street congestion and transit crowding highlight the need to focus on the reliability of the transit system. While transit reliability cannot be forecast to 2050, reliability is a critical transportation system need and is presented here using the most recent available data.

One measure of reliability is on-time performance of transit. On-time performance is measured throughout the journey of each transit route, not just at the end of the route. Since 2015, Muni's overall on-time performance systemwide has decreased slightly from a high of 61.3% in 2016 to a current low of 54.5% in 2019 (Figure 25). Proposition E, passed by San Francisco voters in 1999, set a standard for Muni to have at least an 85% on-time record, with the goal of achieving this by 2004. Muni has not yet achieved this goal, and the most recent trend shows a need to continue to identify solutions to improve on-time performance.

Another measure of transit reliability is the variability of transit speed. More variable transit speeds indicate increased likelihood of a bus or train not being available when expected and/or travel taking longer than expected. Variability of transit speed improved from around 30% in 2011 (i.e., observed speeds are typically within 30% of average speed) to nearly 15% in 2017, before increasing again in 2019 to over 20% (Figure 26). Figure 27 shows transit speed variability for specific local and regional routes that travel on San Francisco's arterials in 2017.

Figure 25. *Muni On-Time Performance by Fiscal Year, 2015 – 2019*

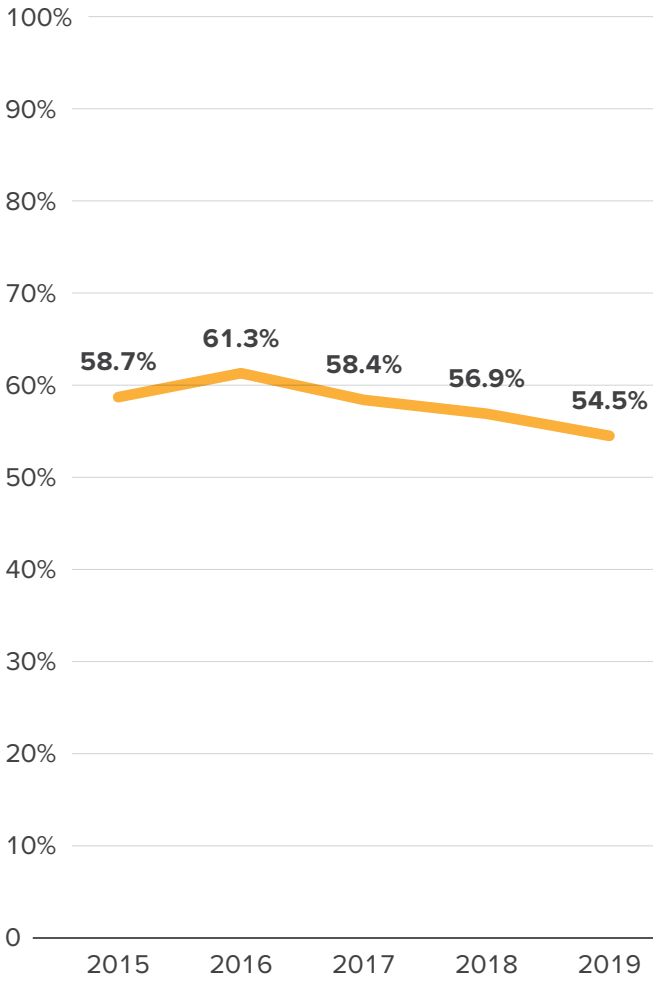
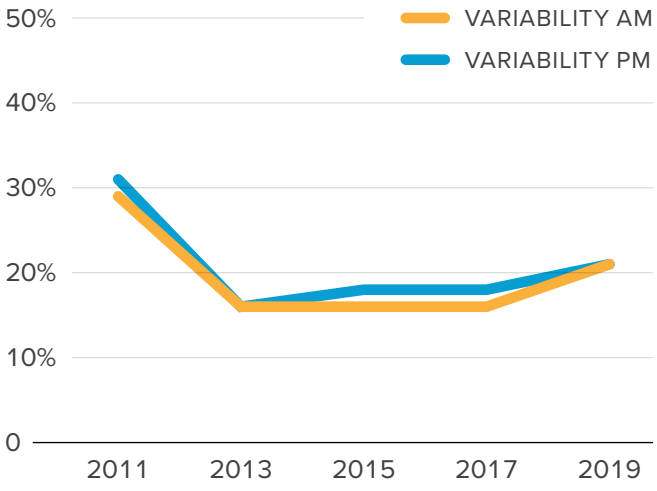


Figure 26. *Transit Speed Variability, 2011 – 2017*



Source: 2019 SFCTA Congestion Management Program Report

Figure 27. *Variability of Transit Speeds for Existing Evening Peak Transit Service (2017)*

0% – 5% 5% – 10% 10% – 20% 20% – 30% 30% – 40% more than 40%

Photo by Sergio Ruiz

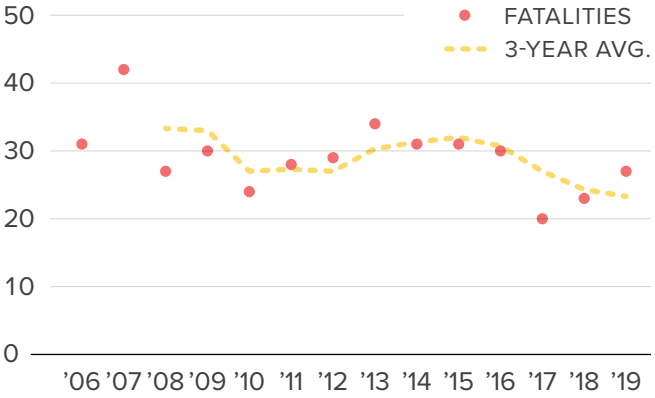
SAFETY IS A PERSISTENT CONCERN

In 2014, San Francisco became a Vision Zero city, vowing to eliminate all traffic-related deaths by 2024 through education, enforcement, and road infrastructure redesign. The Vision Zero SF Action Strategy defines data-driven strategies that focus on creating safer streets, educating the public, enforcing traffic laws, and advancing transformative policies that save lives. As part of this effort, the City has identified a high injury street network, finding that 70% of San Francisco's severe and fatal traffic injuries occur on just 12% of its streets.

Safety is another metric that cannot be easily forecast into the future, so is presented here using the most recent available data. Overall traffic fatalities have fluctuated over the past decade, including increases in the last two years (Figure 28).

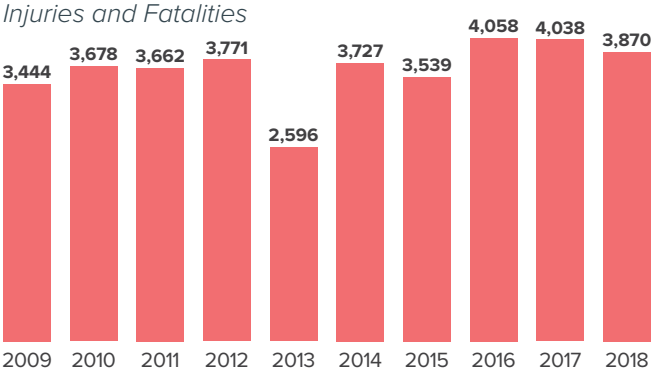
Despite the significant focus and resources on eliminating fatalities and improving transportation safety, these issues remain a significant concern. Except for 2013, bicycle and pedestrian fatalities and injuries have generally increased over the last decade (Figure 28). Figures 29 and 30 show the locations of bicycle and pedestrian injuries in San Francisco from 2006 to 2017.

Figure 28. *Traffic Fatalities in San Francisco, 2006 – 2019*



Note: 2019 traffic fatalities are through November 2019.
Source: SFMTA

Figure 29. *Annual Bicycle and Pedestrian Injuries and Fatalities*



Source: Statewide Integrated Traffic Records System (SWITRS) data 2009 – 2018

Figure 30. *Bicycle Collisions in San Francisco, 2006 – 2017*

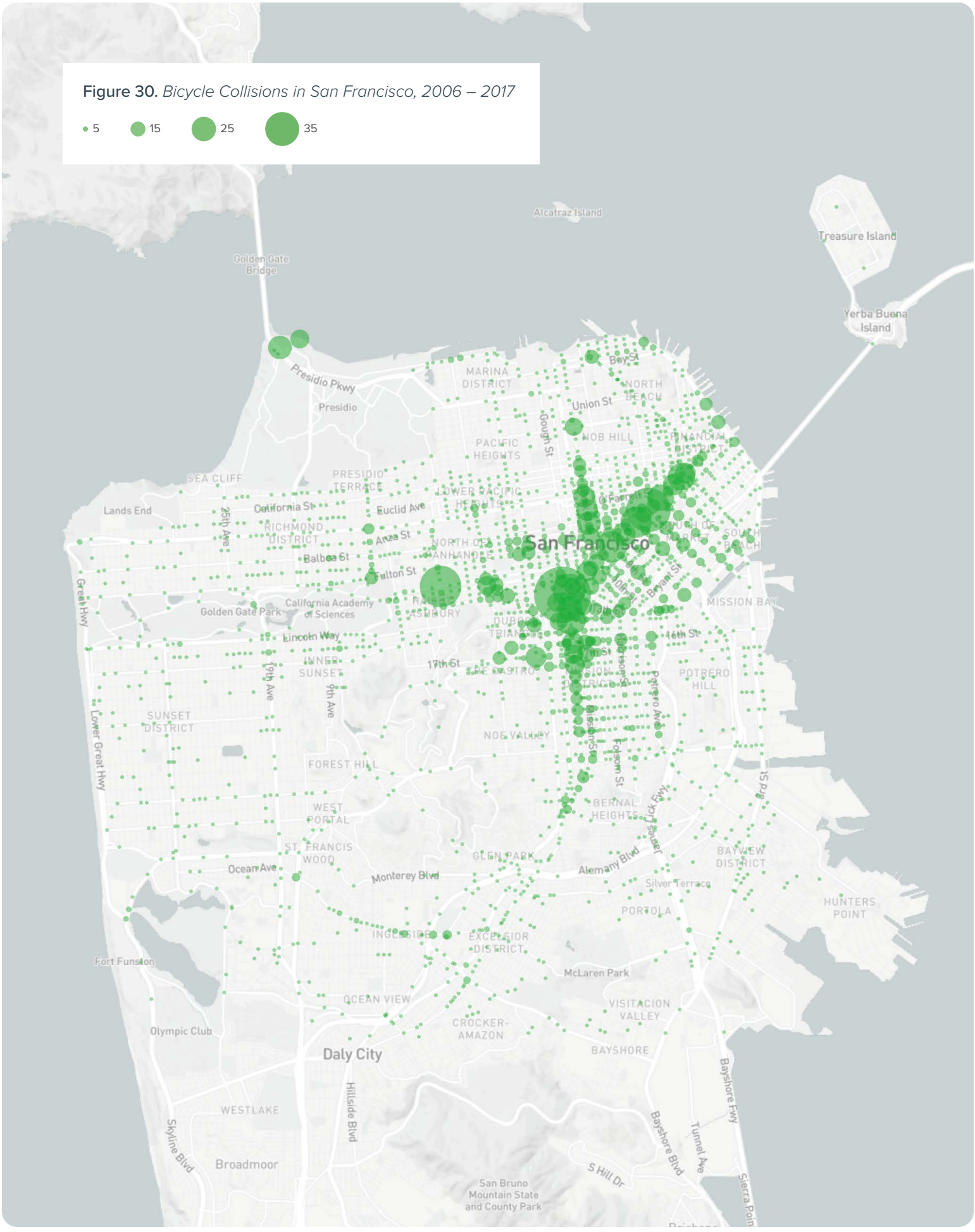
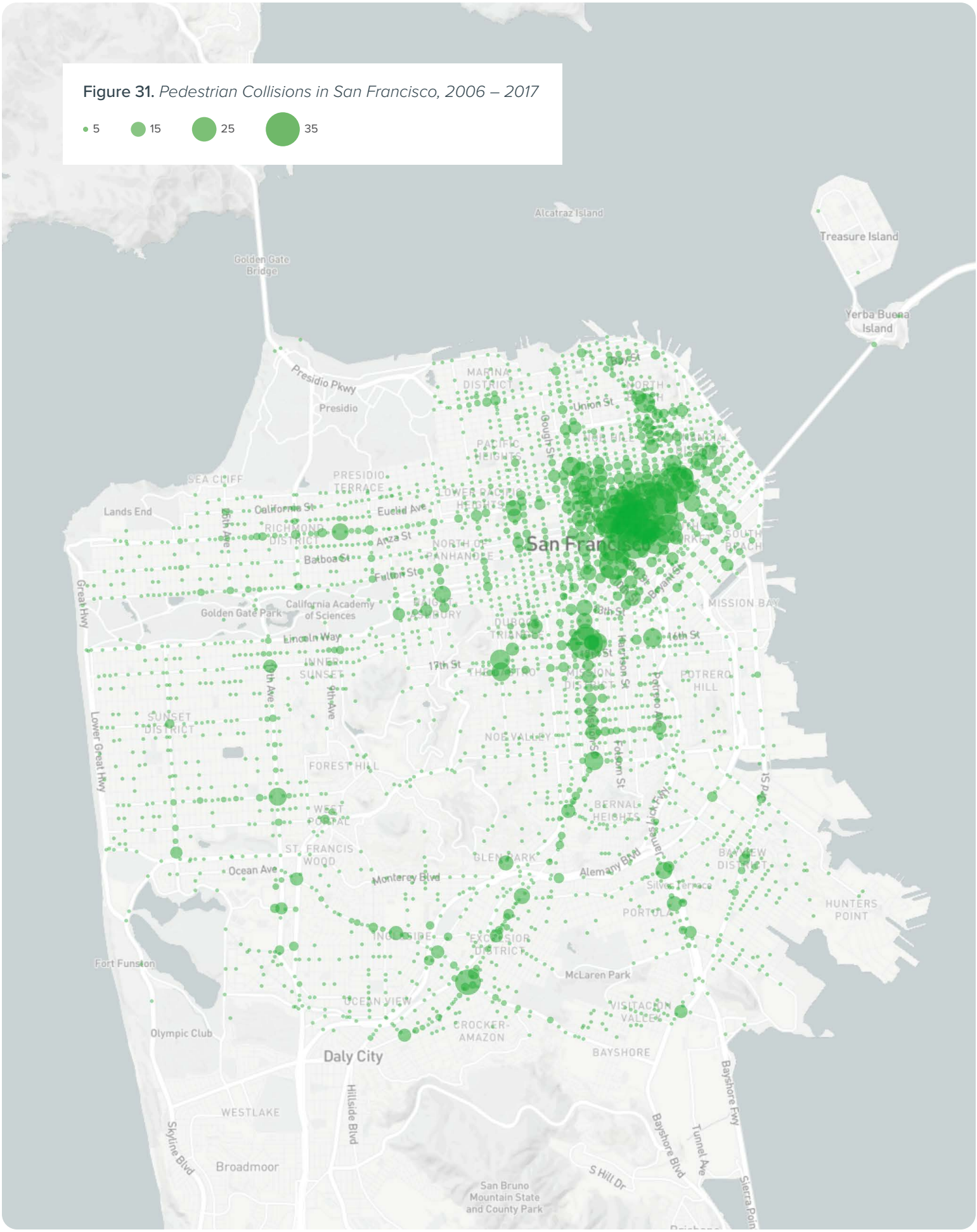


Figure 31. *Pedestrian Collisions in San Francisco, 2006 – 2017*

5 15 25 35



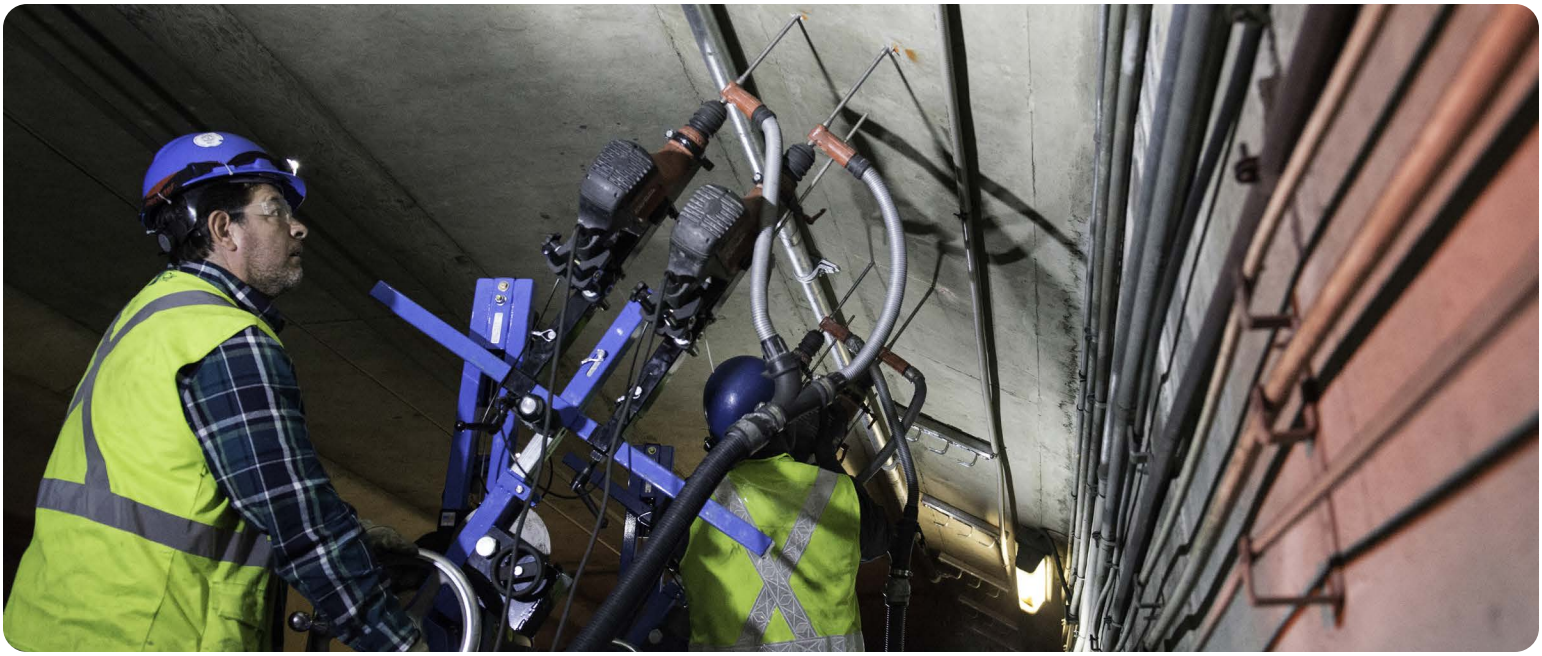


Photo by SFMTA Photography Department

KEEPING ASSETS IN A STATE OF GOOD REPAIR REMAINS AN IMPORTANT FOCUS

State of Good Repair refers to the condition of transportation infrastructure to be able to operate at their full level of performance. Keeping the existing transportation system in a state of good repair is essential to providing safe and reliable transportation options for San Francisco residents, workers, and visitors. It is also the foundation needed to support safety and livability enhancements and planned growth — it is necessary for attaining the long-range Vision for San Francisco's transportation system.

The transportation system includes everything from streets and roads to bridges and freeways to local and regional transit systems to bicycle and pedestrian facilities. Regular reinvestment in these systems is more cost effective than replacing assets that have fallen into a state of disrepair and can mean a much better experience for travelers. Smooth pavement provides a more comfortable ride for bus riders, is safer for cyclists, pedestrians and wheelchair users, and causes less damage to vehicles. Regular maintenance of buses and trains minimizes breakdowns that decrease the reliability of transit service and inconvenience riders.

The estimated state of good repair needs for San Francisco — as is the case for the Bay Area region as a whole — could consume all available discretionary funding. Deciding how to cost effectively maintain existing transportation assets while strategically upgrading and enhancing the network is a necessary approach given limited resources. The sections below provide a snapshot of the state of good repair needs for San Francisco's transportation system.

Transit

San Francisco has an extensive local and regional transit network, reflecting its Transit First policy. This represents an enormous investment in physical infrastructure such as vehicles, tracks, tunnels, maintenance facilities, stations and software, as well as ongoing operating costs to provide transit service and maintain these systems on a day-to-day basis.

Neither SFMTA nor the regional transit operators serving San Francisco, such as BART and Caltrain, have the budget to replace all their assets before or by the end of their useful life, which has led to a serious backlog in repairs. When assets do get replaced, it is typically easier to secure funding to replace assets that directly touch passengers, such as new buses or trains, than it is to repair, upgrade or replace assets like maintenance facilities.

Table 15 shows the Metropolitan Transportation Commission's (MTC) draft estimated capital and operating needs by agency for 2020 through 2050, based on data and information provided by transit operators. The table identifies transit operators that San Francisco regularly contributes money for capital needs, along with the Transbay Joint Powers Authority (TJPA), which operates the Salesforce Transit Center. Operating costs include the cost to operate and maintain existing transit service levels, systemwide non-operating expenses (including debt service), and costs to operate service for committed expansion projects like the Central Subway when they come online.

Local Streets

Maintaining local streets, roads, and on-system bicycle, pedestrian and other non-pavement infrastructure such as signs, signals, sidewalks and storm drains is a key responsibility of local government. San Francisco, like most jurisdictions, carries a backlog of deferred local street maintenance. With the influx of new funding, especially Senate Bill 1 state gas tax funds, pavement conditions have improved in recent years, though funding still lags significantly behind need. In addition, the current competitive construction market means costs for materials and labor are higher, so each dollar does not go as far as in previous years.

MTC's preliminary estimate of the funds needed to maintain the pavement in San Francisco at the current 'fair' average condition (around a moving three-year average Pavement Condition Index score of 72) and associated non-pavement infrastructure through 2050 is $5.2 billion. To reach a state of good repair (e.g., an average Pavement Condition Index score in the low to mid 80's) is $5.8 billion. MTC's preliminary estimates for the funding shortfall for these two scenarios is $1.9 billion and $2.5 billion, respectively.

Local Bridges

San Francisco has 24 locally owned bridges that, like transit facilities and streets, require ongoing maintenance. One common way to summarize the overall condition of a bridge is the Sufficiency Rating, which is calculated based on several factors that describe a bridge's structural evaluation, functional obsolescence and its essentiality to the public. A rating of 100% represents an entirely sufficient bridge and a rating of zero percent represents an entirely deficient bridge. San Francisco's local bridge structures have an average Sufficiency Rating of 73, with 3 of the 24 structures having a Sufficiency Rating of less than or equal to 50.

MTC's preliminary estimate of operating and maintenance needs to achieve and maintain San Francisco's local bridges in a state of good repair through 2050 is $79 million. This assumes a state of good repair is achieved in the first ten years and maintained thereafter. The data available for local bridge needs is not as robust as for local streets and roads, but this estimate provides an order of magnitude sense of the total need for state of good repair work.

Table 15. *Draft Transit Capital and Operating Needs by Operator (millions of YOE$)*

Agency	Transit Capital Needs		Transit Operating Needs
	State of Good Repair[4]	Maintain Current Conditions[5]	
BART	$31,278	$21,824	$58,043
Caltrain	$5,375	$3,943	$8,349
TJPA	TBD	TBD	$2,096
SFMTA	$21,234	$16,035	$67,139

4 MTC Estimate of cost to achieve a state of good repair (no assets exceed their useful life) within ten years, and then maintain that level through 2050.

5 MTC estimate of the cost to maintain assets at their existing condition for 2020 – 2050

Freeways and Highways

The California Department of Transportation (Caltrans) develops a needs assessment for the state highway system every two years. This needs assessment, the State Highway System Management Plan (SHSMP), includes a 10-year forecast of needs to achieve established performance targets for state-owned pavement, bridges and tunnels, drainage, transportation management systems (e.g. changeable message signs on freeways), and related assets like highway lighting and overhead signs. The SHSMP in turn informs the State Highway Operation and Protection Program (SHOPP), a funding program for managing the state-owned road network focused on state of good repair. Consistent with federal requirements and best practice, Caltrans has developed an asset management plan that identifies the total needs for pavement and bridge preservation.

MTC has developed a preliminary estimate of the total cost to reach a state of good repair for the state highway system for the nine county Bay Area at a total of $24.4 billion. County-level estimates (i.e., for San Francisco alone) are not available at this time. A preliminary review of pavement conditions on state highways in San Francisco shows that almost one half of lane miles are in poor condition, using an international roughness index (IRI) standard that state departments of transportation, like Caltrans, are required to report to the U.S. Department of Transportation as part of federal performance measurement requirements (Table 16).

Table 16. *Pavement Condition of State Highways in San Francisco, 2017*

International Roughness Index (IRI) Threshold		Lane Miles (%)
Good	Under 95	21%
Fair	95 to 170	32%
Poor	170 or higher	47%

Source: USDOT Highway Performance Monitoring System (HPMS) data, 2017

As part of the Streets and Freeways Study, the ConnectSF team will conduct additional state of good repair analysis of the state highway system in San Francisco, looking for opportunities to coordinate enhancements with maintenance and repair work and to advocate for San Francisco's fair share of SHOPP funding.

Resiliency and Sea Level Rise

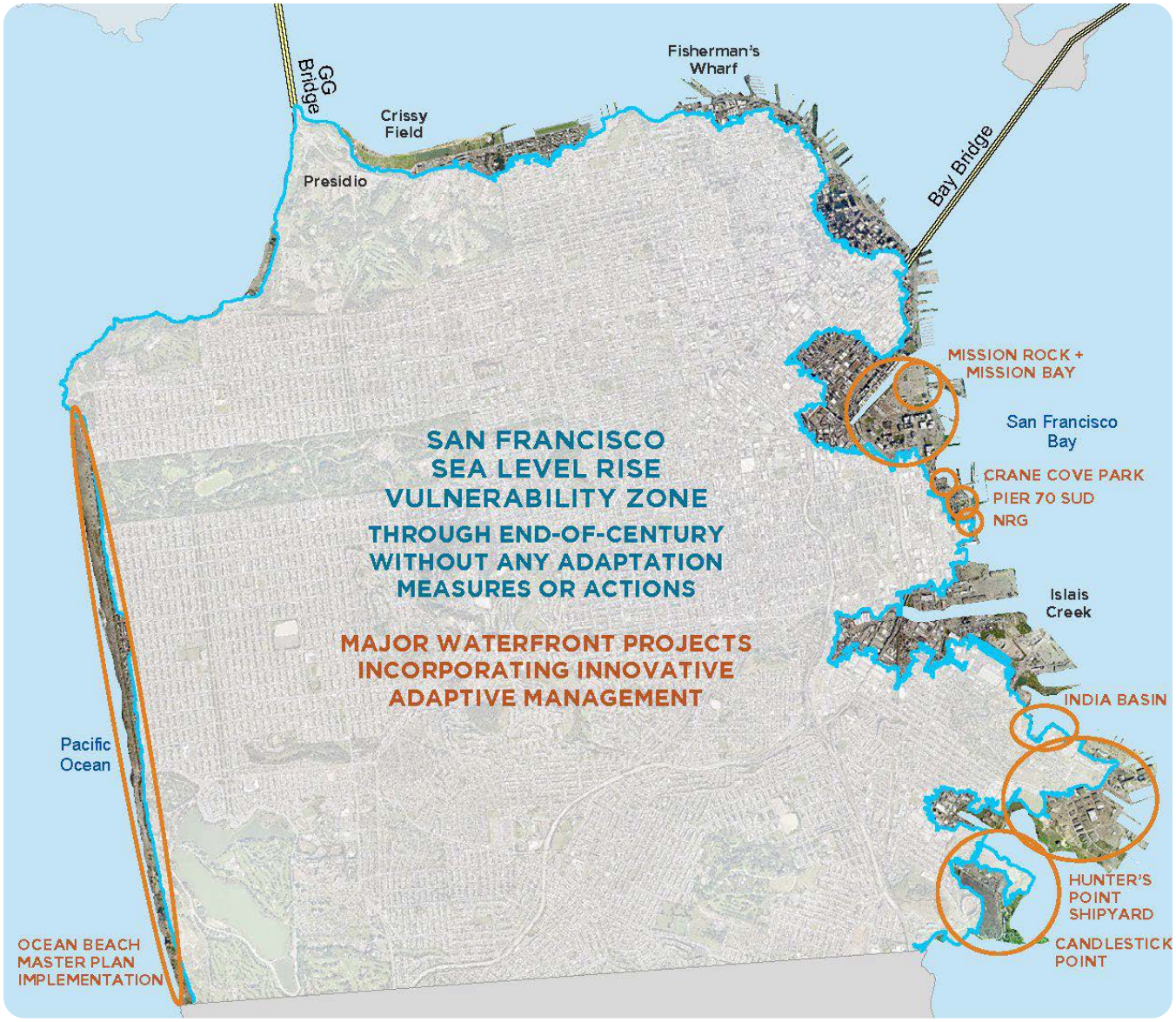
When and how state of good repair investments and network expansions/enhancements are made must take into account the impacts of climate change and the need to increase the resiliency of the transportation system and other infrastructure. San Francisco is already affected by periodic coastal flooding today and will be even more at-risk in the future. By 2050, the sea level may increase by up to 24" with an additional 40" of inundation during storm surges and/or king tide events.

San Francisco is planning for this through the Sea Level Rise Coordinating Committee, an inter-departmental effort that includes the Planning Department and SFMTA. The committee conducted a Vulnerability and Consequences Assessment (2019) that analyzed impacts to various sectors, including Mobility.

Transportation assets are expected to be impacted by sea level rise in several neighborhoods, including Fisherman's Wharf/ North Beach, Financial District, South of Market/ Mission Creek, and Bayview North/Islais Creek (Figure 31). The ConnectSF process is being coordinated with ongoing climate change and adaptation planning processes underway within the City to help mitigate the impacts.

Figure 32. *San Francisco Sea Level Rise Vulnerability Zones*

Source: SF Planning Dept, Sea Level Rise Vulnerability and Consequences Assessment — May 2019 presentation to Planning Commission



Conclusion

While San Francisco's continued growth in the future will provide some local and regional benefits, the City faces many challenges before it can reach the Vision for San Francisco developed by the community and stakeholders. Without new investments and bold policy interventions, it will be very difficult to make real progress towards the ConnectSF goals related to equity, environmental sustainability and economic vitality. Areas of concern include:

- **Uneven outcomes for Communities of Concern.** While accessibility and commute times are expected to improve for San Francisco residents as a whole, they are expected to get worse for residents of Communities of Concern.
- **Lack of progress toward an increased non-auto mode share.** New development, more people, and more jobs in the coming years mean that travel by all modes is expected to grow substantially. However, proposed transportation investments will only maintain the non-auto mode share (transit, biking, and walking) as it is today. Given the City's ambitious goals to increase the non-auto mode share to 80% and reduce greenhouse gas emissions to 80% of 1990 levels by 2050, maintaining the status quo will not be sufficient.
- **Continued growth in transit crowding and congestion.** While average travel times and accessibility outcomes are expected to remain consistent or improve, San Francisco residents and visitors using transit and driving will see declining conditions on transit and on streets. Both transit crowding and roadway congestion are expected to increase in the future, emphasizing the need for further investment to better accommodate residents and other system users.

Table 17 provides a snapshot of key findings in each goal area. Most of these findings are forecast to 2050, but those that cannot be forecast are presented using current data only. A comprehensive review of all of the metrics analyzed for the Statement of Needs is provided in Appendix A.

Table 17. *Overall Findings by Goal Area*

EQUITY

- By 2050, residents of Communities of Concern (CoCs) have access to about 5% fewer jobs by transit on average than other San Francisco residents.
- Commute times increase for residents of Communities of Concern, from 21.7 minutes in 2015 to 23 minutes in 2050, while declining for other San Francisco residents.
- The share of CoC households with access to high quality transit declines from 94% in 2015 to 92% in 2050 while increasing for other San Francisco households.

ECONOMIC VITALITY

- Commute times for San Francisco residents increase slightly from 24.1 in 2015 to 24.4 minutes in 2050.
- Transit speeds are expected to increase slightly, from 11.6 mph in 2015 to 12.4 mph in 2050, while auto speeds are expected to decline by about 15%.
- The share of passenger hours on Muni that are crowded increases from 18% in 2015 to 23% in 2050.

ENVIRONMENTAL SUSTAINABILITY

- Mode share by transit, biking and walking remains unchanged from 2015 to 2050, with a slight increase from 39.4% to 39.8% of trips.
- GHG emissions are expected to decline by about 26% by 2050, due to current State of California requirements and programs to produce a cleaner vehicle fleet.[6]

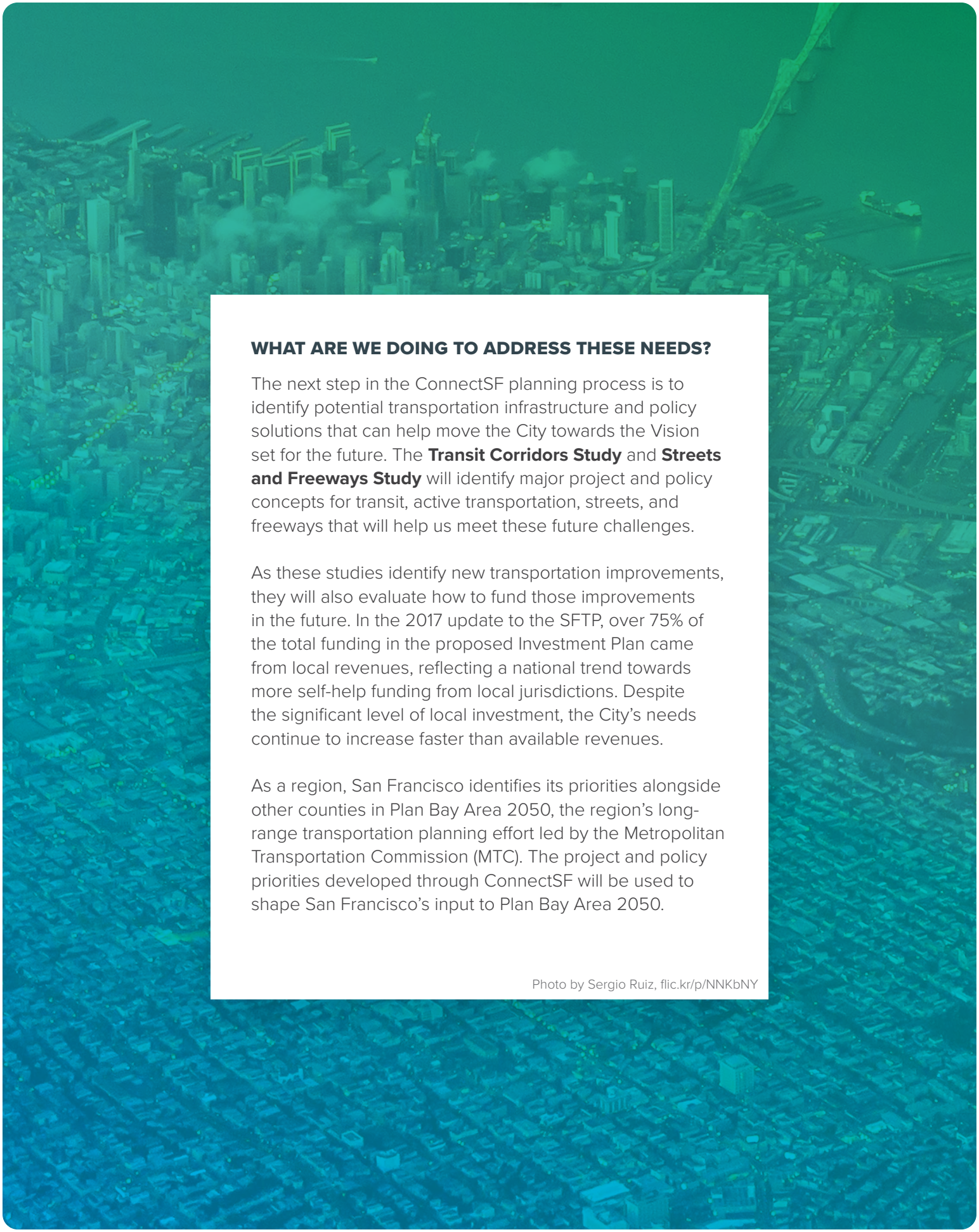
SAFETY AND LIVABILITY

- Bicycle and pedestrian injuries and fatalities have increased in recent years, with the last three years being the highest three years of the last decade.

ACCOUNTABILITY AND ENGAGEMENT

- Over 5,000 individuals and more than 60 organizations have contributed to developing the Vision for ConnectSF
- Since 2015 Muni's on-time performance systemwide has decreased from a high of 61.3% in 2016 to a low of 54.5% in 2019

6 California's statutory authority to require lower vehicle emissions is currently the subject of legal action by the federal government



WHAT ARE WE DOING TO ADDRESS THESE NEEDS?

The next step in the ConnectSF planning process is to identify potential transportation infrastructure and policy solutions that can help move the City towards the Vision set for the future. The **Transit Corridors Study** and **Streets and Freeways Study** will identify major project and policy concepts for transit, active transportation, streets, and freeways that will help us meet these future challenges.

As these studies identify new transportation improvements, they will also evaluate how to fund those improvements in the future. In the 2017 update to the SFTP, over 75% of the total funding in the proposed Investment Plan came from local revenues, reflecting a national trend towards more self-help funding from local jurisdictions. Despite the significant level of local investment, the City's needs continue to increase faster than available revenues.

As a region, San Francisco identifies its priorities alongside other counties in Plan Bay Area 2050, the region's long-range transportation planning effort led by the Metropolitan Transportation Commission (MTC). The project and policy priorities developed through ConnectSF will be used to shape San Francisco's input to Plan Bay Area 2050.

Photo by Sergio Ruiz, flic.kr/p/NNKbNY

Acknowledgments

ConnectSF is a partnership of the Planning Department, Transportation Authority, the Municipal Transportation Authority, the Office of Economic and Workforce Development, and the Mayor's Office.

ConnectSF

TO LEARN MORE OR TO GET INVOLVED:

connectsf.org

APPENDIX A

FINDINGS BY GOAL AREA

ConnectSF

DECEMBER 2019

APPENDIX A FINDINGS BY GOALS AREA

This appendix identifies the full set of metrics that were evaluated as part of the Statement of Needs. Metrics are organized by the goals that were generated as part of the ConnectSF Vision. The ConnectSF Vision included five goal areas:

EQUITY	San Francisco is an inclusive, diverse, and equitable city that offers high-quality affordable access to desired goods, services, activities, and destinations
ECONOMIC VITALITY	To support a thriving economy, people and businesses easily access key destinations for jobs and commerce in established and growing neighborhoods both within San Francisco and the region
ENVIRONMENTAL SUSTAINABILITY	The transportation and land use system support a healthy, resilient environment and sustainable choices for future generations
SAFETY AND LIVABILITY	People have attractive and safe travel options that improve public health, support livable neighborhoods, and address the needs of all users
ACCOUNTABILITY AND ENGAGEMENT	San Francisco city agencies, the broader community, and elected officials work together to understand the City's transportation needs and to deliver projects, programs, and services needed in a clear, concise and timely fashion

The following pages list the objectives from ConnectSF and the complete set of metrics for each goal. The objectives identified as part of the vision are broad, touching on all elements of the complex interplay between transportation, land use, and environmental policy. Many of the metrics speak to multiple objectives, including some that touch on multiple goals. Metrics are listed once within each goal area to b evaluation of that goal.

Each section lists the goal and objectives, followed by a short summary statement about how San Francisco is expected to perform on this goal through by a listing of each metric and progress on its performance.

EQUITY

San Francisco is an inclusive, diverse, and equitable city that offers high-quality affordable access to desired goods, services, activities, and destinations

Objectives

- Create equitable access to schools, jobs, and services that is fast and convenient
- Expand affordable travel options for low- and moderate-income households and for historically disenfranchised communities
- Close equity gaps in the transportation system
- Maintain San Francisco's economic and demographic diversity
- Add housing for low- and moderate-income groups and families
- Stabilize housing for low- and moderate-income households
- Preserve affordable housing, especially in areas receiving new infrastructure investment
- Add new low- and moderate-income housing near essential services and schools; Locate services and amenities near populations that need them

How are we doing?

Communities of Concern (CoC) are expected to experience declining accessibility to jobs and access to high quality transit relative to residents in other areas of the City.

METRIC	KEY FINDING	PROGRESS
Commute times for residents of CoCs	Residents of Communities of Concern have shorter commute times now and in the future compared to other households. However, in the future commute times worsen for residents of Communities of Concern by 6% from 21.7 to 23 minutes.	✖
Commute times for low- and very low-income residents	Low- and Very low-income households enjoy shorter than average commutes in 2015, but those households are seeing increases in commute travel times of 3% and 7% by 2050 while higher income groups are seeing decreases.	✖
Transportation Costs for low-income households	In both 2015 and 2050, low-income households on average have significantly higher shares of income spent on transportation costs compared to high income households. The percentage share of income spent by low-income households on transportation increases 15% during this time, from 16.5% to 18.9%.	✖

METRIC	KEY FINDING	PROGRESS
Transportation Costs for an average San Francisco household	The percent of income spent on transportation for an average San Francisco household stays about the same between 2015 and 2050.	
Access to high-quality transit by households in Communities of Concern	The number of households in CoCs with access to high quality transit increases (from 111,000 to 165,000), but the share of households with access declines (from 94% to 92%). The share of non-CoC households with access to high quality transit increases (from 85% to 89%).	
Average number of jobs residents of CoCs can access	By 2050, on average residents of CoCs have access to about 38,000 fewer jobs by transit than other San Francisco residents.	
Average number of jobs low- and very low- income residents can access	Jobs accessible by transit and auto is increasing for all income groups but access for low- and very low-income households will not increase the number of jobs as much as moderate-, middle-, and high-income households.	
Difference in air quality in different areas of the city	In 2015, approximately 1/3 of Air Pollution Exposure Zones are located in CoCs.	

ECONOMIC VITALITY

To support a thriving economy, people, and businesses easily access key destinations for jobs and commerce in established and growing neighborhoods both within San Francisco and the region

Objectives

- Ensure the safe and efficient movement of people and goods
- Increase access to schools, jobs, and services for local and regional travelers
- Improve and create transportation connections within San Francisco
- Increase capacity, reliability and connectivity of regional transportation connections
- Deliver efficient goods movement within and through the City
- Create and maintain a diverse economy in San Francisco by helping to retain small businesses and the production/distribution/repair (PDR) sector, with businesses of all sizes and sectors with a range of job opportunities for people of all skills sets
- Enhance placemaking and access to neighborhood commercial corridors

How are we doing?

By 2050 job access and commute times improve for many San Francisco residents, but get worse for residents commuting out of San Francisco and for residents of Communities of Concern. Expected investments improve transit travel speeds.

METRIC	KEY FINDING	PROGRESS
Commute times generally for SF residents	Commute times for all residents stays about the same, increasing slightly from 24.1 to 24.4 minutes.	⊖
Commute times for residents who live and work in San Francisco	Commute times for residents who live and work in San Francisco decreases 3% from 21.6 to 21 minutes.	⊖
Commute times for San Francisco residents commuting elsewhere in region	Commute times for San Francisco residents commuting elsewhere in the region does not change much, increasing slightly from 40.2 to 42.8 minutes.	⊖
Commute times for Bay Area residents commuting into San Francisco	Commute times for Bay Area residents commuting to San Francisco will stay the same at about 54 minutes.	⊖
Commute times for residents of CoCs	Residents of Communities of Concern have shorter commute times now and in the future compared to other households. However, in the future commute times worsen for residents of Communities of Concern by 6% from 21.7 to 23 minutes.	✖

METRIC	KEY FINDING	PROGRESS
Commute times for low- and very low-income residents	Low- and Very low-income households enjoy shorter than average commutes in 2015, but those households are seeing increases in commute travel times of 3% and 7% by 2050 while higher income groups are seeing decreases.	✖
Street congestion	Overall, congestion on San Francisco streets gets worse. The proportion of vehicle hours in delay during the evening peak period increases from 50% to 59% between 2015 and 2050.	✖
Transit speeds along major auto corridors	Average transit speeds along major auto corridors during the PM peak will improve slightly by 2050 – from 11.6 mph to 12.4 mph, an improvement in speed of 6.5%.	✔
Average number of jobs a San Francisco household can access	More jobs are accessible to San Francisco workers and more jobs are accessible by auto than by transit. There is greater improvement in job accessibility by transit than by auto.	✔
Average number of jobs residents of CoCs can access	By 2050, on average residents of CoCs have access to about 38,000 fewer jobs by transit than other San Francisco residents.	✖
Average number of jobs low- and very low- income residents can access	Jobs accessible by transit and auto are increasing for all income groups but access for low and very low-income households will not increase the number of jobs as much as moderate-, middle-, and high-income households.	✖
Easy access to regional transit by all San Francisco residents	In 2015, about 59% of all jobs in San Francisco are accessible within 15 minutes (walk, bike or transit) of a regional transit connection. That proportion stays about the same with 60% of all jobs accessible in 2050.	–
Easy access to regional transit by residents of CoCs	The percentage of CoC households with easy access to a regional connection increases from (27.5% to 28.8%) but the increase is at a slower rate than other households in SF. The CoC percentage also remains lower than that of other households which is 32.3% in 2050.	✖
Easy access to jobs from a regional transit hub	The number of jobs accessible within 15 minutes (by walking, biking, or transit) of a regional transit connection increases from 439,000 to 556,000 jobs.	✔
Muni transit speeds	Overall, the average speed of vehicles in the Muni system increases from 10.0 mph to 10.9 mph during the evening peak, a 9% increase.	✔
Regional transit speeds	Across all providers, in aggregate regional transit speeds decrease slightly from 16.1 mph to 15.5 mph. The decrease is largely driven by declines in regional bus speeds.	–
Transit crowding (Muni)	Local transit will get more crowded. The share of passenger hours on Muni that are crowded increases from 18% to 23%. Muni buses are the workhorses of the system with more than double the passenger hours of rail and seeing an increase from 15% to 19% of hours in crowded conditions. Crowding is worse on Muni rail than on buses, and the share of passenger hours on Muni rail that are crowded increases from 24% to 32%.	✖
Transit crowding (Regional)	Regional transit will get more crowded. By 2050, AC Transit Transbay service will see a significant increase of hours in crowded conditions from 31 to 45%, and BART and Caltrain crowding remains steady with 11% and 3% of hours in crowded conditions, respectively.	✖

ENVIRONMENTAL SUSTAINABILITY

The transportation and land use system support a healthy, resilient environment and sustainable choices for future generations

Objectives

- Sustainable and active transportation modes are the preferred means of travel in San Francisco
- Grow public transportation options and expand active transportation infrastructure (Transit-First policy)
- Transportation exceeds the City's climate change goals
- Reduce the transportation system's resource consumption, emissions, waste, and noise
- Add transit-oriented and infill development as well as development in Priority Development Areas (PDAs) to reduce local and regional pollution
- Approve and construct concentrations of new housing and neighborhood amenities that will allow more households of all incomes and types to live with less dependence on automobiles

How are we doing?

Vehicle miles traveled and driving per person generally is stable or declining, but total vehicle miles travel increased due to increases in population and employment. Greenhouse gas emissions are expected to decline due to increased use of clean fuels, but San Francisco will struggle to meet the ambitious climate change goals set by the City.

METRIC	KEY FINDING	PROGRESS
Average miles driven for all trips occurring to, from, and within San Francisco	The number of vehicle miles traveled per San Francisco resident is projected to decrease during this time period.	✓
Person miles driven per capita by San Franciscans	Person miles driven per capita in San Francisco increases slightly from 6.5 in 2015 to 6.6 in 2050.	−
Average vehicle miles driven per San Francisco job	The average vehicle miles traveled per job decreases by 16% between 2015 and 2050 - from an average of 10.5 vehicle miles traveled per job in 2015 to an average of 8.8 vehicle miles traveled per job in 2050.	✓
Total miles driven for all trips driven on San Francisco roads	Total vehicle miles traveled increases by 21% from 2015 to 2050 for all trips on San Francisco roads.	✗
Share of trips taken by sustainable modes	Overall mode share is not expected to change significantly from 2015 to 2050. Trips by transit, biking and walking only increase from 39.4% to 39.8%, making it unlikely we will meet the city's goal of 80% sustainable trips.	−
Commute mode share	The sustainable mode share for citywide commutes increases slightly from 47.9% to 49% between 2015 and 2050.	−

METRIC	KEY FINDING	PROGRESS
Miles of high quality active transportation and transit network.	Between 2013 and 2018, the high quality bike network increased 33% from 91 to 121 miles.	✓
Greenhouse gas emissions associated with vehicle travel on San Francisco roadways	From 2015 to 2050, GHG emissions decline by about 26%. The reduction of transportation-related GHG emissions is based on an expected increase in cleaner cars, such as electric cars, during this time period.	✓
Difference in air quality in different areas of the city	In 2015, approximately 1/3 of Air Pollution Exposure Zones are located in CoCs.	−
How competitive is surface transit relative to driving?	The average auto to transit speed ratio for all freeway and arterial road segments measured as part of the congestion management program will improve slightly between 2015 and 2050 – from 1.6 in 2015 to 1.45 in 2050, an improvement of 9.4%. Auto-transit speed ratios will improve slightly on arterials and decline slightly on freeway segments.	✓

SAFETY AND LIVABILITY

People have attractive and safe travel options that improve public health, support livable neighborhoods, and address the needs of all users

Objectives

- Eliminate transportation fatalities; drastically reduce serious injuries
- Make a transportation system that is safe for all users, all modes of transportation, in all communities
- Provide travel options that support healthy lifestyles by expanding the connectivity and increasing the quality of the active transportation system
- Improve the transportation system's ability to accommodate all users, especially those with mobility impairments
- Emphasize safe and attractive connections to parks, schools, and commercial districts
- Improve inter-district and regional connections, especially for under-connected [outer] neighborhoods
- Create neighborhoods that are attractive, safe, green places to walk, bike, and socialize
- Ensure residents can meet daily needs locally with sufficient neighborhood-based retail, services, and community facilities

How are we doing?

Safety continues to be an immediate concern.

METRIC	KEY FINDING	PROGRESS
Number of bicycle and pedestrian fatalities and injuries	Between 2009 and 2018, there has been a slight upward trend in total bicycle and pedestrian fatalities and injuries with the highest numbers occurring in the past three years.	✖
Miles of high quality active transportation and transit network.	Between 2013 and 2018, the high quality bike network increased 33% from 91 to 121 miles.	✔

ACCOUNTABILITY AND ENGAGEMENT

San Francisco city agencies, the broader community, and elected officials, work together to understand the City's transportation needs and to deliver projects, programs, and services needed in a clear, concise and timely fashion

Objectives

- Increase engagement with under-represented communities and groups
- Provide timely and frequent information and engagement opportunities so that the community and decision-makers share ownership of actions
- Speed project and program delivery
- Allocate capital resources efficiently and cost-effectively
- Deliver services and respond to customer requests efficiently and cost-effectively

How are we doing?

The city continues to face immediate challenges with customer experience and transit on-time performance.

METRIC	KEY FINDING	PROGRESS
311 response targets met	The city's goal is to abate 95% of street and sidewalk cleaning requests within 48 hours. In fiscal year 2017-18, the City did not meet its target and responded to 73% of requests within 48 hours.	✖
Transit riders' satisfaction with their experience on Muni	Overall satisfaction with Muni decreased. In 2018, 63% of survey respondents rated Muni as "excellent" or "good" compared to 70% of customers in 2016 and 2017.	✖
Engagement on ConnectSF	Over 5,000 individuals and more than 60 organizations have contributed to developing ConnectSF to date	✔
Muni operating costs	From 2013-2017, transit service has become more expensive to provide in San Francisco.	✖
Muni on-time performance	Since 2015 Muni's on-time performance systemwide has decreased slightly from a high of 61.3% in 2016 to a current low of 54.5% to date in 2019.	✖

APPENDIX B

STATEMENT OF NEEDS METHODOLOGY

ConnectSF

DECEMBER 2019

APPENDIX B STATEMENT OF NEEDS METHODOLOGY

APPROACH

This appendix describes the process to support the development of the ConnectSF Statement of Needs. The purpose of the Statement of Needs is two-fold: to understand how the San Francisco transportation system will perform in 2050 given what currently exists or is planned (i.e., without any further long-range planning for projects), and to determine what areas the City needs to address in order to achieve the ConnectSF Vision.

To do this, staff developed a baseline understanding of how San Francisco's transportation system is performing today and how it is expected to perform in the future, assuming that adopted policies and projects and those in the pipeline are in place. With that in mind, the ConnectSF team identified the following key research question and supporting questions:

- Key research question: What challenges do we need to address to get to our Vision for the future?
- Supporting questions:
  - Does the performance of our current projects and policies planned through 2040 meet the goals and aspirations set out in our Vision?
  - If it doesn't, what are the gaps or areas where we need to do better to reach the Vision?

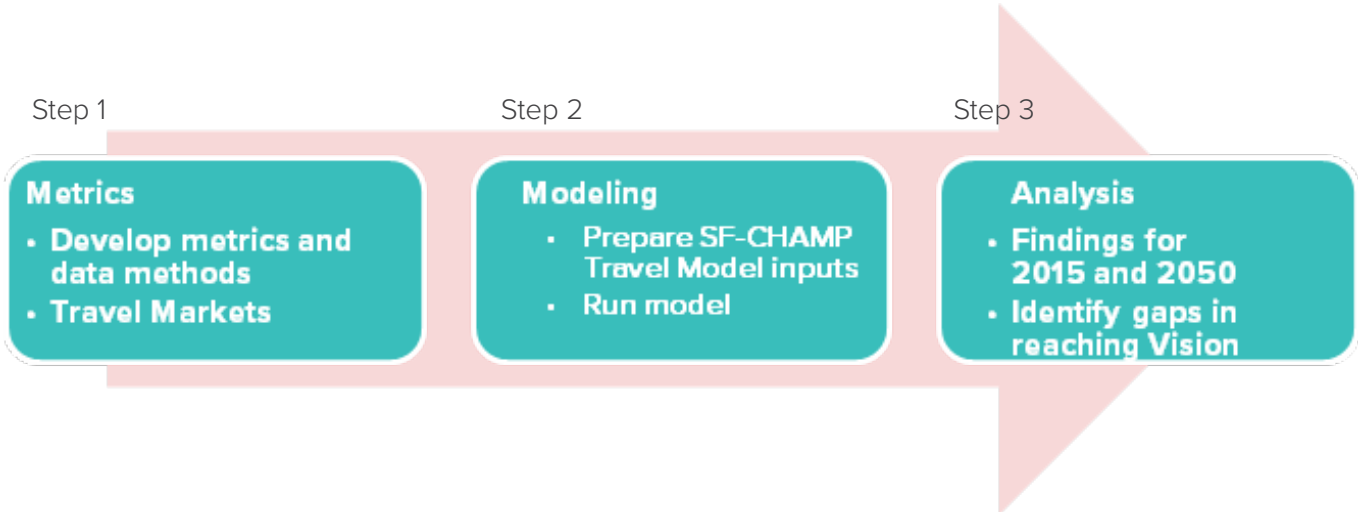
This appendix outlines the methodology for how the ConnectSF team prepared the Statement of Needs to answer these questions.

STEP 1: DEVELOPING METRICS, METHODS AND OTHER CONSIDERATIONS

Identify metrics for each goal area

The ConnectSF Vision has five goals: equity; economic vitality; environmental sustainability; safety and livability; and accountability and engagement. Staff developed objectives that described specific ways the City can achieve each goal. Metrics were then identified to measure progress towards – or away from – the goals.

Figure A. Summary of Methodology Process



The full list of objectives and metrics can be found in Appendix A.

Travel Markets and Other Considerations

ConnectSF also documented current and future key travel markets as well as other issues to consider in relation to the future of transportation in San Francisco.

Key travel markets help planners and the public understand where in San Francisco and the region people travel to and from, both now and in the future. Subsets of travel markets are used tp estimate which modes people are taking or will take (e.g., driving alone, carpooling, taking a Transportation Network Company (TNC) or ride-hail, bicycling, taking transit, or walking), the purpose of trips (e.g., work, shopping, etc.), and the time of day of their trips. Taken together, these factors are referred to as trip-making patterns. ConnectSF staff looked at daily trip-making patterns by all modes (with a focus on work and school commute trips) as well as the number of vehicles entering and exiting San Francisco.

In addition to travel markets, the ConnectSF team identified other topics that will impact the future of transportation. State of good repair is one of those topics, which outlines the ongoing maintenance needs of existing transportation infrastructure in San Francisco. For example, this includes maintenance needs for San Francisco's local streets, bridges, and freeways.

Some metrics were only available for the present and/or recent past and were not able to be modeled and forecasted for the year 2050. One example is the metric on the number of bicycle and pedestrian injuries and fatalities. For these metrics, staff identified sources from existing reports or data analysis efforts by city, state, or federal agencies.

STEP 2: MODELING

Determine tools or methods to produce metrics

Travel models are a key tool in transportation planning. Modeling can help answer critical transportation-related questions, such as how a transportation system will perform in the future or if a particular project or policy will affect transportation conditions, such as congestion or transit crowding.

Most metrics were analyzed using SF-CHAMP, a travel forecasting tool developed by SFCTA. It uses inputs such as San Francisco and Bay Area residents' observed travel patterns, detailed representations of San Francisco's transportation system (e.g., transit line frequency), population and employment characteristics, roadway volumes, and the number of vehicles available to San Francisco households. After these inputs are entered into the model, SF-CHAMP produces measures relevant to transportation and land use planning, such as current and future transit usage (e.g., how many passengers use what type of transit system). For the Statement of Needs, staff used SF-CHAMP to assess how changes to both the transportation system and to where people live and work will affect how people travel in the region for the present-day (using the base year of 2015) and future horizon year of 2050.

Affirm modeling assumptions

To inform the transportation model, basic assumptions need to be developed. For this step, demographic assumptions for the San Francisco Bay Area were created for 2015 and 2050 using regional forecasts prepared by the Metropolitan Transportation Commission (MTC) for Plan Bay Area (2017). This included existing and projected population numbers as well as characteristics of residents and workers (e.g., age, employment, household size).

Data preparation of existing and future conditions

In addition to affirming modeling assumptions, the SF-CHAMP model required land use conditions and transportation system inputs for 2015 and 2050. As such, the Planning Department compiled land use data from 2015 and projected what it would like in 2050, given existing City and region's existing policies and projects.

For the existing today's transportation network, the ConnectSF team identified the projects and street conditions that existed in 2015. For the future, the team captured planned projects that were included in the transportation network assumptions for Plan Bay Area 2040. This create a baseline understanding of what would happen in 2050 if we do not plan for new projects beyond those currently expected to be completed by 2040. When new project and policy concepts are identified through the Streets and Freeways Study and Transit Corridors Study, we will be able to see what impact they will have on baseline conditions.

Figure B illustrates the land use and transportation data prepared as inputs to SF-CHAMP.

A detailed description of the process for developing the land use and transportation assumptions, including land use allocations, can be found in Appendix C.

Running the model and gathering data

Figure B. Land Use and Transportation Inputs for SF-CHAMP

Using the modeling assumptions and data inputs, staff ran the SF-CHAMP travel model to produce several forecastable metrics. For those that could not be forecasted, staff used information available for the present and/or recent past, using the relevant data from the sources identified in Step 1.

STEP 3: ANALYSIS OF TRANSPORTATION MODEL RESULTS

The ConnectSF team analyzed the outputs from the model and gathered data to develop findings on the expected trends for each metric and travel market. This analysis included a comparison of the modeling results from 2015 and 2050 as well as how the transportation system's performance compared with what the Vision sets out for San Francisco. The findings from the analysis of metrics are the basis for the Statement of Needs report.

APPENDIX C

MODELING ASSUMPTIONS

ConnectSF

DECEMBER 2019

APPENDIX C MODELING ASSUMPTIONS

WHAT IS MODELING?

Travel models are a key tool in transportation planning. Models helps planners, policymakers, and others understand and make decisions about which policies and projects to adopt and fund. Modeling can help to answer critical transportation-related questions, such as how a transportation system might perform in the future or if a particular project or policy might improve conditions, such as congestion.

While there is a great need for many kinds of transportation improvements in San Francisco, specific investments need to be identified and prioritized so that they can be implemented in a manner that takes the City's needs, development patterns, and aspirations into consideration. This is especially true of larger multi-million dollar projects that take a long time to plan, design, and build.

Modeling is one tool that can help San Francisco understand where and how to invest its limited transportation dollars by assessing a project or policy's effects. It can help policymakers and the public make decisions about where and when transportation projects can be most effectively pursued and implemented (Figure A).

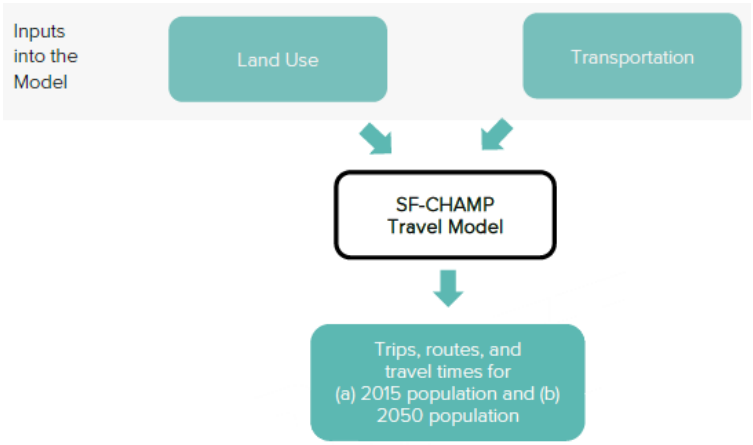
Figure A. Role of modeling in transportation planning process

HOW CONNECTSF USES MODELING

Phase 2 of the ConnectSF program first uses modeling to understand today's conditions and transportation system as well as to anticipate what the City's conditions and transportation system may look like in 2050. The model used is called San Francisco's Chained Activity Modeling Process (SF-CHAMP). SF-CHAMP is a travel forecasting tool, which predicts daily travel and activity patterns, including trips, routes, modes, and travel times for a synthetic population representing every individual in the San Francisco Bay Area. Base and future year scenarios represent existing and future land use, transportation infrastructure, policies, prices, and the built environment.

Given the interdependence of land use and transportation, the ConnectSF modeling process factored in both land use and transportation conditions. Figure B illustrates the general ConnectSF modeling process.

Figure B. General ConnectSF Modeling Process



SF-CHAMP 6 MODEL SYSTEM

The SF-CHAMP model consists of numerous model steps and sub-models that work together to produce travel demand estimates. There are two primary types of models within SF-CHAMP: demand models and supply models. The demand models take the synthetic population, land use data, and travel accessibilities as inputs and estimate travel decisions. The supply models assign trips to transportation networks and simulate how the networks operate. The SF-CHAMP model consists of iterative looping between the demand and supply models. The SF-CHAMP model is estimated, calibrated, and validated to match observed conditions in a base year or existing conditions scenario. The estimation step uses observed behaviors documented in a travel survey to understand how people make decisions when faced with a variety of options. The calibration process adjusts these models so that the overall outputs from a base year model run align with large scale observed behavior. The validation process compares model outputs to observed conditions, such as traffic volumes, travel speeds, and transit ridership.

More information about SF-CHAMP can be found at https://www.sfcta.org/sf-champ-modeling.

INPUTS INTO THE MODEL: EXISTING AND FUTURE YEAR CONDITIONS

Existing conditions were captured in a model run called the 2015 Base Scenario. For ConnectSF, this includes the most recent information available for both land use and transportation – what today's built environment looks like, including its transit, streets, and freeways. The 2015 baseline conditions included the 2015 transportation network and a Land Use Allocation for 2015, described in the next section.

A future scenario with anticipated conditions was also used, called the 2050 Baseline Scenario. For this, the model considered 2015 baseline conditions for today's land use and transportation plus what land use and transportation will look like in the City and region in 2050 with existing policies as well as approved and funded projects in place. The 2050 future land use scenario included all of the City's development plans and policies that are in the pipeline or are being built today. Similarly, the 2050 future transportation scenario included all of the City's and region's transportation projects and policies currently planned, funded, and/or being constructed and completed by 2050. The 2050 future conditions for land use included a Land Use Allocation for 2050, described in the next section. Projects and policies used as inputs for 2050 conditions are listed in Table 4.

INPUTS INTO THE MODEL: LAND USE ALLOCATIONS

Both the 2015 baseline and 2050 future scenario for land use employed a land use allocation. This allocation assigns households and jobs to specific geographic locations based on where housing and jobs are permitted by zoning as well as regulations for other factors such as density. The following section describes how the 2015 Land Use Allocation and 2050 Land Use Allocation were developed. These land use allocations are also important to understand as they were used as part of the transportation inputs into the model.

2015 LAND USE ALLOCATION

The 2015 Land Use Allocation is an estimate of how many households and jobs are located in each of the City's Traffic Analysis Zones (TAZ)[1] in 2015. This estimate was compiled from the following three sources:

1. Estimated number of households and jobs in San Francisco in 2015

These numbers are projections for a jurisdiction's total number of households and jobs in a given year.

1 A traffic analysis zone (TAZ) is the unit of geography used in transportation models. The size of a zone varies, but for a typical metropolitan planning software, a zone of under 3000 people is common. There are 981 TAZs in San Francisco.

San Francisco uses figures provided by ABAG/MTC, created in consultation with Bay Area cities and counties. The 2015 Land Use Allocation uses numbers in ABAG/MTC's Plan Bay Area 2017 (Table 1[2]).

Table 1: Estimated Number of Households and Jobs in San Francisco in 2015[1]

	2015
Households	389,000
Jobs	748,000

Source: Plan Bay Area 2017

2. San Francisco Land Use Database

The San Francisco Planning Department maintains a Land Use Database, which includes all dwelling units in the City by parcel. Existing dwelling units as of December 2015 were aggregated by TAZ. The number of existing dwelling units in each TAZ was then converted to projected households using a scaling factor representing the ratio of estimated households in 2015 (see Table 1) to existing dwelling units citywide.

In summary, the 2015 Land Use Allocation consists of the following:

2015 Land Use Allocation = 2015 data from 2017 Plan Bay Area + 2015 City's Land Use Database + 2015 Dun and Bradstreet data

3. Dun & Bradstreet data[3]

Jobs with San Francisco addresses were aggregated by TAZ from Dun & Bradstreet's 2015 data. As with households, the number of jobs in each TAZ was then multiplied by a scaling factor so that the sum of jobs across the entire City is equal to that projected for 2015 (see Table 1).

2050 LAND USE ALLOCATION

The 2050 Land Use Allocation was constructed by adding households and jobs to the 2015 Land Use Allocation in two stages: (1) A land use allocation was first developed for 2040[4], which was then used to (2) develop a 2050 Land Use Allocation. The 2040 allocation was created first because the most recent forecast (from the 2017 update to Plan Bay Area) used 2040 as its forecast year. Both steps are further described below.

2040 LAND USE ALLOCATION

A 2040 Land Use Allocation was developed as a precursor to creating the 2050 Land Use Allocation.

The 2040 Land Use Allocation was prepared by using existing and anticipated zoning to estimate the growth potential within each TAZ from 2015 to 2040 using the following information. A development simulation platform, UrbanSim[5], was used to allocate a portion of the household and jobs growth projected for San Francisco in Plan Bay Area 2017 to each TAZ. The main inputs to UrbanSim were the following:

1. 2015 Land Use Allocation
2. Estimated number of households and jobs in San Francisco in 2040, as shown in Table 2
3. Development capacity from 2015 to 2040, which included the following:

2 The San Francisco Planning Department uses the term "Land Use Control Totals" for these estimates. The regional Plan Bay Area 2040 provided high-level land use forecast figures (i.e., population and jobs) for the nine-county Bay Area. These forecast figures serve as control totals for the San Francisco Planning Department's re-allocation of these figures to TAZs in the SF-CHAMP model. For the other Bay Area counties, SF-CHAMP assumes population and employment estimates directly from the corresponding MTC TAZ.
3 Dun & Bradstreet data is the most complete and geographically granular firm-level employment data available. However, as with all data sources, some inaccuracies are inevitable. The data was vetted and some adjustments were made. These adjustments include distributing jobs across multiple sites associated with a single employer, when these jobs are erroneously reported in a single "headquarters" location (e.g., health care organizations and other multi-campus institutions). Staff will maintain a list of such potential inaccuracies and attempt to fix significant ones in future modeling iterations.
4 A 2040 LUA was developed to correspond with approved Plan Bay Area 2017 land use control totals.
5 More information on UrbanSim can be found here: http://www.urbansim.com/urbansim/; http://www.urbansim.com/resources/

- Development capacity in "pipeline" projects that were not completely built by the end of 2015. The project pipeline includes building projects for which applications have been filed and are in various stages of approval, up to and including construction.
- Development capacity in "soft sites", defined as lots where existing development is 30% or less of the maximum allowed by existing zoning. The development capacity of soft sites is the maximum allowed by existing zoning, minus existing land use. They are filtered for general development feasibility based on historical preservation status and other factors.
- Development capacity in plan areas, where total build-out was estimated during plan development and adoption. This includes adopted area plans as well as plans still under development but anticipated to be adopted in the near future.
- Development capacity due to recent state and local ordinances granting density bonuses and allowing accessory dwelling units (ADUs) based on estimates of likely use over the planning horizon.

Table 2: Projected Number of Households and Jobs in San Francisco in 2040

	2040
Households	482,000
Jobs	872,000

Source: Plan Bay Area 2017

In summary, the 2040 Land Use Allocation consists of the following:

2040 Land Use Allocation = 2015 Land Use Allocation + 2040 data from 2017 Plan Bay Area + Development capacity from 2015 to 2040

For example, ConnectSF estimated the number likely ADUs (e.g., secondary units or "granny flats") to be built by using past experience and assumed 11% of maximum total ADU development potential, which was then assigned randomly to parcels where the ADU legislation applies.

2050 LAND USE ALLOCATION

The 2050 Land Use Allocation was constructed by adding growth projected from 2040 to 2050 to the 2040 Land Use Allocation. Because the growth projected by 2040 will use up most of the City's zoned capacity, ConnectSF developed multiple re-zoning concepts that could accommodate growth beyond 2040. These re-zoning concepts are grounded in planning best practices and also involve higher densities and more mixed uses than are allowed under current and proposed zoning. (These principles are described in the sidebar text, Growth Beyond 2040: Principles, on the following page). Household and jobs growth from 2040 to 2050 are then allocated to each TAZ according to a growth scenario using these rezoning concepts.

Table 3: Provisional Number of Households and Jobs in San Francisco in 2050

	2050
Households	528,000
Jobs	924,000

Source: SF Planning Department

In summary, the 2050 Land Use Allocation consists of the following:

2050 Land Use Allocation = 2040 Land Use Allocation + Growth projected for 2040 to 2050

At the time of the writing of this document, the estimated number of households and jobs for 2050 have not yet been projected by ABAG/MTC. As such, ConnectSF developed provisional numbers for households and jobs for 2050 that corresponded with City goals for housing construction, the ConnectSF Vision, and Plan Bay Area 2040 allocations. These preliminary numbers are shown in Table 3.

Growth beyond 2040: Principles

Growth projected by Plan Bay Area 2040 will essentially use up the City's zoned capacity. Growth beyond 2040 projections will likely require re-zoning certain areas of the City to create new zoned capacity.

To ensure that growth patterns beyond 2040 will optimize the City's transportation system performance consistent with the ConnectSF Vision, agency staff first identified transit-supportive land use principles to guide development beyond existing zoned capacity:

- Locate growth near existing transit stops that have excess capacity or that can be upgraded to provide additional transit capacity.
- Locate growth near potential high-capacity transit stops, including possible high-capacity transbay transit expansions.
- Locate residential growth at or near existing job centers to maximize walking trips.
- Look for opportunities to balance transit loads on transit corridors in San Francisco (i.e., to ease crowding on buses and trains).
- Equity and economic competitiveness principles of the ConnectSF Vision suggest that some new development (as well as any profit derived from the development process) should be distributed rather than concentrated.

Growth beyond 2040: Components

Based on the transit-supportive principles and cognizant of the City's existing land-use and parcelization patterns, ConnectSF outlined re-zoning concepts. Each concept was converted to a 2050 Growth Component representing the net new jobs and households that could theoretically be created if the relevant parcels were re-developed to the maximum square footage allowed under the re-zoning concept. Three types of Growth Components were developed:

- Substantial densification of areas containing large parcels to the south and east of the existing downtown "core". These areas are adjacent to existing job centers and regional transit and are expected to receive additional regional transit connectivity before 2065, including high-speed rail, electrified Caltrain, and a possible second rail crossing.
- Substantial densification of certain existing employment centers at outlying transit nodes away from the downtown core, where there are large parcels that can accommodate concentrated development, and where additional investments in transit could provide regional transit connectivity.
- Moderate densification of local transit walk-sheds, where existing low residential and/or commercial density combines with existing or planned transit capacity. Existing infrastructure such as parks and schools in these transit walk-sheds can be leveraged to provide high-quality family-supportive housing.

The sum of all net new jobs and households across all of the Growth Components exceed the growth projected from 2040 to 2050 by ConnectSF. Furthermore, some parcels are affected by multiple transit-supportive re-zoning concepts, meaning that some Components can not be combined lest these parcels be counted twice.

Growth beyond 2040: Scenarios

To help identify a logical and optimal combination of Growth Components, ConnectSF studied different combinations of Growth Components in "growth scenarios", where different patterns of growth correspond to different policy levers such as rezoning and affordable housing requirements. While all three types of Growth Components described above could accommodate new households, only the first two include large lots that could potentially be suitable for large employment centers, with the areas to the south and east of the existing downtown offering the best access to existing and planned regionally connected transit. Because the development potential of these areas is finite, there are trade-offs between developing more housing within walking distance of downtown jobs and developing more commercial space within walking distance of regional transit.

To gain insights into the effect of these land use trade-offs on the overall performance of the transportation system, two contrasting growth scenarios were tested in the CHAMP model:

- Develop areas to the south and east of the existing downtown "core" as mixed-use neighborhoods with large employment centers, and leverage transportation investments in outlying transit nodes with large-scale residential development.
- Develop areas to the south and east of the existing downtown "core" as mixed-use primarily residential neighborhoods, and leverage transportation investments in outlying transit nodes to add employment in existing employment centers within walking distance to existing residential neighborhoods.

Analysis of the model outputs suggests that the overall transportation system would perform slightly better under the second growth scenario.

SYNTHETIC POPULATION

SF-CHAMP is an agent-based simulation model, which means it tries to predict the actions of individual people[6]. The activities of people living in the San Francisco Bay Area in 2050 (e.g., where they work or go to school; how they get around) forms the basis for travel forecasting, which provides a picture of what travel could look in the horizon year (i.e., 2050).

Because the people living in the San Francisco Bay Area in 2050 cannot be definitively described, existing information can be used to create a stand-in population – what is called a synthetic population. This synthetic population essentially consists of a list of fictitious people and households whose attributes (e.g., demographics, person characteristics, household characteristics) parallel those of today's existing San Francisco Bay Area population as well as the population that is anticipated to live in the San Francisco Bay Area in 2050[7]. The land use inputs described in the previous section (i.e., San Francisco land use

6 Examples of other types of "agents" include organizations, companies, and countries.

7 A population synthesizer (called SynthPop) was used to develop the synthetic population model inputs. This tools uses the U.S. Census' Public Use Microdata Sample (PUMS) data to create realistic household and person records that meet Plan Bay Area's estimated households and jobs numbers (i.e., control totals).

For this effort, the modeling process used the PUMS data from the five-year American Community Survey for 2008-2012 for the nine-county San Francisco Bay Area.

The synthetic population outputs consist of a household file and a person file. Each person is associated with a household record (including non-household persons such as people living in group quarters) and the person file has a field that identifies the corresponding household. Synthetic people and households are assigned to TAZs where they reside.

allocations and regional land use forecasts from Plan Bay Area 2040) was used as the environment that this synthetic population would live in for 2050.

INPUTS INTO THE MODEL: TRANSPORTATION NETWORK

Besides land use inputs, transportation network inputs are the other main category of SF-CHAMP travel model inputs. Network inputs describe the transportation facilities and services that enable transportation between different locations, represented by TAZs and Micro Analysis Zones (MAZs)8. There are two primary types of transportation network inputs:

- Road network inputs: These inputs include information about roads and other street facilities. This includes a roadway characteristics, including number of road lanes for mixed-flow traffic, free-flow travel speed, hourly vehicle capacity, availability and type of transit lane, availability and type of bicycle facility, tolls (by time of day and vehicle class), walking paths, bicycle paths, and others.
- Transit network inputs: Transit network inputs describe transit services, including routes, stop locations, service frequency by time of day, transit mode (e.g., local bus, express bus, commuter rail, light rail, or ferry), vehicles, fares, and transit stations' access, egress, and transfer connections, and others.

For the 2015 Baseline (Existing) Transportation scenario, network inputs reflect transportation system conditions in the year 2015.

The 2050 Future Transportation scenario's network inputs are constructed by starting with the 2015 Baseline (Existing) Transportation network and adding projects that are projected to be completed between 2015 and 2040. The 2050 Future Transportation scenario uses the transportation network projected for 2040, which includes projects listed in Table 4. They include significant Plan Bay Area 2040 projects as well as additional local San Francisco projects. Future transit service assumptions in San Francisco are based on SFMTA's Transit Fleet Management Plan (2014).

Tables 5 and 6 show data for service miles, service hours, and network miles of the transportation system in 2015 and 2050. A service mile is any mile a vehicle is on the road including dead-heading, but not including training miles or road test miles from maintenance facilities. A service hour is the number of hours a transit vehicle is on the road. Roadways, bus lanes, bike facilities, HOV lanes and HOT lanes are all reported by the overall number of miles in San Francisco. These characteristics were based on the existing transportation network (2015) and for what the transportation network would look like in 2050 assuming that all transportation projects in Plan Bay Area 2040 are built by 2050.

TRAVEL MODEL LIMITATIONS AND KNOWN ISSUES

All models have limitations. This section describes some general model limitations and known issues that apply specifically to the version of SF-CHAMP used in the ConnectSF analysis.

GENERAL LIMITATIONS

In summary, the 2050 Future Transportation scenario consists of the following:

2050 Future Transportation = 2015 Baseline (Existing) Transportation Network + Transportation Projects Completed from 2015 to 2040 + Transportation Projects in Plan Bay Area 2040 + Local San Francisco transportation projects

Table 4. Major Projects Included in the 2050 Future Transportation Scenario

The 2050 Future Transportation scenario uses the transportation network projected for 2040, which includes the following projects:

- Local (San Francisco)
  - Van Ness Avenue Bus Rapid Transit
  - Geary Boulevard BRT
  - 16th Street BRT
  - Geneva-Harney BRT
  - Haight Street Contraflow Transit Lane
  - Sansome Contraflow Transit Lane
  - Muni Forward (Transit Effectiveness Project)
  - Historic Streetcar Extension - Fort Mason to 4th & King
  - T-Third Extension to Caltrain
  - T-Third Phase II: Central Subway
- Regional
  - AC Transit East Bay BRT
  - AC Transit San Pablo Ave BRT
  - Albany/Berkeley Ferry Terminal
  - BART Berryessa Extension
  - BART Irvington Station
  - BART Metro Program + Bay Fair Connector
  - BART: Silicon Valley Phase 2
  - Bus and Ferry Service Expansion
  - California HSR in the Bay Area
  - Caltrain Electrification Phase 1 + CBOSS
  - Caltrain/HSR Downtown San Francisco Extension
  - Central Bay Ferry Service Enhancement
  - eBART
  - Implement Transbay Transit Center/ Caltrain Downtown Extension (Phase 1 - Transbay Transit Center)
  - North Bay Ferry Service Enhancement
  - SMART: Larkspur to San Rafael
  - SMART: Santa Rosa to Cloverdale

Table 5 Summary of Transit Network in ConnectSF Travel Model

	2015	2050
Muni bus service miles	65,922	71,103
Muni rail service miles	16,671	19,909
BART service miles	31,131	55,689
Caltrain service miles	4,472	5,876
Ferry service miles	3,371	5,958
Muni bus service hours	6,148	6,003
Muni rail service hours	1,677	1,828
BART service hours	875	1,617
Caltrain service hours	127	177
Ferry service hours	156	275

Notes:

- BART, Caltrain, and Ferry calculations are regional totals
- Rail service miles and hours count train sets, not rail cars (e.g., 10-car BART train counts as one, not ten)
- Service miles are estimated based on time of day frequencies and time period durations (simplification of actual schedules)
- Service hours estimated based on estimates of service miles, road congestion, and transit ridership (output of model, not input)
- Ferry runs to/from SF estimated based on time of day frequencies and likely to differ significantly from actual schedules
- The decline in Muni bus service hours is a result of projected faster operating speeds. Higher operating speeds are likely a result of the expansion of bus priority or bus-only lanes.

Table 6 Summary of Roadway Network in ConnectSF Travel Model

Measure	2015 Base	2050 Baseline
Roadway lane miles	2,570.7	2,529.5
Freeway lane miles	180.5	178.3
Street lane miles	2,390.2	2,351.2
Bus lane miles	25.1	68.9
Bicycle facility miles	427.1	460.5
Bike class 1 or 4 miles	74.7	95.9
Bike class 2 miles	138.7	153.1
Bike class 3 miles	213.7	211.5
HOV lane miles	0.4	0.4
HOT lane miles	0.0	5.9

Notes:

- Summaries for San Francisco county roads (excludes other counties)
- Freeway summary includes ramps and connectors
- Lane mileage counts mixed flow vehicle lanes (excludes bike and bus lanes)
- Mileage calculations consider AM peak period conditions (lane counts and bus lanes differ by time of day)

Travel demand models are limited by the quality of the input assumptions and data used for validation, which are limited in scope and uncertain, especially for future year scenarios. Travel models are often fairly accurate in a base year for summary statistics, but estimates of travel behavior become less accurate at finer levels of detail. Models are estimated, calibrated and validated based on past travel behavior patterns. Travel models are reasonably robust tools for estimating how travel behavior would react to modest changes in land uses, prices, or accessibilities. Travel models do not understand how underlying travel behavior preferences may change over time.

Data sources used in model development, estimation, calibration, and validation include:

- Various Census data products
- Household travel surveys
- Traffic counts
- Traffic speed data
- Transit ridership data
- TNC trip data from the TNCs Today report

During the model estimation, calibration, and validation phases of model preparation, staff strive to develop a model that matches real world conditions as accurately as possible. In some cases, different sources of data provide conflicting information. In other cases, improving validation against one data source causes validation against another data source to worsen. In other cases, a model that matches observed data too well can lose sensitivity to some of the policies and projects the model is designed to test. This is called over-fitting observed data. Staff make trade-offs during model preparation to prepare a model that serves the needs and objectives for the modeling tool as effectively as possible.

LIMITATIONS SPECIFIC TO CONNECTSF ANALYSIS

In the 2015 base year scenario, SF-CHAMP overestimated mode share for ride-hail trips (or transportation network companies [TNCs]) for residents in very dense neighborhoods. In particular, residents of central neighborhoods such as Downtown and Chinatown have TNC mode shares in the base year scenario that may be too high. These mode shares further increase in the 2050 scenario along with land use densities.

The current implementation of SF-CHAMP TNC functionality makes it difficult to improve TNC mode share validation for this sub market. Therefore, interpretation of ConnectSF model results should reflect an understanding of this limitation.

Figure C. Inputs into the SF-CHAMP model.