CORE CAPACITY TRANSIT STUDY

MEMORANDUM

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CC: PMT

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Date: 8/3/2016

Title: SF Metro Corridor Current and Planned Transit Capacity and Demand

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1 Introduction

The intent of this memo is to establish the baseline transportation conditions for the San Francisco (SF) Metro Corridor, as defined for the Core Capacity Transit Study (CCTS), including comparison of transit growth forecasts in relation to when transit capacity improvements are expected to be implemented.

This memo presents a summary of past and current travel demand and transit capacity conditions, as well as assumptions about future travel demand and transit capacity conditions in the SF Metro Corridor. The summary conditions are described for three planning years:

1. 2010: Transit demand and capacity conditions for all transit modes, as well as automobile, bicycle, and pedestrian demand
2. 2015: Transit demand and capacity conditions for all transit modes, as well as automobile, bicycle, and pedestrian demand
3. 2040: Assumed transit demand and capacity conditions for all transit modes, as well as the automobile and bicycle and pedestrian demand. The assumptions for transit capacity includes planned improvements as identified in agency plans and programs.

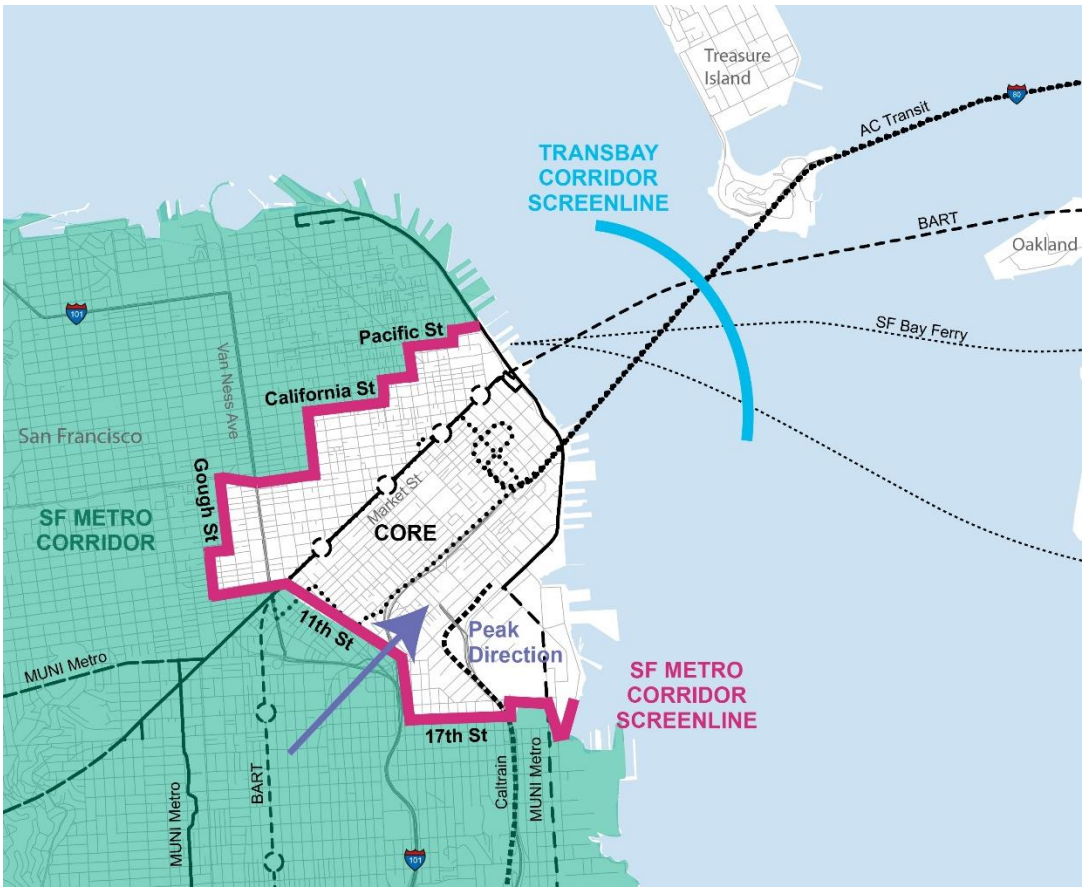
This memo also documents changes in transit demand and capacity between 2010-2015 and 2015-2040.

1.1 Definitions

Capacity: Transit capacity is the policy stated capacity of individual buses/train cars. Policy documents used as sources for agency-specific capacities are referenced in Appendix A. Automobile vehicle and person trips are assumed to be equal to realized capacity as observed and calculated in 2015.

Core: The area in Downtown San Francisco approximately bounded by 17th Street to the south, Gough St and 11th St on the west, the San Francisco Bay on the east, and California St and Pacific St on the north (see Figure 1, and Appendix A).

Figure 1: San Francisco Core with Transbay and San Francisco Metro Screenlines



SF Metro Corridor: The area in San Francisco that is not the Core (shaded in green in Figure 1).

SF Metro Corridor Screenline: The Screenline that captures all travel to the Core from the SF Metro Corridor and from the San Francisco Peninsula. The screenline boundary in San Francisco follows the traffic analysis zones (TAZs) that define the San Francisco Core. The SF Metro Corridor screenline is shown in pink in Figure 1.

1.2 Corridor Background

1.2.1 Travel Overview

As San Francisco recovered from the 2009 Great Recession, rapid expansion in high tech and other related job sectors drove significant employment growth in recent years. Between 2010 and the end of 2014, employment in the city grew by 25%, to approximately 353,000[1] jobs in the Core. The CCTS Market Assessment concluded that employment growth will likely lead to greater demands on the transportation system.

[1] http://onthemap.ces.census.gov/

1.2.2 Trip Distribution

Trips generated by employment growth in the Core originate from locations all around the San Francisco Bay Area. The East Bay, which is comprised of Alameda and Contra Costa Counties, accounts for the highest percentage of trips to the Core. An analysis of East Bay trips is discussed in length in the *Transbay Corridor: Current Demand, Current and Planned Transit Capacity* memo.

The SF Metro Corridor accounts for the second highest percentage of commute trips to the Core. In 2013, about 34% of workers in the Core commuted from within the SF Metro Corridor. Table 1 summarizes the geographical split of downtown San Francisco employee home locations.

Table 1: Place of Residence of Core Workers

Residence of Employees	Percentage
East Bay	41%
San Francisco Metro Corridor	34%
Peninsula/South Bay	19%
Marin/North Bay	6%

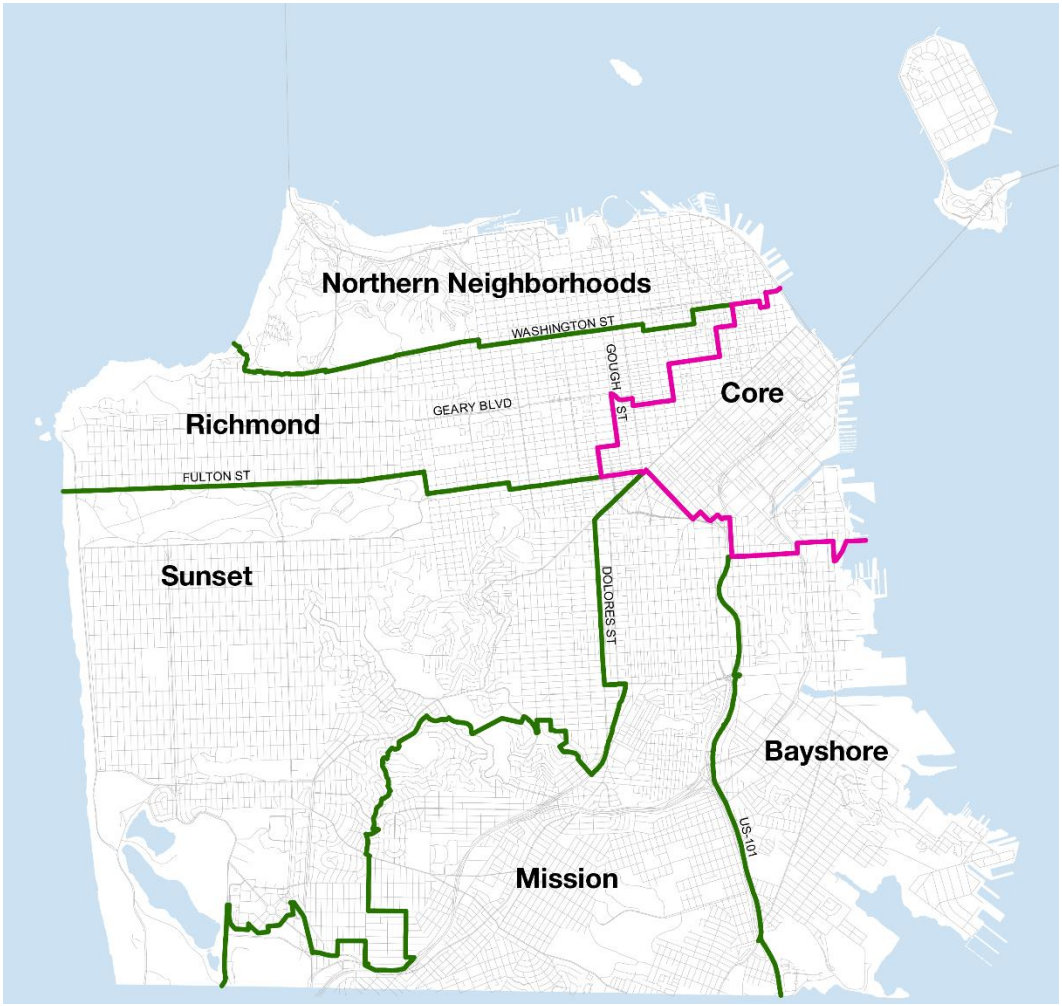
Source: LEHD, US Census Bureau (2013)

The SF Metro Corridor is divided into five subareas to provide a more nuanced understanding of the transit capacity and demand conditions within different parts of the city. Treasure Island could be considered a sixth subarea, but transit improvements are the responsibility of a private developer and not considered as part of this study.

As shown in Figure 2, the five subareas discussed in this memo are:

1. Northern Neighborhoods
2. Richmond
3. Sunset Corridor
4. Mission Corridor
5. Bayshore

Figure 2: SF Metro Corridor Subareas



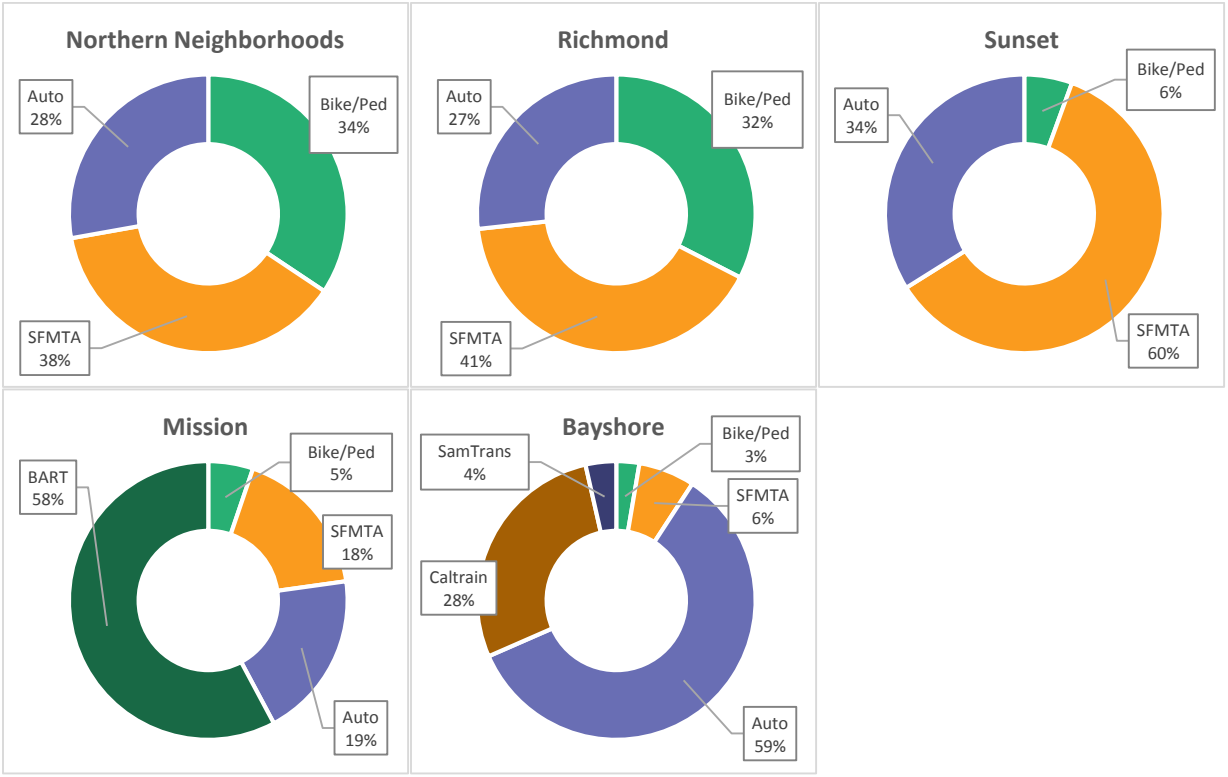
Transportation demand across the SF Metro Corridor varies greatly from subarea to subarea. The organization of the transportation network plays an important role in shaping how people travel to the Core and throughout the city. The SF Metro Corridor accommodates trips using a variety of travel modes and operators, including BART and Caltrain regional rail service; SFMTA bus, streetcar, and light rail service; SamTrans buses; automobile trips; and bicycle and pedestrian trips. Figure 3 shows travel patterns and modes from the five subareas to the Core in the AM peak hour.

Each subarea exhibits different travel patterns in the AM peak, including:

- The SFMTA carries 38% of trips in the Northern Neighborhoods subarea, but is followed closely by bicycle and pedestrian trips, with 34% of trips.
- The Richmond subarea has similar travel characteristic to the Northern Neighborhoods, with 41% of trips using SFMTA and 32% of trips biking or walking to the Core.
- In the Sunset subarea, 60% of trips to the Core are carried by SFTMA light rail (LRT) and bus service, and automobiles carry the second-largest share of trips at 34%.

- In the Mission subarea, BART plays a dominant role, carrying 58% of trips going to the Core. Automobiles also carry the second-largest share of trips in this subarea, with 19% of trips, and SFMTA services carry 18% of trips.
- The Bayshore subarea is the most auto-oriented of the subareas, with 59% of trips completed via automobile. Caltrain trips account for the second highest share at 28%, and the remainder are split between SFMTA, SamTrans, and active modes.

Figure 3: Travel Patterns from the SF Metro Corridor Subareas to the Core in the AM peak, 2015



1.3 Memo Organization

The remainder of this memo is organized into the following sections:

- Section 2: Methodology
- Section 3: Historic (2010) and Existing (2015) Capacity and Demand
- Section 4: Planned Capacity (2040)
- Section 5: Future Demand (2040)
- Section 6: Findings
- Appendix A: Methodology – Transit Capacity and Demand Assumptions
- Appendix B: Historic Transit Capacity (2010) – Detailed Table
- Appendix C: Existing Transit Capacity (2015) – Detailed Table
- Appendix D: Planned Transit Capacity (2040) – Detailed Table
- Appendix E: 2040 Transit Ridership Forecasting Methodology SFCTA Memorandum

2 Methodology

The process for calculating transit and auto capacity and demand are summarized in this section. More complete details on (1) the methodology assumptions and data sources; (2) historic, (3) existing, (4) planned transit capacity; and (5) ridership forecasting are provided in Appendices A through E, respectively.

2.1 Demand Forecasting Methodology

2.1.1 Transit

Transit demand for the years 2010 and 2015 is calculated using ridership data provided by the transit operators. Transit demand is captured either at the screenline shown in Figure 1, or, where directed by transit operators, at the maximum load point and not at the screenline. SFMTA data reflects the demand at the max load point. For 2040, two transit demand forecasts were developed, one from the Plan Bay Area Model and the second using an adjusted forecast, called the Adjusted Growth Forecast. The Adjusted Growth Forecast was developed using growth assumptions created for the CCTS Market Assessment. The two demand forecasts provide an indication of the potential demand for transit over the next 25 years.

2.1.2 Automobile and Non-Motorized Trips

Automobile and non-motorized trips in 2010 and 2015 are calculated based on the Plan Bay Area model output. For 2040, the Plan Bay Area Model and Adjusted Growth Model provide the potential range of future demand. The automobile and non-motorized demand is presented for the entire SF Metro Corridor as well as by subarea.

2.2 Capacity Forecasting Methodology

2.2.1 Transit

Transit capacities for the years 2010, 2015 and 2040 are calculated using route data provided by each transit operator. Capacity is calculated using the policy stated person capacity of each transit vehicle multiplied by the number of vehicles in service during the AM peak hour for each individual route. For light rail and conventional rail routes, the policy stated person capacity of the vehicle is multiplied first by the number of vehicles that make up the train-set, then by the number of trains in service during the AM peak hour. The number of vehicles per hour for each individual route is based upon representative schedules from 2010 and 2015. For Muni's capacity, only routes with headways 12 minutes or less were used to calculate capacity. Service assumptions for 2040 were taken from policy documents first and augmented through discussions with transit operators.

2.2.2 Automobile and Non-Motorized Trips

Capacity of automobile and non-motorized trips (i.e. bicycles and pedestrians) in the SF Metro Corridor is assumed to be equal to the demand for trips using these modes. The roadway network is assumed to be at capacity for automobiles, and there is no stated policy capacity for bicycle and pedestrian trips. Although there is likely additional capacity to accommodate greater bicycle and pedestrian volumes, for the purposes of this study, capacity and demand for these modes are considered equal, respectively, in

order to understand where growth will require new transit improvements. The automobile and non-motorized demand is presented in Section 3 for the entire SF Metro Corridor as well as by subarea.

3 Historic (2010) and Existing (2015) Capacity and Demand

This memo assesses existing capacity and demand using 2015 as the baseline year. Although the Plan Bay Area growth forecast uses 2010 as the baseline year, the San Francisco Core and Bay Area as a whole have experienced significant growth since then, making 2015 a more appropriate forecasting baseline. This memo reports "historic" capacity and demand in 2010 in order to illustrate the latest travel trends compared to the Plan Bay Area forecast. The analysis described here focuses on AM peak hour demand to conform to the Transbay Corridor demand and capacity analysis. Capacity includes all transit capacity (by operator and mode) and person-trips in automobiles.

3.1 Transit Capacity

Transit capacity is calculated by summing the capacity of each transit route crossing the SF Metro screenline in the AM peak hour, peak direction (see Figure 1). Detailed information for individual transit routes is provided in Appendices B and C for 2010 and 2015 respectively. Table 2 shows the number of vehicles and capacity totals for 2010 and 2015. Table 3 shows the change in capacity by mode from 2010 to 2015.

Table 2: Historic and Existing AM Peak Hour, Peak Direction Capacity by Mode (2010 and 2015)

Operator	2010		2015	
	AM Vehicles at Screenline	AM Peak Hour Capacity	AM Vehicles at Screenline	AM Peak Hour Capacity
BART	142 cars 16 trains	15,194	142 cars 16 trains	15,194
Caltrain	25 cars 5 trains	3,250	25 cars 5 trains	3,250
Muni Metro	63 cars 41 trains	6,313	68 cars 45 trains	6,878
Muni Hist. Streetcar	20 cars 20 trains	1,200	20 cars 20 trains	1,200
Muni Bus	202 buses	13,165	237 buses	15,167
SamTrans	6 buses	412	6 buses	412
Total		**39,533**		**42,101**

Table 3: Change in Capacity by Operator (2010-2015 AM Peak Hour, Peak Direction)

Operator	2010	2015	Change	
	AM Capacity	AM Capacity	Number	Percent
BART	15,194	15,194	0	0%
Caltrain	3,250	3,250	0	0%
Muni Metro	6,313	6,878	566	9%
Muni Hist. Streetcar	1,200	1,200	0	0%
Muni Bus	13,165	15,167	2,002	15%
SamTrans	412	412	0	0%
Total	**39,533**	**42,101**	**2,568**	**6%**

Between 2010 and 2015, BART, Caltrain and SamTrans had no significant change in capacity. Muni buses had an increase in capacity of 15% and Muni Metro had an increase in capacity of 9%, while the Muni Historic Streetcar service remained unchanged. Overall, the SF Metro Corridor transit capacity to the Core increased by 6%.

While the corridor overall saw minimal change in capacity in this time period, some subareas experienced more notable changes in transit capacity. Table 4 reports the number of vehicles and capacity totals for each subarea for 2010 and 2015, and Table 5 summarizes the change in capacity for each subarea for the same time period.

Table 4: Existing and Historic Transit AM Peak Hour, Peak Direction Capacity by Subarea (2010 and 2015)

Subarea	2010			2015		
	Operator	Vehicles	Capacity	Operator	Vehicles	Capacity
Northern Neighborhoods	Muni Bus	33	2,593	Muni Bus	39	3,018
	Muni Streetcar	10		Muni Streetcar	10	
Richmond	Muni Bus	98	6,003	Muni Bus	110	6,723
Sunset	Muni Metro	57	7,120	Muni Metro	61	8,125
	Muni Streetcar	10		Muni Streetcar	10	
	Muni Bus	13		Muni Bus	26	
Mission	BART	16	19,550	BART	16	19,816
	Muni Bus	58		Muni Bus	62	
Bayshore	Caltrain	5	4,268	Caltrain	5	4,420
	Muni Metro	6		Muni Metro	7	
	SamTrans	6		SamTrans	6	
Total Transit Capacity			**39,533**			**42,101**

Table 5: Change in Transit Capacity by Subarea (2010-2015 AM Peak Hour, Peak Direction)

Subarea	2010	2015	Change	
	AM Capacity	AM Capacity	Number	Percent
Northern Neighborhoods	2,593	3,018	425	16%
Richmond	6,003	6,723	720	12%
Sunset	7,120	8,125	1,005	14%
Mission	19,550	19,816	266	1%
Bayshore	4,268	4,420	152	4%
Total	**39,533**	**42,101**	**2,568**	**6%**

Transit capacity increased the most in the Northern Neighborhoods, Richmond and Sunset subareas, with an increase of 16%, 12% and 14% respectively.

3.2 Transit Demand

Transit demand to the Core in the SF Metro Corridor increased 26% from 2010 to 2015 in the AM peak hour. Caltrain and the Muni Historic Streetcar had the highest percent increases in demand at 55% and 56% respectively, followed by BART at 40% and Muni Metro at 33%.

Table 6 reports the 2010-2015 AM peak hour demand by operator.

Table 6: Change in AM Peak Hour, Peak Direction Demand by Transit Operator (2010-2015)

Mode	2010	2015	Change	
	AM Demand	AM Demand	Number	Percent
BART	9,828	13,738	3,910	40%
Caltrain	1,892	2,936	1,044	55%
Muni Metro	6,408	8,550	2,142	33%
Muni Hist. Streetcar	499	780	280	56%
Muni Bus	11,397	11,745	348	3%
SamTrans	350	382	32	9%
Total	**30,375**	**38,131**	**7,756**	**26%**

From 2010-2015, total transit demand increased 26%, while overall capacity only increased by 6%. This resulted in overall transit occupancy levels increasing from 77% in 2010 to 91% in 2015. Demand only outstripped supply on Muni Metro, which had a peak hour occupancy of 124% in 2015. Table 7 reports the change in occupancy by operator over this time period.

Table 7: Change in AM Peak Hour, Peak Direction Occupancy by Operator/Mode and Time Period

Mode	2010			2015		
	AM Capacity	AM Demand	Occupancy	AM Capacity	AM Demand	Occupancy
BART	15,194	9,828	65%	15,194	13,738	90%
Caltrain	3,250	1,892	58%	3,250	2,936	90%
Muni Metro	6,313	6,408	102%	6,878	8,550	124%
Muni Hist. Streetcar	1,200	499	42%	1,200	780	65%
Muni Bus	13,165	11,397	87%	15,167	11,745	77%
SamTrans	412	350	85%	412	382	93%
Total	**39,533**	**30,375**	**77%**	**42,101**	**38,131**	**91%**

Table 8 reports the change in AM transit demand by subarea from 2010 to 2015. The Richmond, Sunset, Mission and Bayshore subareas saw an increase in transit demand, at 7%, 37%, 27% and 44% respectively. The Northern Neighborhoods subarea saw a decrease in transit demand over this time period, at -3%.

Table 8: Change in AM Peak Hour, Peak Direction Demand by Subarea (2010-2015)

Subarea	2010	2015	Change	
	Demand	Demand	Number	Percent
Northern Neighborhoods	1,988	1,924	-64	-3%
Richmond	5,433	5,828	394	7%
Sunset	7,047	9,669	2,623	37%
Mission	13,248	16,873	3,625	27%
Bayshore	2,659	3,837	1,178	44%
Total	**30,375**	**38,131**	**7,756**	**26%**

From 2010 to 2015, overall transit occupancy rates in the corridor rose from 77% to 91%, but both the Richmond and Northern Neighborhoods subareas saw occupancy rates decline as capacity increased more than demand. The Bayshore subarea experienced the highest increase in occupancy from 2010 to 2015, at 39%. Although most subareas had sufficient capacity to accommodate growth in ridership, demand in the Sunset subarea grew to exceed capacity, with an occupancy rate of 119%. Table 9 reports the change in transit occupancy from 2010 to 2015 by subarea.

Table 9: Change in AM Peak Hour, Peak Direction Transit Occupancy by Subarea (2010-2015)

Subarea	2010			2015			Percent Change
	Capacity	Demand	Occupancy	Capacity	Demand	Occupancy	Occupancy
Northern Neighborhoods	2,593	1,988	77%	3,018	1,924	64%	-17%
Richmond	6,003	5,433	91%	6,723	5,828	87%	-4%
Sunset	7,120	7,047	99%	8,125	9,669	119%	20%
Mission	19,550	13,248	68%	19,816	16,873	85%	26%
Bayshore	4,268	2,659	62%	4,420	3,837	87%	39%
Total	**39,533**	**30,375**	**77%**	**42,101**	**38,131**	**91%**	**18%**

3.3 Auto Trip Capacity and Demand (2010-2015)

Auto demand in the SF Metro Corridor declined in the AM peak hour by 7% from 2010 to 2015. However, this decline is not consistent throughout all of the subareas. The Sunset and Richmond subareas experienced the greatest declines in auto trip demand, at 10% and 13% respectively, while the Bayshore subarea saw the smallest decline at 2%. Auto trip demand is estimated using the Plan Bay Area regional transportation model. Change in automobile trip demand from 2010 to 2015 is reported in Table 10.

Table 10: Change in Auto Demand to the Core by Subarea (2010-2015 AM Peak Hour)

Subarea	2010	2015	Change	
	AM Demand	AM Demand	Number	Percent
Northern Neighborhoods	2,389	2,218	-171	-7%
Richmond	5,089	4,416	-673	-13%
Sunset	5,059	4,552	-507	-10%
Mission	5,322	5,099	-223	-4%
Bayshore	7,040	6,875	-165	-2%
Total	**24,898**	**23,159**	**-1,739**	**-7%**

3.4 Bicycle and Pedestrian Demand (2010-2015)

From 2010 to 2015, biking and walking demand increased overall by 16% for the SF Metro Corridor as a whole. The Richmond subarea saw the greatest increase in demand, at 21%, and Bayshore saw the smallest at 5%. Table 11 summarizes the growth in bike and walk trips over this time period.

Table 11: Change in Biking and Walking Demand to the Core by Subarea (2010-2015 AM Peak Hour)

Subarea	2010	2015	Change	
	AM Demand	AM Demand	Number	Percent
Northern Neighborhoods	2,342	2,741	399	17%
Richmond	4,454	5,377	922	21%
Sunset	693	747	54	8%
Mission	1,280	1,369	89	7%
Bayshore	295	310	15	5%
Total	**9,065**	**10,543**	**1,479**	**16%**

3.5 Total San Francisco Metro Corridor Demand and Capacity

When transit, bicycle, pedestrian and vehicle capacity is combined, the overall AM peak hour demand for the entire SF Metro corridor increased by 12% from 2010 to 2015. All transit services experienced increases in demand, with the greatest increases on BART, Caltrain, Muni Historic Streetcar, and Muni Metro. Bicycle and pedestrian demand increased by 16%. Automobile demand experienced the only decline, at 7%. The change in peak hour demand from 2010 to 2015 is summarized in Table 12.

Table 12: Change in AM Peak Hour, Peak Direction Demand for All Modes (2010-2015)

Mode	2010	2015	Change	
	AM Demand	AM Demand	Number	Percent
BART	9,828	13,738	3,910	40%
Caltrain	1,892	2,936	1,044	55%
Muni Metro	6,408	8,550	2,142	33%
Muni Hist. Streetcar	499	780	280	56%
Muni Bus	11,397	11,745	348	3%
SamTrans	350	382	32	9%
Auto	24,898	23,159	-1,739	-7%
Bicycle/Pedestrian	9,065	10,543	1,479	16%
Total	**64,337**	**71,833**	**7,496**	**12%**

Table 13 summarizes capacity and demand by mode for the SF Metro Corridor in the AM peak hour between 2010 and 2015. Overall demand increased at a higher rate than capacity from 2010 to 2015, leading to higher occupancy rates. In 2015, Muni Metro exceeded 100% average occupancy, and the other services in the SF Metro Corridor reached an overall occupancy rate in the 77% to 93% range.

Table 13: AM Peak Hour Capacity, Demand, and Occupancy by Mode

Mode	2010 AM Capacity	2010 AM Demand	2010 Occupancy	2015 AM Capacity	2015 AM Demand	2015 Occupancy
BART	15,194	9,828	65%	15,194	13,738	90%
Caltrain	3,250	1,892	58%	3,250	2,936	90%
Muni Metro	6,313	6,408	102%	6,878	8,550	124%
Muni Hist. Streetcar	1,200	499	42%	1,200	780	65%
Muni Bus	13,165	11,397	87%	15,167	11,745	77%
SamTrans	412	350	85%	412	382	93%
Auto	24,898	24,898	100%*	23,159	23,159	100%*
Bicycle/Pedestrian	9,065	9,065	100%*	10,543	10,543	100%*
Total	**73,496**	**64,337**	**88%**	**75,803**	**71,833**	**95%**
*See discussion in section 2.2.2						

The change in AM peak hour demand for each subarea from 2010 to 2015 is summarized in Table 14.

Table 14: Change in AM Peak Hour, Peak Direction Demand for All Modes by Subarea (2010-2015)

Subarea	2010 AM Demand	2015 AM Demand	Change Number	Change Percent
Northern Neighborhoods	6,719	6,883	164	2%
Richmond	14,976	15,620	644	4%
Sunset	12,799	14,968	2,169	17%
Mission	19,850	23,341	3,491	18%
Bayshore	9,994	11,022	1,028	10%
Total	**64,337**	**71,833**	**7,496**	**12%**

The increase in travel demand from 2010 to 2015 varies by subarea. The Northern Neighborhoods subarea experienced the lowest increase in demand at 2% (164 trips). The Mission experienced the highest change in demand at 18% (3,491 trips).

Table 15 summarizes occupancy rates for each subarea in the AM peak hour between 2010 and 2015. Overall, the SF Metro Corridor operated at 95% capacity in 2015, an increase from 88% in 2010. The majority of subareas were able to handle the increase in demand, with the exception of the Sunset subarea. In the Sunset, the occupancy rate was 112% in 2015. The Richmond and Bayshore subareas tied for the second highest occupancy rate, at 95%.

Table 15: AM Peak Hour Capacity, Demand, and Occupancy by Subarea

Subarea	2010			2015		
	AM Capacity	AM Demand	Occupancy	AM Capacity	AM Demand	Occupancy
Northern Neighborhoods	7,323	6,719	92%	7,977	6,883	86%
Richmond	15,546	14,976	96%	16,515	15,620	95%
Sunset	12,872	12,799	99%	13,423	14,968	112%
Mission	26,152	19,850	76%	26,284	23,341	89%
Bayshore	11,603	9,994	86%	11,605	11,022	95%
Total	**73,496**	**64,337**	**88%**	**75,803**	**71,833**	**95%**

4 Planned Capacity (2040)

Each transit operator has plans for capacity-improving projects underway. However, not all projects are fully funded, and all projects need to be implemented to achieve the full capacity assumptions documented in this section. The capacity figures reported here and Appendix A notes the policy documents upon which the capacity calculations are based.

4.1 Planned Transit Capacity

Similar to calculating existing transit capacity, the planned transit capacity is calculated using adopted capacity policies and planned transit service. Planned transit capacity during the AM peak hour for each transit service is summarized in Table 16. The planned capacity figures represent total future capacity, including existing capacity (2015). Detailed information for each route is provided in Appendix D. The AM peak hour growth in capacity is detailed in Table 17.

Planned transit capacity in 2040 is expected to be significantly higher than existing capacity. A sample of projects that will expand capacity include:

- BART train car replacement and fleet expansion
- Caltrain Electrification
- SFMTA Central Subway (T-Third Street improvements)
- Service increases on multiple SFMTA bus lines, including the 9, 9R, 7, 7R, 10, 30 and 30X routes.
- New SFMTA bus and rail routes, including the Candlestick Point Express, 11- Downtown Connector, the Hunters Point Express and the E- Embarcadero line.

Table 16: Planned Transit Capacity by AM Peak Hour, Peak Direction and Operator (2040)

Operator	AM Services	AM Capacity
BART	270 cars 27 trains	28,890
Caltrain	48 cars 6 trains	5,376
Muni Metro	114 cars 65 trains	11,615
Muni Historic Streetcar	24 cars 24 trains	1,440
Muni Bus	270 buses	16,817
SamTrans	7 buses	477
Total	**399**	**64,615**

Table 17: Change in Planned Capacity by Mode (2015 to 2040)

Operator	2015	2040	Change	
	AM Capacity	AM Capacity	Number	Percent
BART	15,194	28,890	13,696	90%
Caltrain	3,250	5,376	2,126	65%
Muni Metro	6,878	11,615	4,737	69%
Muni Historic Streetcar	1,200	1,440	240	20%
Muni Bus	15,167	16,817	1,650	11%
SamTrans	412	477	65	16%
Total	**42,101**	**64,615**	**22,514**	**53%**

The AM peak hour growth in capacity by subarea is detailed in Table 18.

Table 18: Change in Planned Transit Capacity by Subarea (2015 to 2040)

Subarea	2015	2040	Change	
	AM Capacity	AM Capacity	Number	Percent
Northern Neighborhoods	3,018	3,968	950	31%
Richmond	6,723	6,841	118	2%
Sunset	8,125	8,971	846	10%
Mission	19,816	33,810	13,994	71%
Bayshore	4,420	11,025	6,606	149%
Total	**42,101**	**64,615**	**22,514**	**53%**

The Mission subarea will see the largest increase in capacity, with nearly 14,000 additional AM peak trip capacity in 2040, mainly due to BART's planned service increase. The Bayshore subarea will also have a considerable increase of over 6,600 AM peak trips in 2040, resulting primarily from increases in Caltrain and Muni T-Third Street service.

4.2 Automobile, Bicycle and Pedestrian Trip Capacity

This study assumes that the forecasted demand for automobile, bicycle and pedestrian trips is equal to the capacity to provide those trips.

5 Future Demand (2040)

Future demand for 2040 was estimated using two different forecast methods. The first method used forecasts established by Plan Bay Area (PBA) and the second method used an adjusted Plan Bay Area forecast called the Adjusted Growth Forecast (AG).

Plan Bay Area developed land use assumptions and employment projections for 2040. The Adjusted Growth Forecast updates these projections to reflect potential market trends identified in the CCTS Market Assessment. Demand estimates from both forecasts are presented in this memo. The PBA forecast estimates a 0.95% growth in travel demand per year for trips traveling to the Core from the SF Metro Corridor during the AM peak hour, while the AG Forecast estimates a 1.12% annual growth rate. Table 19 provides the average annual growth rates for each subarea. Although the AG Forecast estimates a higher growth rate for the entire corridor, in some subareas the PBA Forecast growth rate is higher. Thus, the "low" and "high" columns in Table 19 do not equate to one particular forecast.

Table 19: Annual Growth Rates by Subarea (2015-2040)

Subarea	Low Growth	High Growth
Northern Neighborhoods	0.89%	0.91%
Richmond	0.71%	0.75%
Sunset	0.68%	0.74%
Mission	1.00%	1.32%
Bayshore	1.10%	1.32%
Entire SF Metro Corridor	**0.95%**	**1.12%**

Source: SFCTA

For the SF Metro Corridor as a whole, the available capacity of the corridor is expected to exceed demand through 2040.

While the planned for the entire corridor capacity is expected be greater than the projected as a whole, a review of the individual subareas provides a more nuanced picture. Much of the future capacity increase in the SF Metro Corridor is planned for BART and Caltrain, which serve the Mission and Bayshore subareas respectively. Each of these subareas, along with the Northern Neighborhoods, are expected to provide more capacity than forecasted demand. Meanwhile, the Richmond and Sunset subareas are expected to have greater demand than available capacity and will experience over-capacity conditions by 2040. Figures 4 through 8 show 2015-2040 capacity and demand projections for the each subarea.

Figure 4 shows current and future travel demand and capacity for the Northern Neighborhoods subarea. This subarea's demand is forecast to grow through 2040, with an annual growth rate between 0.89% under the AG forecast and 0.91% under the PBA forecast. Planned capacity increases in transit will be greater than the projected increase in demand in 2040.

Figure 4: Northern Neighborhoods Subarea Future Capacity and Demand

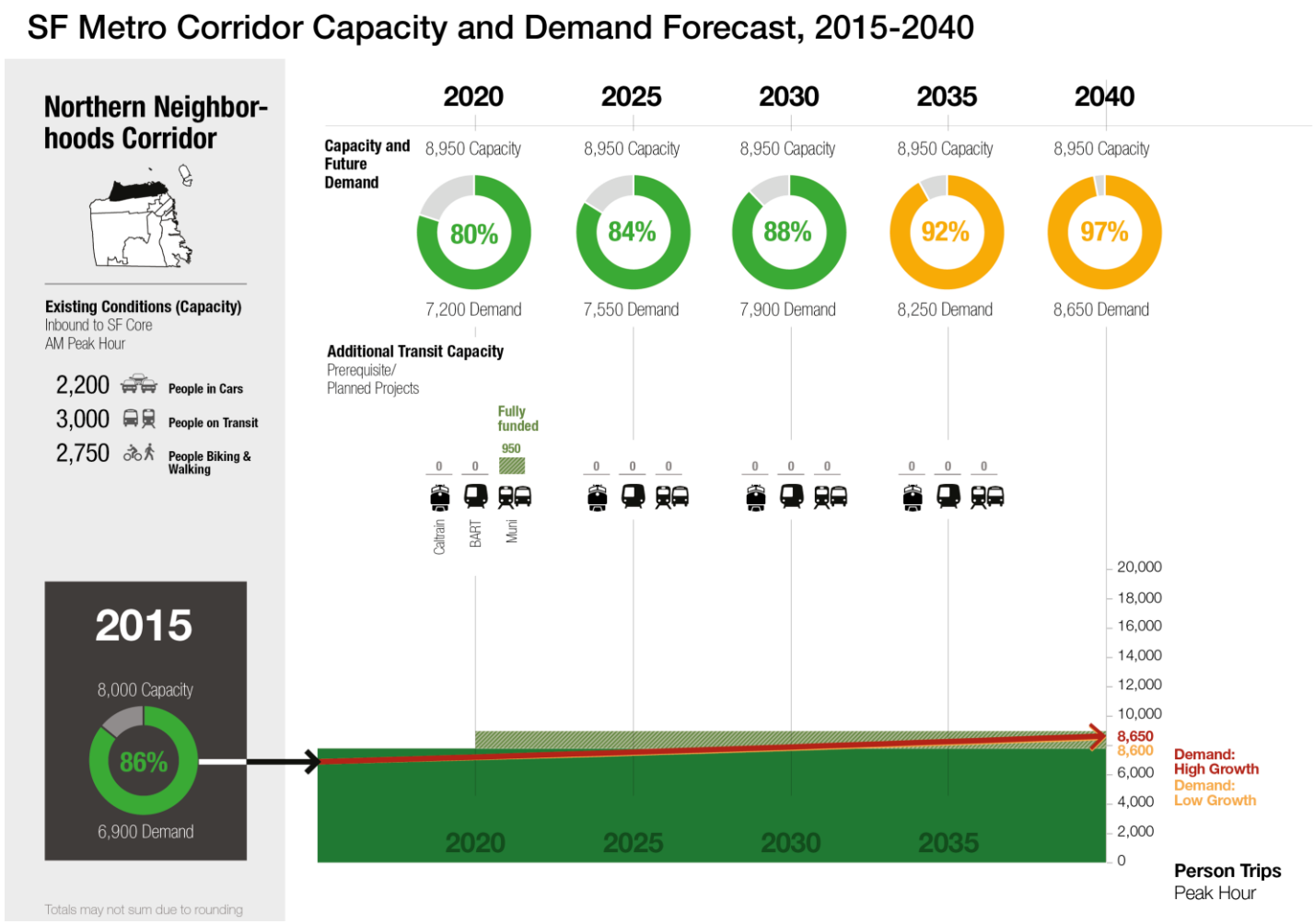


Figure 5 shows current and future demand and capacity for the Richmond subarea. Demand in this subarea is forecast to increase 0.75% annually under the AG forecast and 0.71% under the PBA forecast. While capacity in the subarea is planned to increase, demand will exceed planned capacity by 2030.

Figure 5: Richmond Subarea Future Capacity and Demand

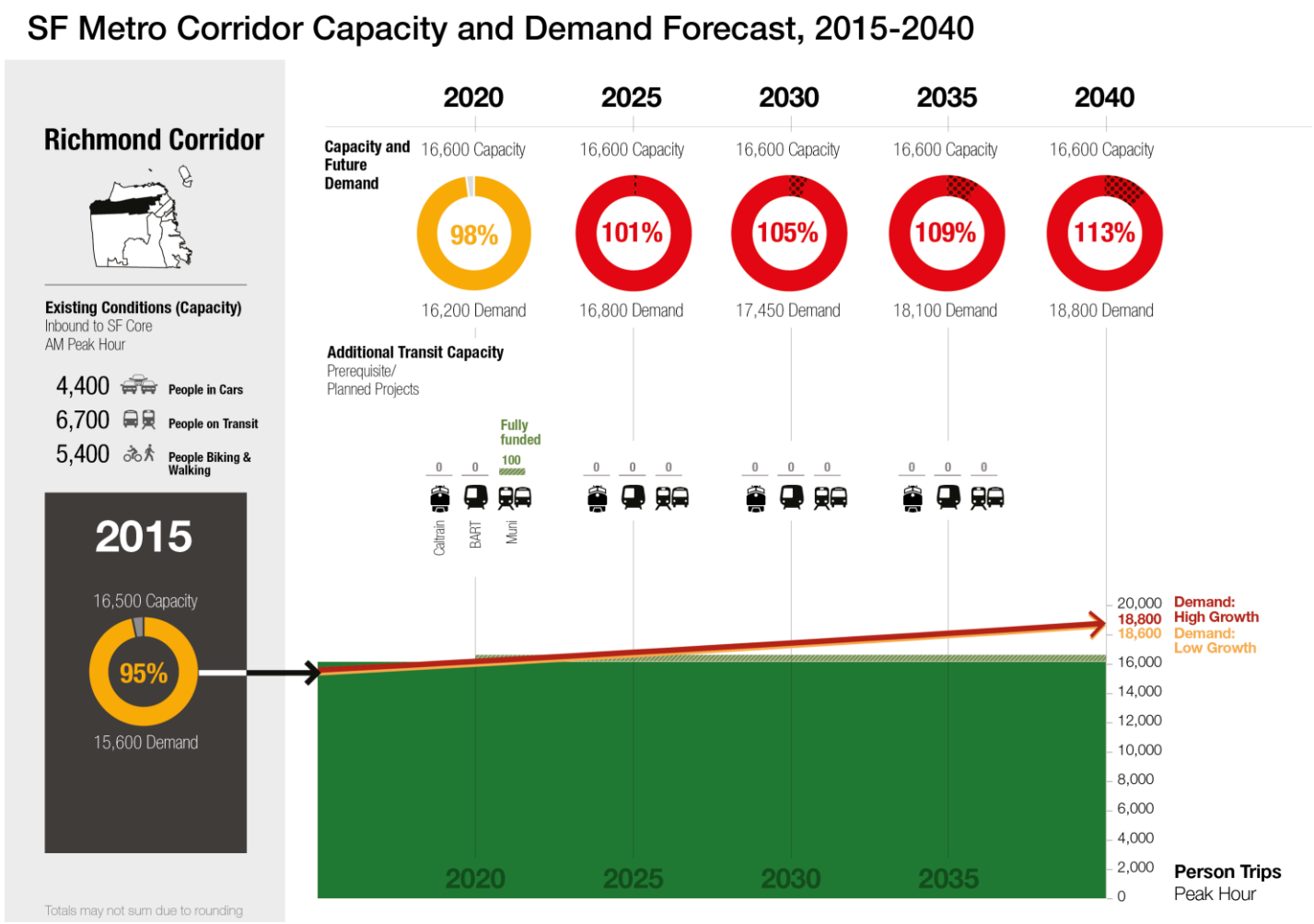


Figure 6 shows current and future demand and capacity for the Sunset subarea. Demand outstripped capacity in 2015, and this condition will worsen over time through 2040. Demand is expected to grow by 0.68% under the AG forecast and 0.74% under the PBA forecast.

Figure 6: Sunset Subarea Future Capacity and Demand

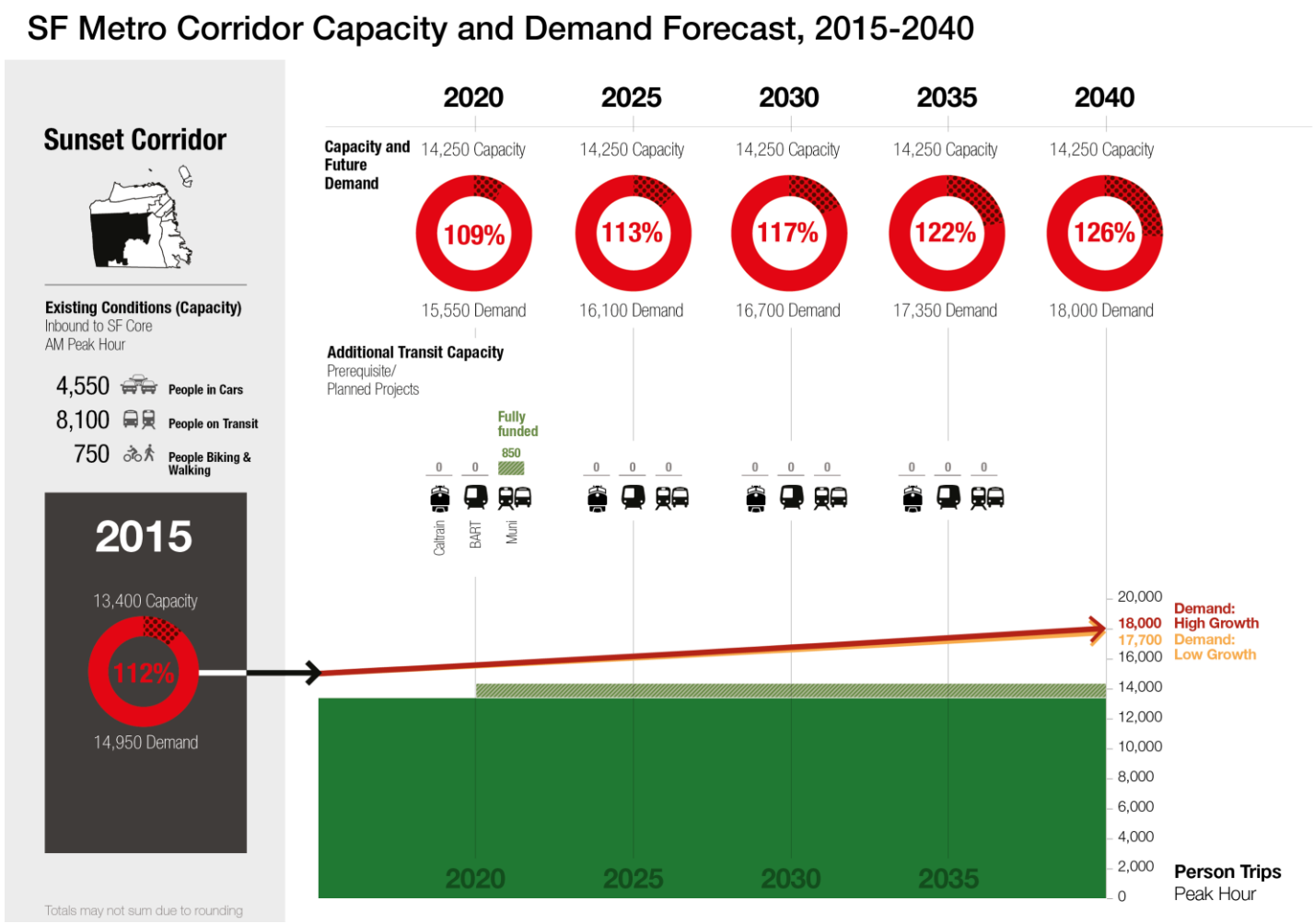


Figure 7 shows current and future demand and capacity for the Mission subarea. Travel demand is expected to grow at 1.32% annually under the AG forecast and 1.00% under the PBA forecast. This subarea is served by BART, which is planning to increase capacity by 62% before 2040, and SFMTA, which is also planning to increase capacity. The range of future demand is within the subarea's planned capacity through 2040.

Figure 7: Mission Subarea Future Capacity and Demand

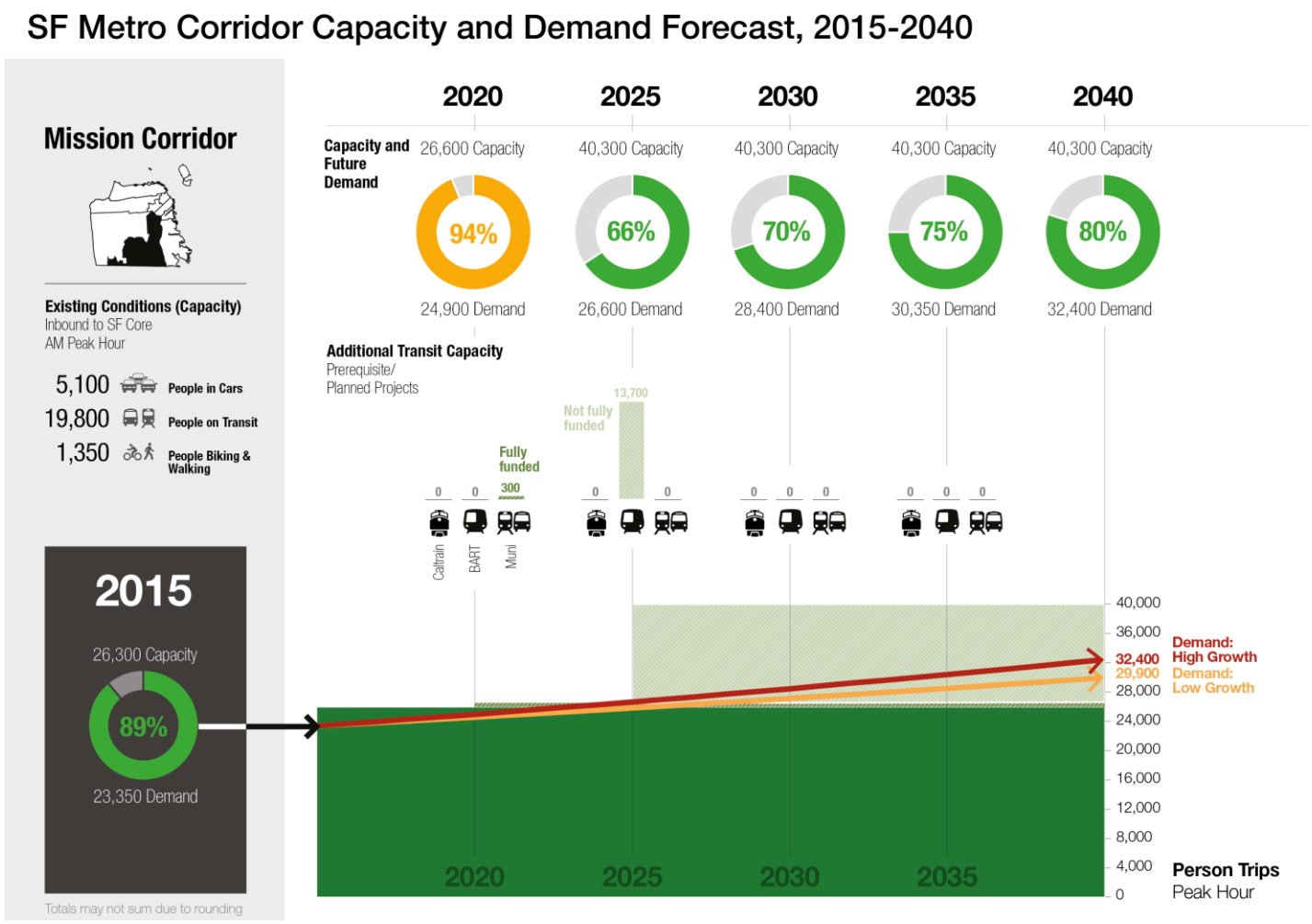
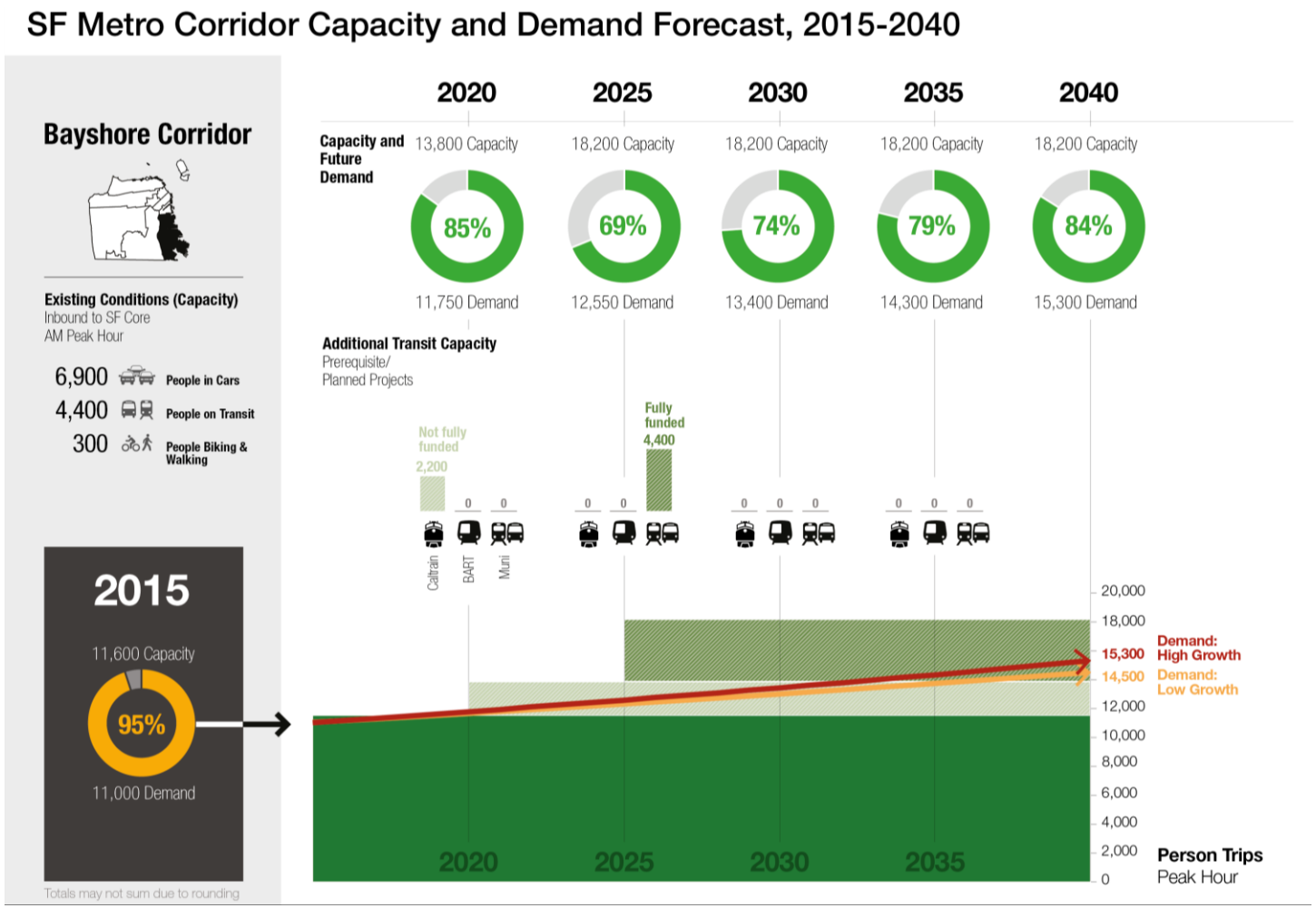


Figure 8 shows current and future demand and capacity for the Bayshore subarea. This subarea is expected to grow at 1.32% annually under the AG forecast and 1.10% under the PBA forecast. There are numerous projects to increase transit capacity planned for this subarea, including Caltrain electrification, T-Third Street improvements, the Hunters Point Express bus line and the Candlestick Point Express bus line. As a result, the range of future demand is less than the subarea's planned capacity.

Figure 8: Bayshore Subarea Future Capacity and Demand



Demand will exceed capacity in the Sunset and Richmond subareas within the study timeframe. In 2015, the Sunset subarea experienced over-capacity conditions, and despite planned capital investment projects, demand continue to exceed capacity. No capacity increasing projects are planned for this subarea past 2020, and by 2040 the occupancy rate is projected to be 125%. In the Richmond Subarea, the occupancy rate was 95% in 2015, and by 2030 demand will exceed capacity despite planned increases in capacity. By 2040, the occupancy rate is projected to rise to 111%.

6 Findings

Workers access the Core from all parts of the city and their traveling options are diverse, including:

- BART
- Caltrain
- SFMTA, bus and light rail
- Automobiles, including carpools and driving alone
- Walking and biking
- Other bus services

Key capacity and demand findings include:

1. Overall transit capacity in the SF Metro Corridor increased by 6% from 2010 to 2015, while transit demand increased 26%.

2. Most transit providers have been able to meet the increase in demand, except Muni Metro. Under 2015 conditions, demand exceeded current Muni Metro capacity levels, with an occupancy rate of 124%. This mainly impacts the Sunset subarea, which relies on Muni Metro and had an overall transit occupancy rate of 119% in 2015.

3. Travel demand for the whole corridor is projected to continue growing at a rate between 0.95% and 1.12% annually.

4. Implementation of all planned transit improvements will increase transit capacity by 22,500 AM peak trips. On a corridor-wide basis, planned capacity improvements will be sufficient to accommodate the projected travel demand under both PBA and AG forecasts.

5. The additional planned capacity is not proportionally distributed throughout the SF Metro Corridor, but rather concentrated to the Mission and Bayshore subareas due to a 90% increase in BART capacity and 65% increase in Caltrain capacity.

6. Under both PBA and AG forecast scenarios, without additional transit capacity improvements, transit demand in the long term will exceed capacity in the Sunset and Richmond subareas. Future investments will bring some relief to crowding but will not solve capacity issues under these growth scenarios. Other investments will be needed to address demand in the long term (2040 and beyond).

CORE CAPACITY
TRANSIT STUDY

MEMORANDUM

APPENDIX A

Methodology – Transit Capacity and Demand Assumptions

Methodology – Transit Capacity and Demand Assumptions

The methodology used to calculate current and planned transit capacity, current observed volume of automobile trips, and summarize the Plan Bay Area Model outputs for existing and forecasted demand is specific to the SF Metro Corridor. Although the geographic boundaries of the SF core are consistent between the Transbay and SF Metro corridors, the unique characteristics of each corridor result in distinct methodologies to produce the capacity and demand estimates.

The main steps in the SF Metro methodology are:

1) Establish the Core Traffic Analysis Zones (TAZ)
2) Establish screenlines
3) Identify guiding policy documents for transit capacity

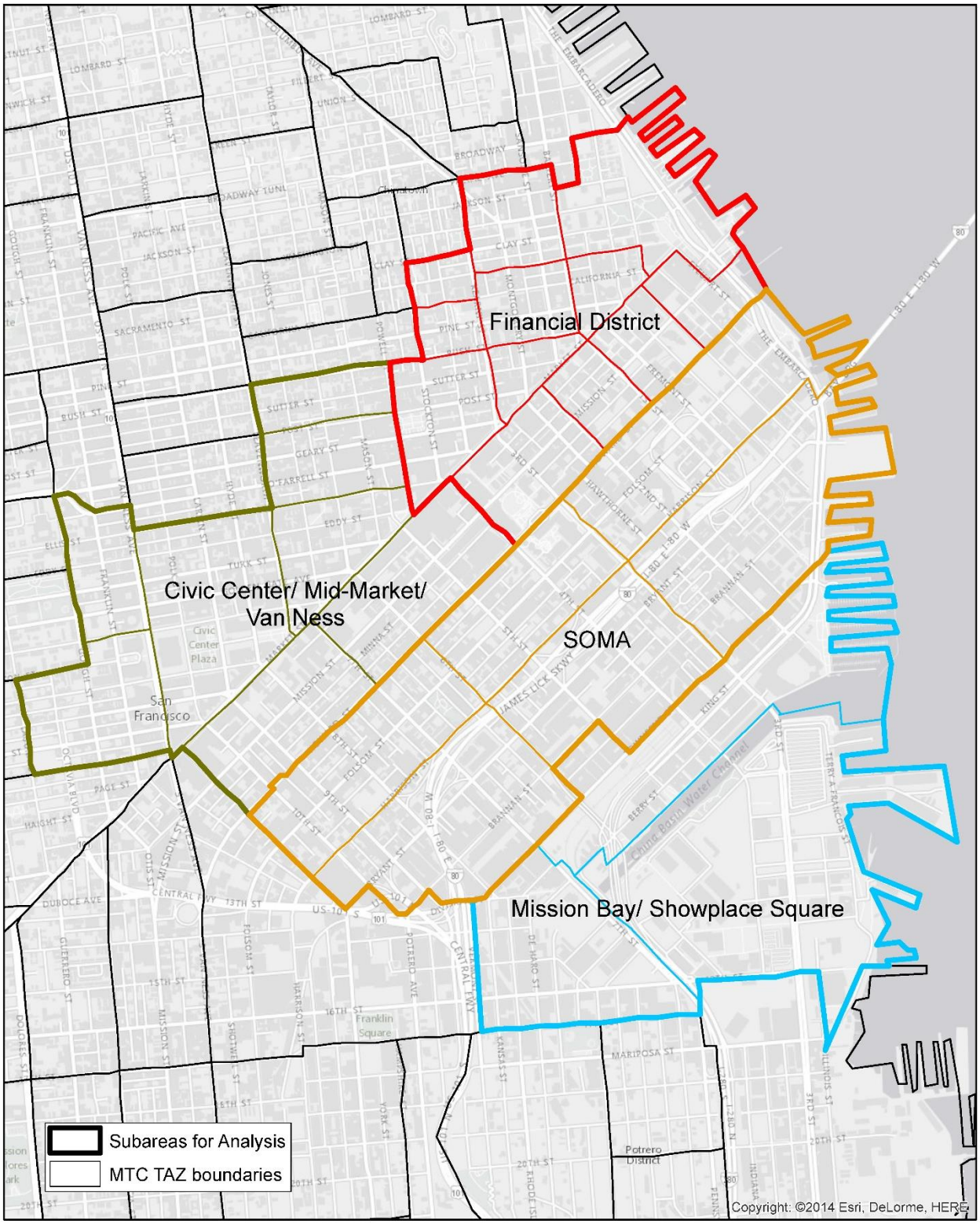
1 Core Geography

The Core is defined by four subareas:

- Financial District
- Mid-Market
- Mission Bay/Showplace Square
- South of Market (SoMa)

The boundaries of the subareas are defined by MTC Travel Analysis Zones (TAZs). This study focuses on the amount of capacity and demand for transit and vehicle trips to the Core; trips to areas outside the Core are not considered. Figure 1 shows the boundaries of the Core, subareas of the Core, and TAZs.

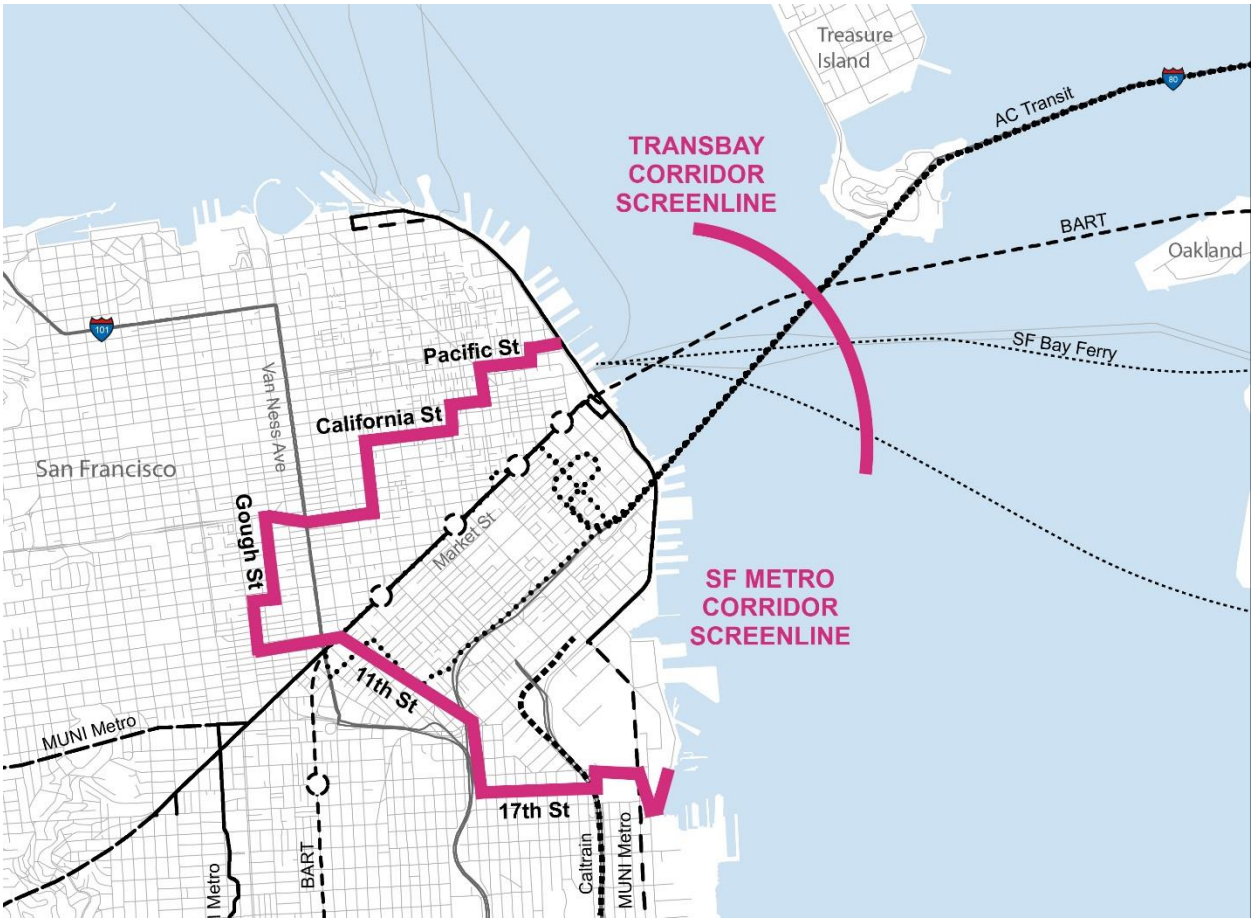
Figure A1: Core Subareas



2 Screenlines

One screenline for each corridor was designated to calculate the existing and planned capacity and demand. The Transbay Corridor screenline captures trips originating in the East Bay, and the SF Metro Corridor screenline captures trips from the five SF Metro Corridor subareas. The San Francisco Metro screenline includes Caltrain, SFMTA Muni surface and underground routes, SamTrans routes, and BART service from Daly City/Millbrae. The screenlines are shown in Figure 2.

Figure A2: Transbay and San Francisco Metro Screenlines



3 Guiding Policies on Capacity and Service

Each transit agency calculates capacity independently. For consistency purposes, capacity calculations were informed by the relevant policy documents from each agency, summarized in Table 2. Total capacity is calculated by determining the number of services per hour, the number of vehicles per hour, and the capacity per vehicle. Total service is also calculated using relevant policy documents, summarized in Table 3. Automobile capacity is calculated by determining the number of vehicle trips crossing the screenline into the Core during the peak hour. This number is then multiplied by the average observed occupancy.

BART

BART capacity assumptions were drawn from the BART Sustainable Communities Operations Analysis (2013), and include:

- Planned Capacity Target Year – 2040
- Vehicle Capacity – All current and planned vehicle capacity figures were derived from the Operations Analysis document.
- Service Frequency –The service frequency for the proposed new line was added to the service frequency for the Yellow Line.

Caltrain

Caltrain capacity assumptions were drawn from a Joint Powers Board presentation from June 4, 2015, and service assumptions were taken from Cambridge Systematics' Transbay Transit Center (TTC) Caltrain Ridership Forecast and TTC Ridership by Mode by Hour (November 2008). Assumptions include:

- Planned Capacity Target Year – 2030
- Vehicle Capacity – All current and planned vehicle capacity figures were derived from SFCTA.
- Service Frequency – Service frequency and planned headway

Muni

Current and planned transit headway information for every current and planned line was taken from the Muni Forward Implementation Workbook (2015). Capacity for Muni's primary transit vehicles were taken from the SFMTA Transit Fleet Management Plan (2014).

- Planned Capacity Target Year – The projects listed in the Muni Forward Implementation Workbook will be completed by 2030.
- Vehicle Capacity – The Fleet Management Plan provides seated and standing capacity for light rail vehicles, historic streetcars, and standard buses.
- Service Frequency – Muni has listed current and planned headways by the minute for every line.

Table A1: Vehicle/Vessel Capacity

	Either Seated or Standing Passengers	Source
BART	107	BART Sustainable Communities Operations Analysis (2013)
Caltrain	112	Joint Powers Board Presentation June 4, 2015
Muni Metro	101	2014 SFMTA Transit Fleet Management Plan
Muni Bus – 40 ft	54	2014 SFMTA Transit Fleet Management Plan
Muni Bus – 60 ft	80	2014 SFMTA Transit Fleet Management Plan
Muni Historic Streetcar	70	2014 SFMTA Transit Fleet Management Plan
SamTans	57	

Table A2: Service Guiding Documents

	Source
BART	BART Sustainable Communities Operations Analysis (2013)
Caltrain	Cambridge Systematics Transbay Transit Center (TTC) Caltrain Ridership Forecast and TTC Ridership by Mode by Hour
SFMTA	Muni Forward Implementation Workbook (2015)

4 Demand Forecasts

Plan Bay Area and the Adjusted Growth Model form the basis for future demand forecasts. The 2010 forecasts and counts are the baseline year. The forecast year is 2040. All trips have a given specific departure hour[2].

Plan Bay Area trip tables (original Plan Bay Area – RTP) for trips originating in the San Francisco Metro area and destined for the Core were consulted to:

- Determine the forecast peak hour
- Determine the overall numbers of trips originating in the peak hour.

[2] *Plan Bay Area forecast* data and information can be found here: http://mtcgis.mtc.ca.gov/foswiki/Main/TravelModel.

CORE CAPACITY
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APPENDIX B

Historic Transit Capacity (2010) – Detailed Table

APPENDIX B
Historic Transit Capacity (2010) – Detailed Table

Item	Transit Operator	Transit Service	Service Description	Services per hour	Average Headway (mins)	Capacity per Vehicle	Peak Hour Capacity
1	BART	Heavy Rail	Richmond-Millbrae (Red Line)	4	15.0	107	4,280
2	BART	Heavy Rail	Pittsburg Bay Point-SFO Airport (Yellow Line)	4	15.0	107	3,852
3	BART	Heavy Rail	Dublin Pleasanton-Daly City (Blue Line)	4	15.0	107	3,424
4	BART	Heavy Rail	Fremont-Daly City (Green Line)	4	15.0	107	3,638
5	Caltrain	Heavy Rail	200 Limited-stop Service	3	20.0	130	1,950
6	Caltrain	Heavy Rail	300 Baby Bullet	2	30.0	130	1,300
7	Muni Metro	Light Rail	J-Church	6.9	8.7	101	697
8	Muni Metro	Light Rail	KT-Ingleside/Third Street	6	10.0	101	606
9	Muni Metro	Light Rail	KT-Ingleside/Third Street	6	10.0	101	606
10	Muni Metro	Light Rail	L-Taraval	6.9	8.7	202	1,394
11	Muni Metro	Light Rail	M-Oceanview	6.9	8.7	202	1,394
12	Muni Metro	Light Rail	N-Judah	8.0	7.5	202	1,616
13	Muni Hist. Streetcar	Streetcar	F-Market & Wharves	10.0	6.0	60	600
14	Muni Hist. Streetcar	Streetcar	F-Market & Wharves	10.0	6.0	60	600
15	Muni Bus - 40ft	Bus	1-California	17	3.5	54	918
16	Muni Bus - 40ft	Bus	1AX-California A Express	6.7	9.0	62	415
17	Muni Bus - 40ft	Bus	1BX-California B Express	8.6	7.0	80	686
18	Muni Bus - 40ft	Bus	2-Clement	5	12.0	54	270
19	Muni Bus - 40ft	Bus	3-Jackson	5	12.0	54	270
20	Muni Bus - 40ft	Bus	5-Fulton	16.9	3.6	54	913
21	Muni Bus - 40ft	Bus	71-Haight-Noriega	6	10.0	54	324
22	Muni Bus - 40ft	Bus	8X-Bayshore	8	7.5	80	640
23	Muni Bus - 60ft	Bus	8AX-Bayshore "A" Express	8.0	7.5	80	640
24	Muni Bus - 40ft	Bus	9-San Bruno	5	12.0	54	270
25	Muni Bus - 40ft	Bus	9L-San Bruno	5	12.0	54	270
26	Muni Bus - 40ft	Bus	10-Townsend	3	20.0	54	162
27	Muni Bus - 60ft	Bus	14-Mission	10	6.0	80	800
28	Muni Bus - 60ft	Bus	14L-Mission Rapid	6.7	9.0	80	536
29	Muni Bus - 60ft	Bus	14X-Mission Express	7.5	8.0	80	600
30	Muni Bus - 40ft	Bus	16X - Noriega	6.7	9.0	73	490
31	Muni Bus - 40ft	Bus	21-Hayes	6.7	9.0	54	360
32	Muni Bus - 40ft	Bus	30-Stockton	7.5	8.0	56	421
33	Muni Bus - 40ft	Bus	30X-Marina Express	15	4.0	54	810
34	Muni Bus - 40ft	Bus	31AX-Balboa Express	5	12.0	54	270
35	Muni Bus - 40ft	Bus	31BX-Balboa Express	6	10.0	54	324
36	Muni Bus - 60ft	Bus	38-Geary	5	12.0	80	400
37	Muni Bus - 60ft	Bus	38L-Geary Rapid	11	5.5	80	880
38	Muni Bus - 40ft	Bus	38AX-Geary Express	5.5	10.9	54	297
39	Muni Bus - 60ft	Bus	41-Union	7.5	8.0	80	600
40	Muni Bus - 60ft	Bus	49-Van Ness/Mission	7.5	8.0	80	600
41	SamTrans	Bus	Route 292	5	12.0	65	325
42	SamTrans 1	Bus	Route KX	1	60.0	87	87
			Total Screenline Capacity	**289.4**	**0.2**	**-**	**39,533**

CORE CAPACITY
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APPENDIX C

Existing Transit Capacity (2015) – Detailed Table

APPENDIX C
Existing Transit Capacity (2015) – Detailed Table

Item	Transit Operator	Transit Service	Service Description	Services per hour	Average Headway (mins)	Capacity per Vehicle	Peak Hour Capacity
1	BART	Heavy Rail	Richmond-Millbrae (Red Line)	4	15.0	107	4,280
2	BART	Heavy Rail	Pittsburg Bay Point-SFO Airport (Yellow Line)	4	15.0	107	3,852
3	BART	Heavy Rail	Dublin Pleasanton-Daly City (Blue Line)	4	15.0	107	3,424
4	BART	Heavy Rail	Fremont-Daly City (Green Line)	4	15.0	107	3,638
5	Caltrain	Heavy Rail	200 Limited-stop Service	3	20.0	130	1,950
6	Caltrain	Heavy Rail	300 Baby Bullet	2	30.0	130	1,300
7	Muni Metro	Light Rail	J-Church	7.5	8.0	101	758
8	Muni Metro	Light Rail	KT-Ingleside/Third Street	7.5	8.0	101	758
9	Muni Metro	Light Rail	KT-Ingleside/Third Street	7.5	8.0	101	758
10	Muni Metro	Light Rail	L-Taraval	7.5	8.0	202	1,515
11	Muni Metro	Light Rail	M-Oceanview	6.7	9.0	202	1,353
12	Muni Metro	Light Rail	N-Judah	8.6	7.0	202	1,737
13	Muni Hist. Streetcar	Streetcar	F-Market & Wharves	10	6.0	60	600
14	Muni Hist. Streetcar	Streetcar	F-Market & Wharves	10	6.0	60	600
15	Muni Bus - 40ft	Bus	NX-N Express	6	10.0	54	324
16	Muni Bus - 40ft	Bus	1-California	13.8	4.3	54	745
17	Muni Bus - 40ft	Bus	1AX-California A Express	5	12.0	54	270
18	Muni Bus - 60ft	Bus	1BX-California B Express	7.5	8.0	80	600
19	Muni Bus - 40ft	Bus	2-Clement	5	12.0	54	270
20	Muni Bus - 40ft	Bus	3-Jackson	5	12.0	54	270
21	Muni Bus - 40ft	Bus	5-Fulton	7	8.6	54	378
22	Muni Bus - 40ft	Bus	5R-Fulton Rapid	15	4.0	54	810
23	Muni Bus - 40ft	Bus	7-Haight-Noriega	6	10.0	54	324
24	Muni Bus - 40ft	Bus	7R-Haight-Noriega	6	10.0	54	324
25	Muni Bus - 40ft	Bus	7X-Noriega (using 16x data)	8	7.5	54	432
26	Muni Bus - 60ft	Bus	8-Bayshore	10	6.0	80	800
27	Muni Bus - 60ft	Bus	8AX-Bayshore "A" Express	10	6.0	80	800
28	Muni Bus - 40ft	Bus	9-San Bruno	5	12.0	54	270
29	Muni Bus - 40ft	Bus	9R-San Bruno	8	7.5	54	432
30	Muni Bus - 40ft	Bus	10-Townsend	6	10.0	54	324
31	Muni Bus - 60ft	Bus	14-Mission	7	8.6	80	560
32	Muni Bus - 60ft	Bus	14R-Mission Rapid	7	8.6	80	560
33	Muni Bus - 60ft	Bus	14X-Mission Express	8	7.5	80	640
34	Muni Bus - 40ft	Bus	21-Hayes	13	4.6	54	702
35	Muni Bus - 40ft	Bus	30-Stockton	8	7.5	54	432
36	Muni Bus - 40ft	Bus	30X-Marina Express	13	4.6	54	702
37	Muni Bus - 40ft	Bus	31AX-Balboa Express	6	10.0	54	324
37	Muni Bus - 40ft	Bus	31BX-Balboa Express	6	10.0	54	324
38	Muni Bus - 60ft	Bus	38-Geary	7	8.6	80	560
39	Muni Bus - 60ft	Bus	38R-Geary Rapid	15	4.0	80	1,200
40	Muni Bus - 40ft	Bus	38AX-Geary Express	5	12.0	54	270
41	Muni Bus - 40ft	Bus	41-Union	12	5.0	80	960
42	Muni Bus - 60ft	Bus	49-Van Ness/Mission	7	8.6	80	560
43	SamTrans	Bus	Route 292	5	12.0	65	325
44	SamTrans 1	Bus	Route KX	1	60.0	87	87
			Total Screenline Capacity	**329.6**	**0.2**	**-**	**42,101**

CORE CAPACITY TRANSIT STUDY

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APPENDIX D

Planned Transit Capacity (2040) –

Detailed Table

APPENDIX D
Planned Transit Capacity (2040) – Detailed Table

SF Metro Corridor Peak Direction Screenline Core Capacity – Planned Capacity (2040)

Item	Transit Operator	Transit Service	Service Description	Services per hour	Average Headway (mins)	Capacity per Vehicle	Peak Hour Capacity
1	BART	Heavy Rail	Richmond-Millbrae (Red Line)	5	12.0	107	5,350
2	BART	Heavy Rail	Pittsburg Bay Point-SFO Airport (Yellow Line)	11	5.5	107	11,770
3	BART	Heavy Rail	Dublin Pleasanton-Daly City (Blue Line)	5	12.0	107	5,350
4	BART	Heavy Rail	Fremont-Daly City (Green Line)	6	10.0	107	6,420
5	Caltrain	Heavy Rail	EMU	6	10.0	112	5,376
6	Muni Bus - 40ft	Bus	NX-N Express	7	8.6	54	378
7	Muni Bus - 40ft	Bus	1-California	20	3.0	54	1,080
8	Muni Bus - 40ft	Bus	1AX-California A Express	6	10.0	54	324
9	Muni Bus - 40ft	Bus	1BX-California B Express	8.6	7.0	54	464
10	Muni Bus - 40ft	Bus	2-Clement	8	7.5	54	432
11	Muni Bus - 40ft	Bus	3-Jackson	6	10.0	54	324
12	Muni Bus - 40ft	Bus	5-Fulton	10	6.0	54	540
13	Muni Bus - 40ft	Bus	5R-Fulton Rapid	10	6.0	54	540
14	Muni Bus - 40ft	Bus	7-Haight-Noriega	8	7.5	54	432
15	Muni Bus - 40ft	Bus	7R-Haight-Noriega	8	7.5	54	432
16	Muni Bus - 40ft	Bus	7X-Noriega	6.7	9.0	54	362
17	Muni Bus - 60ft	Bus	8-Bayshore	10	6.0	80	800
18	Muni Bus - 60ft	Bus	8AX-Bayshore Express	6	10.0	80	480
19	Muni Bus - 40ft	Bus	9-San Bruno	10	6.0	54	540
20	Muni Bus - 40ft	Bus	9R-San Bruno	10	6.0	54	540
21	Muni Bus - 40ft	Bus	10-Townsend	10	6.0	54	540
22	Muni Bus - 60ft	Bus	14-Mission	8	7.5	80	640
23	Muni Bus - 60ft	Bus	14R-Mission Rapid	8	7.5	80	640
24	Muni Bus - 60ft	Bus	14X-Mission Express	8	7.5	80	640
25	Muni Bus - 40ft	Bus	21-Hayes	7.5	8.0	54	405
26	Muni Bus - 60ft	Bus	30-Stockton	17.1	3.5	54	923
27	Muni Bus - 60ft	Bus	30X-Marina Express	15	4.0	80	1,200
28	Muni Bus - 40ft	Bus	31AX-Balboa Express	6	10.0	54	324
29	Muni Bus - 40ft	Bus	31BX-Balboa Express	6	10.0	54	324
30	Muni Bus - 60ft	Bus	38-Geary	10	6.0	80	800
31	Muni Bus - 60ft	Bus	38R-Geary Rapid	12	5.0	80	960
32	Muni Bus - 40ft	Bus	38AX-Geary Express	6	10.0	54	324
33	Muni Bus - 40ft	Bus	41-Union	8.6	7.0	54	464
34	Muni Bus - 60ft	Bus	49R- Van Ness	8	7.5	80	640
35	Muni Bus - 40ft	Bus	Candlestick Point Express	6	10.0	54	324
36	Muni Hist. Streetcar	Streetcar	E-Embarcadero	4	15.0	60	240
37	Muni Hist. Streetcar	Streetcar	F-Market & Wharves	10	6.0	60	600
38	Muni Hist. Streetcar	Streetcar	F-Market & Wharves	10	6.0	60	600
39	Muni Metro	Light Rail	J-Church	7.5	8.0	101	758
40	Muni Metro	Light Rail	K-Ingleside	7.5	8.0	101	758
41	Muni Metro	Light Rail	T-Third Street	24	2.5	101	4,848
42	Muni Metro	Light Rail	L-Taraval	8	7.5	202	1,616
43	Muni Metro	Light Rail	M-Oceanview	7.1	8.5	202	1,434
44	Muni Metro	Light Rail	N-Judah	10.9	5.5	202	2,202
45	SamTrans	Bus	Route 292	6	10.0	65	390
46	SamTrans 1	Bus	Route KX	1	60.0	87	87
			Total Screenline Capacity	**399.5**	**0.2**	**-**	**64,615**

CORE CAPACITY
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APPENDIX E

2040 Transit Ridership Forecasting Methodology
SFCTA Memorandum

APPENDIX E
2040 Transit Ridership Forecasting Methodology SFCTA Memorandum

August 14, 2015
San Francisco County Transportation Authority
Core Capacity Transit Study

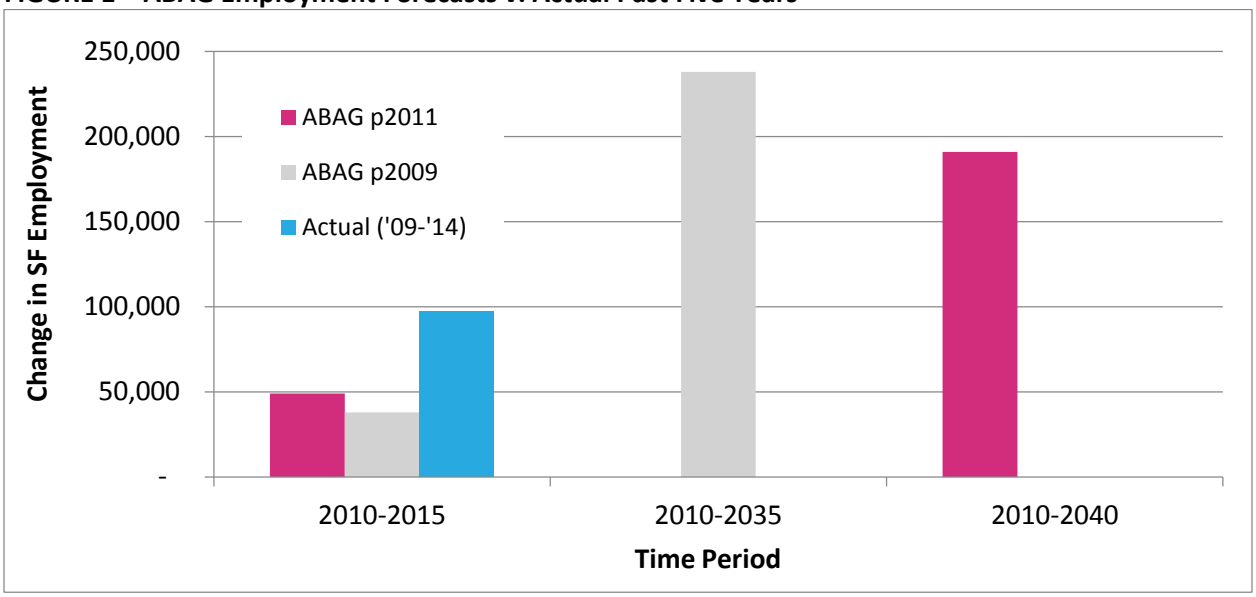
Objectives

- Develop estimates of peak hour and/or peak period transit ridership on core-serving corridors in the year 2040
- Prepare multiple future scenarios to account for the uncertainty of future growth

Background

- The Core Capacity Transit Study (CCTS) is planning to use regional land use and transportation network assumptions for the problem statement and goal setting tasks including:
    - ABAG p2009 and p2011 Jobs Housing Connection Strategy (JHC) land use forecasts
    - Transportation 2035 Travel Model One travel demand forecasts
    - Plan Bay Area (PBA) Travel Model One travel demand forecasts
    - Strategic Economics market assessment findings
- Between 2010 and 2015 employment growth in San Francisco has exceeded ABAG p2009 and ABAG p2011 JHC forecasts by a factor of two to three (Fig 1)
- Between 2010 and 2015 transit ridership on high capacity, core-serving operators has exceeded long range MTC Travel Model One forecasts.
- Between 2010 and 2015 San Francisco has accounted for a larger share of regional employment growth (29%) than forecasted in ABAG p2011 JHC land use forecasts (17%)
- Between 2010 and 2015 population growth in SF and the region has followed ABAG projections more closely than employment
- Recent trends in land use, economic factors, and transit ridership illustrate the uncertainty of future growth projections and suggest the need to analyze a range of potential outcomes
- Since variation from long range land use forecasts occurs primarily in employment, CCTS should consider a variety of land use scenarios with different employment growth profiles to forecast future transit demand
- Travel demand for two land use scenarios can be derived from recent Travel Model One Regional Transportation Plan (RTP) forecasts: Transportation 2035 and Plan Bay Area
- Future year travel demand for a third scenario that incorporates recent land use trends can be estimated by adjusting employment inputs and demand outputs from the Travel Model One Plan Bay Area forecast of year 2040

FIGURE 1 – ABAG Employment Forecasts v. Actual Past Five Years



Source: ABAG p2009 and p2011 land use forecasts & Strategic Economics summary of U.S. Census Quarterly Workforce Indicators, 2014 (for 2009-2014); rounded values

Land Use Scenarios

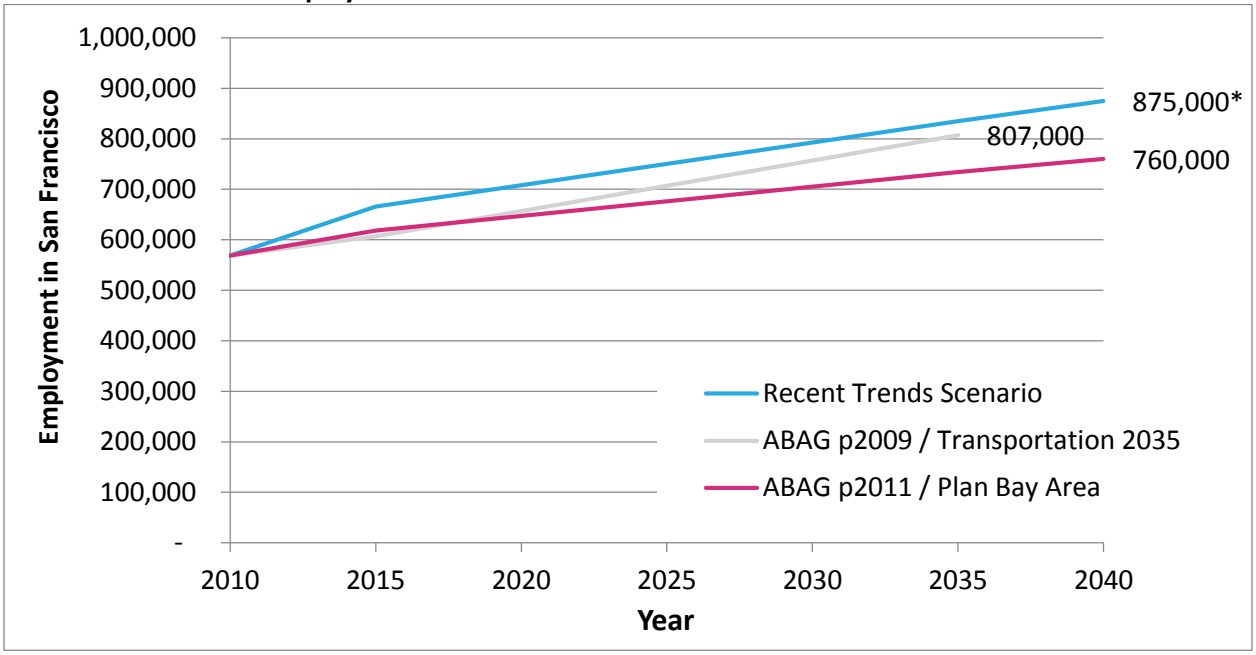
SFCTA proposes consideration of three land use growth scenarios. Two of the land use scenarios are from previously adopted RTPs: Transportation 2035 and Plan Bay Area. Transportation 2035 uses ABAG p2009 land use assumptions. This land use scenario was developed during a robust economic climate and features relatively more employment growth in future years. Plan Bay Area uses ABAG p2011 JHC land use assumptions. ABAG developed p2011 JHC land use assumptions in the depths of a recession. These land use forecasts project less employment growth in future years.

Both of the RTP travel demand model scenarios were developed several years in the past. Neither incorporates recent demographic and economic trends in the San Francisco Bay Area. Strategic Economics has performed a market assessment which identifies recent changes in San Francisco Bay Area development patterns. The third "Recent Trends" land use scenario adjusts ABAG p2011 JHC land use assumptions for the year 2040 to account for these recent trends.

In the "Recent Trends" scenario, population is held constant with ABAG p2011 JHC projections, but employment is adjusted for the San Francisco core area. The change in employment from Plan Bay Area travel demand assumptions will then be used to adjust the Plan Bay Area travel demand model origin-destination tables to account for changes in SF core area employment.

Figure 2 presents a rough example of SF employment under the three scenarios. Actual adjustments for the recent trends scenario will be informed by Strategic Economics' in-process market assessment exercise. Additional scenarios could also be used to evaluate distributions of growth within the SF core area at later stages of the study.

FIGURE 2 – EXAMPLE employment forecasts for San Francisco



Source: ABAG p2009 and p2011 land use forecasts & Strategic Economics summary of U.S. Census Quarterly Workforce Indicators, 2014 (for 2009-2014); rounded values
**Recent Trends Scenario is an example; actual values will be based on the results of the market assessment*

Recent Trends Scenario Methodology

1. Calculate 2010-2015 actual employment growth increment (Recent Trends scenario)

Input	• ABAG p2011 JHC employment by zone, 2010 and 2015 (ABAG-10, ABAG-15) • U.S. Census employment data for SF, 2010 and 2015 (or closest)
Process	• Calculate change in employment by transportation analysis zone (TAZ) under ABAG assumptions • Calculate actual change in employment by TAZ • Net ABAG forecast difference from actual difference
Output	TAZ-level employment increment for 2010-2015 (EI-10-15)
Questions	What is the best data source to use for actuals?

2. Calculate 2015-2040 structural shift employment increment (Recent Trends scenario)

Input	• ABAG p2011 JHC employment by TAZ, 2015 and 2040 (ABAG-15, ABAG-40) • Strategic Economics findings on SF employment capture
Process	• Calculate ABAG change in employment for SF 2015-2040 (ABAG-15-40) • Determine assumption for higher SF capture (from Strategic Economics analysis) • Assign incremental job growth to SF TAZs (EI-15-40)
Output	TAZ-level employment increment for 2015-2040 (EI-15-40)
Questions	• Which assumption to use for higher SF capture? • Apply adjustment only to TAZs in SF Core or to SF overall?

3. Produce 2040 land use scenarios (Recent Trends scenario)

Input	Employment assumptions by zone: ABAG-40, EI-10-15, EI-15-40
Process	Add the 2010-2015 and 2015-2040 employment increments to ABAG p2011 JHC land use assumptions for 2040 (2040-RecentTrends = ABAG-40 + EI-10-15 + EI-15-40)
Output	Scaled 2040 Recent Trends scenario land use assumptions by zone (2040-RecentTrends)

4. Produce 2040 scaled demand tables (Recent Trends scenario)

Input	2040-RecentTrends & Travel Model One Plan Bay Area 2040 (2040-PBA) origin-destination (OD) trip matrices
Process	Use mathematical process to adjust 2040-PBA trip matrices upwards for 2040-RecentTrends land use scenario
Output	2040-RecentTrends trip matrices

5. Adjust mode share in scaled 2040 demand tables (Recent Trends scenario)

Input	• 2040-PBA trips by OD and mode • 2040-RecentTrends trips by OD and mode
Process	• Reflect known capacity constraints by reassigning some trips to different modes, e.g. if the Bay Bridge cannot accommodate more auto traffic, reassign additional future trips to transit • Similar assumptions may be made for intra-San Francisco corridors where adequate capacity constraint information is available
Output	Mode-adjusted 2040-RecentTrends trips by OD and mode (2040-RecentTrends-ModeAdj)
Questions	What are reasonable assumptions to make to inform mode shares?

6. Calculate flows for corridors (all scenarios)

Input	• Transportation 2035 OD trip matrices (year 2035) • 2040-PBA OD trip matrices (year 2040) • 2040-RecentTrends-ModeAdj OD trip matrices (year 2040)
Process	Aggregate zonal flows to previously defined corridors (e.g. Northern Neighborhoods, Richmond District, Sunset/Muni Metro, BART/Mission St, Bayshore, Treasure Island, East Bay, North Bay, Peninsula/South Bay)
Output	2040 trip flows at corridor level to/from core area and to and from Financial District sub area by mode, purpose, and time of day (to compare to other land use scenarios, to present day)

Modeling Tool Discussion

- Assumes use of Travel Model One for demand assessment
- CCTS must assess the validation performance of modeling tool in the base year