Muni Metro Capacity Study

Draft Recommendations

Appendix

September 2025

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SFMTA

Appendix overview

Muni Metro is experiencing both aging pains and growing pains. Much of the Muni Metro system's infrastructure is old and in need of replacement. At the same time, we are experiencing crowding in some portions of the system today. And we want to be prepared to handle higher ridership in the future, if needed.

The Study's goal is to develop a program of capital projects for the next 10-15 years. These projects would allow us to expand our system capacity. They would be combined with maintenance work to replace old Muni infrastructure.

The Study's draft recommendations are available as an interactive website and a written report with the same content. This appendix provides additional details on the following topics:

- Forecasting ridership
- Existing conditions related to rail stop accessibility and transit priority
- Potential ideas for the long-term future (2040s and beyond)
- Strategies that we considered but are not recommending

Forecasting ridership

Muni Metro is currently the fourth busiest light-rail system in the nation. It is the second busiest transit corridor in the Bay Area after the Transbay Tube. Ridership on Muni Metro continues to recover after the COVID-19 pandemic. The level of ridership growth over the coming decades is uncertain.

The Muni Metro Capacity Study began its analysis in 2023. The Study team first used a ridership forecast developed for the 2022 San Francisco Housing Element Update's Environmental Impact Report. This forecast was developed using the San Francisco County Transportation Authority's (SFCTA's) SF-CHAMP activity-based travel demand model. It assumed a full return to pre-COVID travel behavior and 82,000 new housing units in San Francisco by 2031.

As the study progressed, ridership data showed that Muni was not on track for a quick recovery to pre-COVID ridership levels. Also, recent land use growth did not match the levels assumed in the Housing Element's analysis. We heard from community stakeholders that we should factor in these changing conditions.

In response, we developed new ridership forecasts. These forecasts include multiple scenarios to acknowledge uncertainty. They recognize that the future may unfold in different ways.

The forecast methodology uses two factors:

1. Growth in population and jobs
2. The ratio of ridership to population and jobs, or "ridership ratio"

Both are described in more detail in the following subsections.

Growth in population and jobs

Growth in population and jobs drives more Muni Metro ridership. Our analysis considers population and jobs within a half mile of Muni Metro stops south and west of Van Ness Station (excluding Van Ness Station). Van Ness Station represents the part of the system where trains are most full. This is also called the "maximum load point." Inbound from Van Ness Station, trains are less full as more riders get off the train than get on. The maximum load point is the capacity bottleneck for the system.

Our analysis assumes growth in population and jobs south and west of Van Ness Station would be the main reason for more Muni Metro trips at the maximum load point. This would also be the main cause for capacity needs on Muni Metro as a whole.

The analysis considers four potential population and job growth trends. They are ordered here from highest to lowest growth:

- **SF Housing Element**
  This scenario uses the population and job growth estimates from the 2022 San Francisco Housing Element Update. These estimates were created by the San Francisco Planning Department.
- **Updated Forecasts**
  This scenario uses newer population and job growth estimates developed by the San Francisco County Transportation Authority (SFCTA) for the San Francisco Transportation Plan 2050+. These estimates match the draft Plan Bay Area 2050+ for the whole nine-county region. For San Francisco, the Planning Department adjusted the distribution of population and job growth within San Francisco. This helps to better reflect current and future building plans. These assumptions are also the latest being used in other long-term transportation planning for the city.
- **Historic High**
  This scenario assumes that San Francisco's population and jobs will grow by 1% each year, starting from 2023 data from the American Community Survey. This rate includes both fast growth and slowdowns. It is similar to the city's growth rate from 2000 to 2019 (0.90%) and from 2010 to 2023 (1.07%). Each of those periods included at least one major economic downturn.
- **Historic Moderate**
  This scenario assumes a slower growth rate of 0.5% per year, also starting from 2023 data. This rate is based on the city's average growth from 2000 to 2023 (0.49%). That time period included the 2008 recession, the COVID-19 pandemic, and times of fast growth.

The SF Housing Element scenario assumes more-rapid linear growth to 2035 and then less-rapid linear growth from 2035 to 2050. The other three scenarios assume steady linear growth between 2024 and 2050.

Table 1 shows the 2023 base year population and jobs for San Francisco. Table 2 shows the combined population and job growth assumed in each scenario in 2035 and 2050.

Table 1

San Francisco population and jobs, American Community Survey, 2023

Population	Jobs	Population + Jobs
809,000	744,000	1,553,000

Table 2

Assumed increase in population and jobs over 2023 for four land use scenarios

	2035		2050	
	#	%	#	%
SF Housing Element	420,000	27%	629,000	41%
PBA 2050+	246,000	16%	611,000	39%
Historic High	197,000	13%	478,000	31%
Historic Moderate	96,000	6%	224,000	14%

Ridership ratio

The "ridership ratio" compares:

- Weekday Muni Metro boardings by line, to
- The amount of population and jobs near Muni Metro stops, also known as the "service population"

This measurement shows how often people use Muni Metro compared to how many people live or work near a Muni Metro stop. For example, if a Muni Metro line has a ridership ratio of 0.10, it means that for every 100 people and jobs within half a mile of a stop, there are about 10 transit trips taken.

The Study used two different ratios to represent two different ridership recovery scenarios:

- **Full Recovery**: The ridership ratio returns to pre-COVID levels. Ridership ratios in this scenario vary (by line) between 0.09 and 0.34.
- **Half Recovery**: The ridership ratio returns halfway to pre-COVID levels. Ridership ratios in this scenario vary between 0.07 and 0.27.

In both scenarios, we assume the growth in the ridership ratio is linear through 2035. We also assume it is constant from 2035 on.

Ridership forecast results

The combination of four population and job growth scenarios and two ridership ratio scenarios produced twelve potential ridership forecasts. We then used these forecasts to create three ridership "bands," shown in Figure 1 Low, Medium, and High. Table 3 shows the lower and upper bounds for each band. These bounds were chosen to produce similarly sized bands across a range of years.

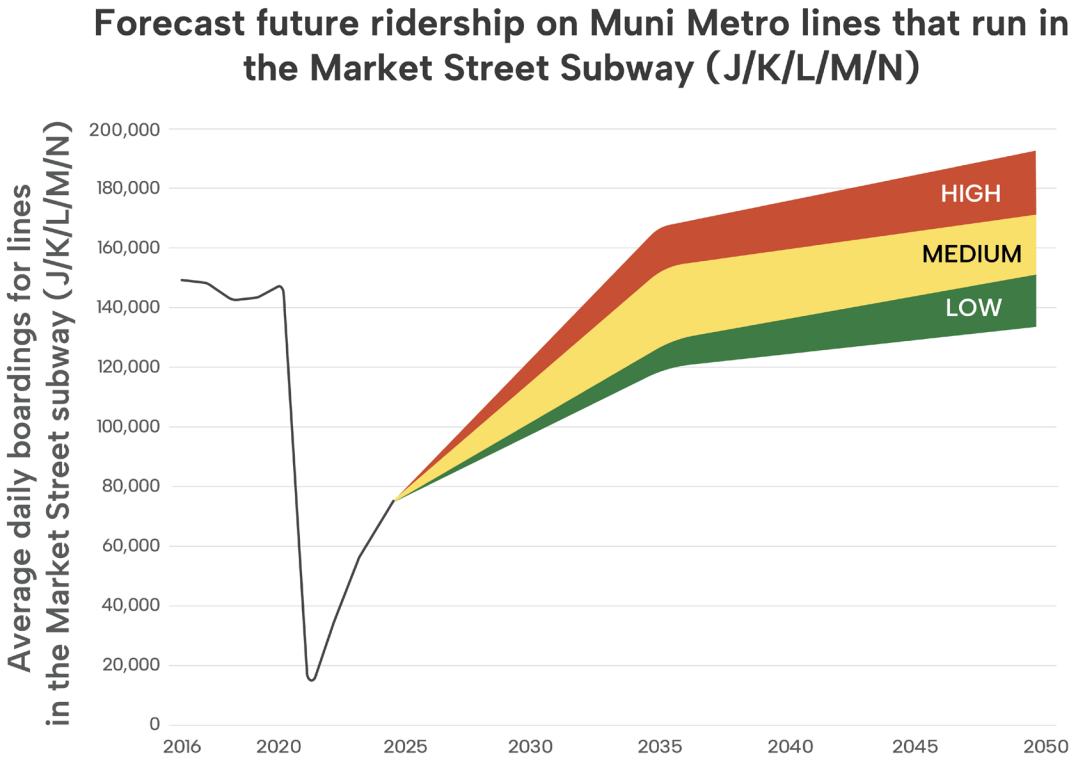

Figure 1

Forecasted future ridership on the Muni Metro lines that run in the Market Street Subway (J/K/L/M/N), showing the high, medium, and low bands. Link to Accessible Text.

Table 3

Ridership forecast trend lines for each ridership forecast band

	Lower bound	Upper bound
Low	Historic Moderate Growth and Half Recovery	Historic High Growth and Half Recovery
Medium	Historic High Growth and Half Recovery	Historic Moderate Growth and Full Recovery
High	Historic Moderate Growth and Full Recovery	SF Housing Element and Full Recovery

Figure 2 illustrates which segments of the Muni Metro system would become overcrowded in each of these bands by 2050. A similar map for 2035 is included in the interactive website and accompanying report.

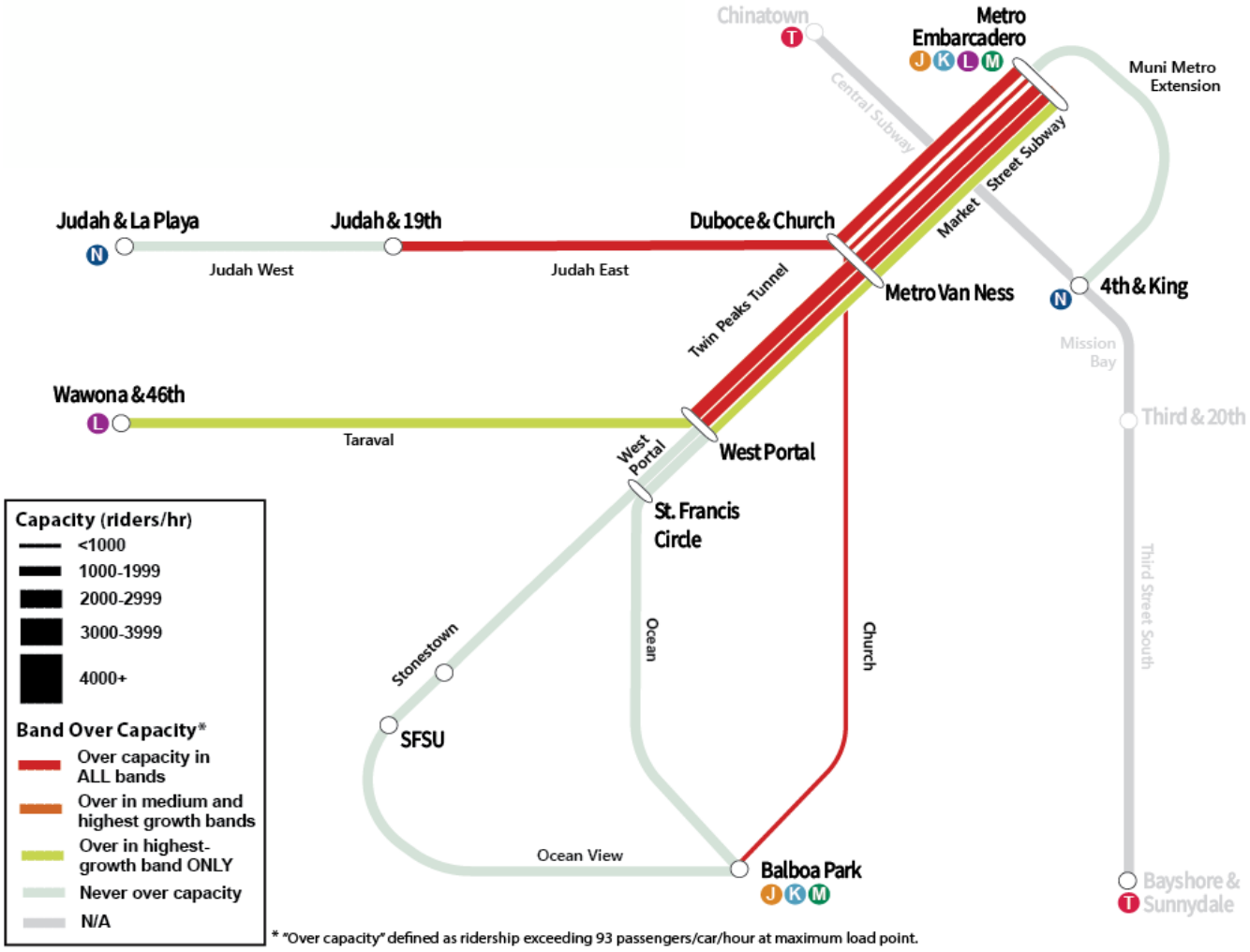

Figure 2

Future overcrowding in 2050, baseline, assumes existing service frequencies. *Link to accessible text.*

Existing conditions related to rail stop accessibility and transit priority

The following graphics show existing rail stop accessibility and transit priority. They focus on the surface sections of the M Ocean View and N Judah that we recommend including in the 10–15-year capital program.

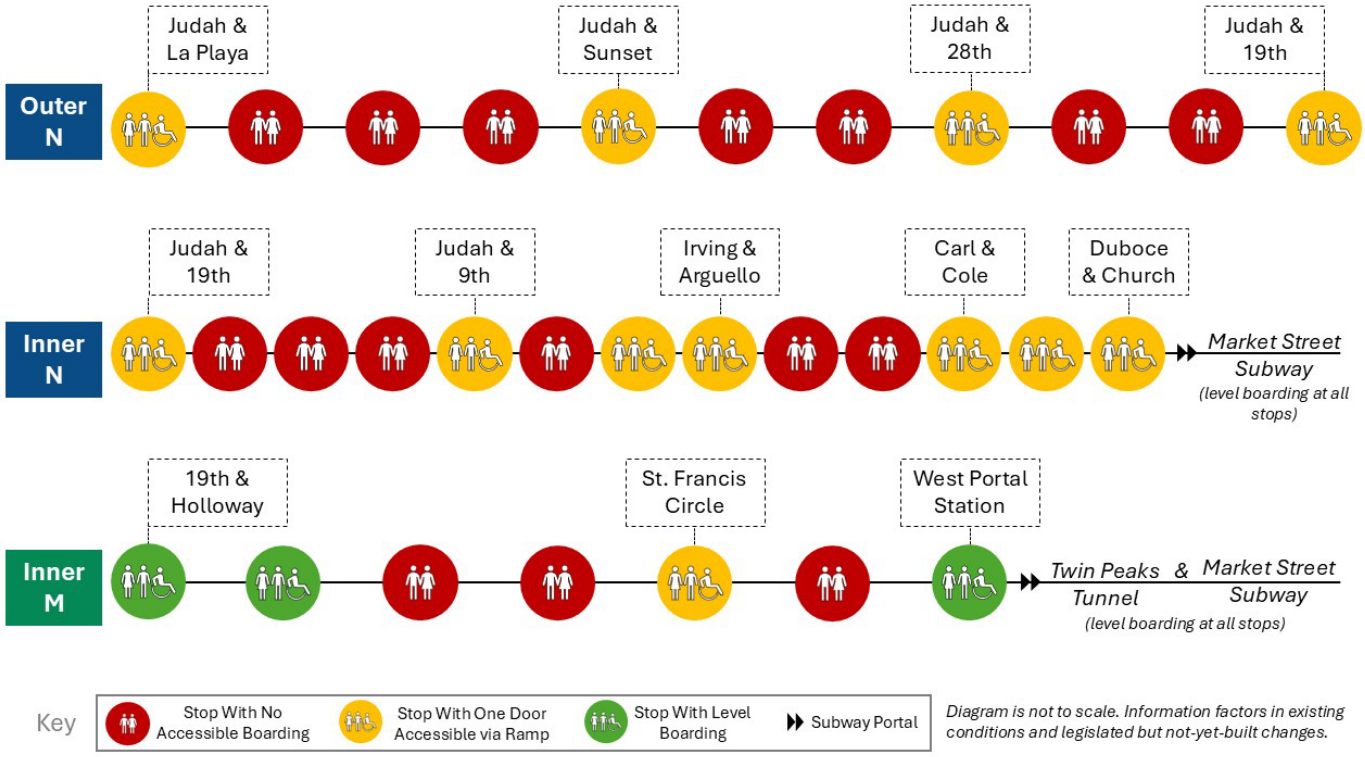

Figure 3

Existing accessibility at surface rail stops. The Study's recommendations are to upgrade M Ocean View stops between West Portal and SF State for fully level boarding and to upgrade N Judah stops with mini-high ramps to make one door of the train accessible. The designs of these stop upgrades would be identified later as a part of a community planning process. Link to accessible text.

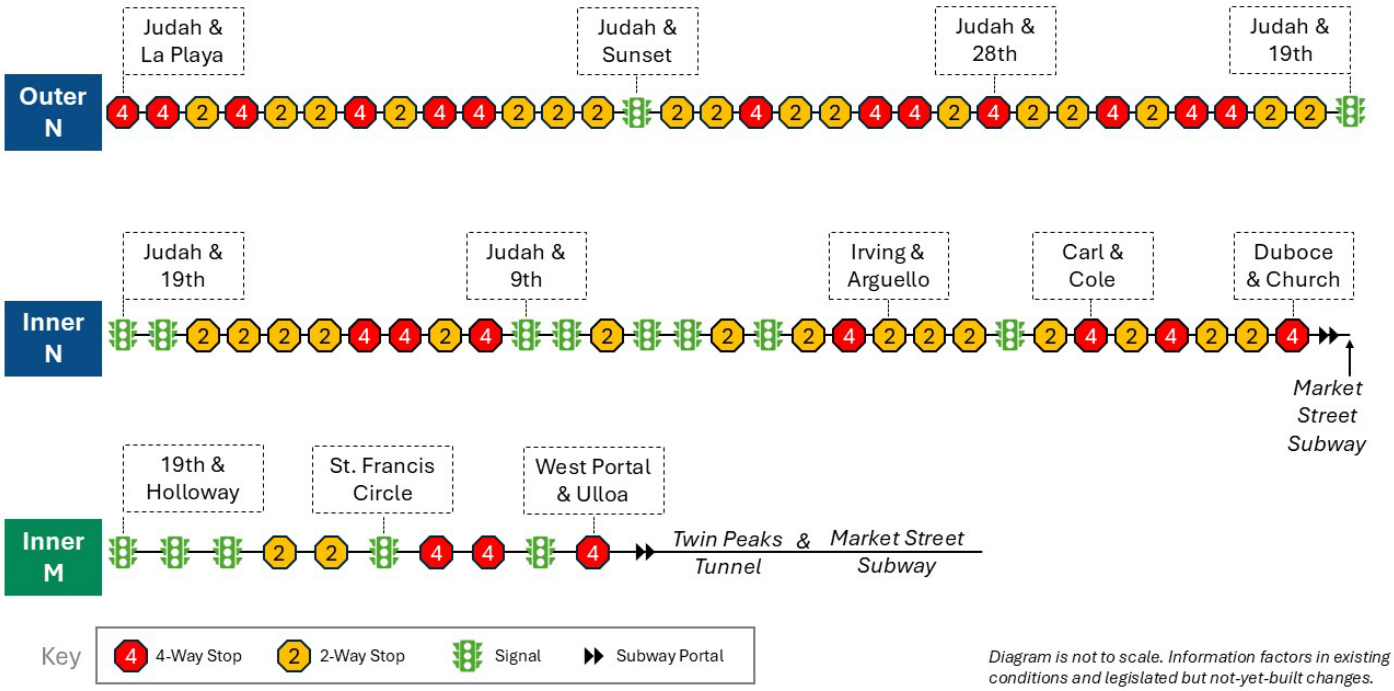

Figure 4

Existing transit priority conditions at intersections. The Study's recommendations are to upgrade more intersections with signals or traffic calming measures that allow trains to continue without delay. The specific locations for this treatment would be identified later as a part of a community planning process. [*Link to accessible text.*]

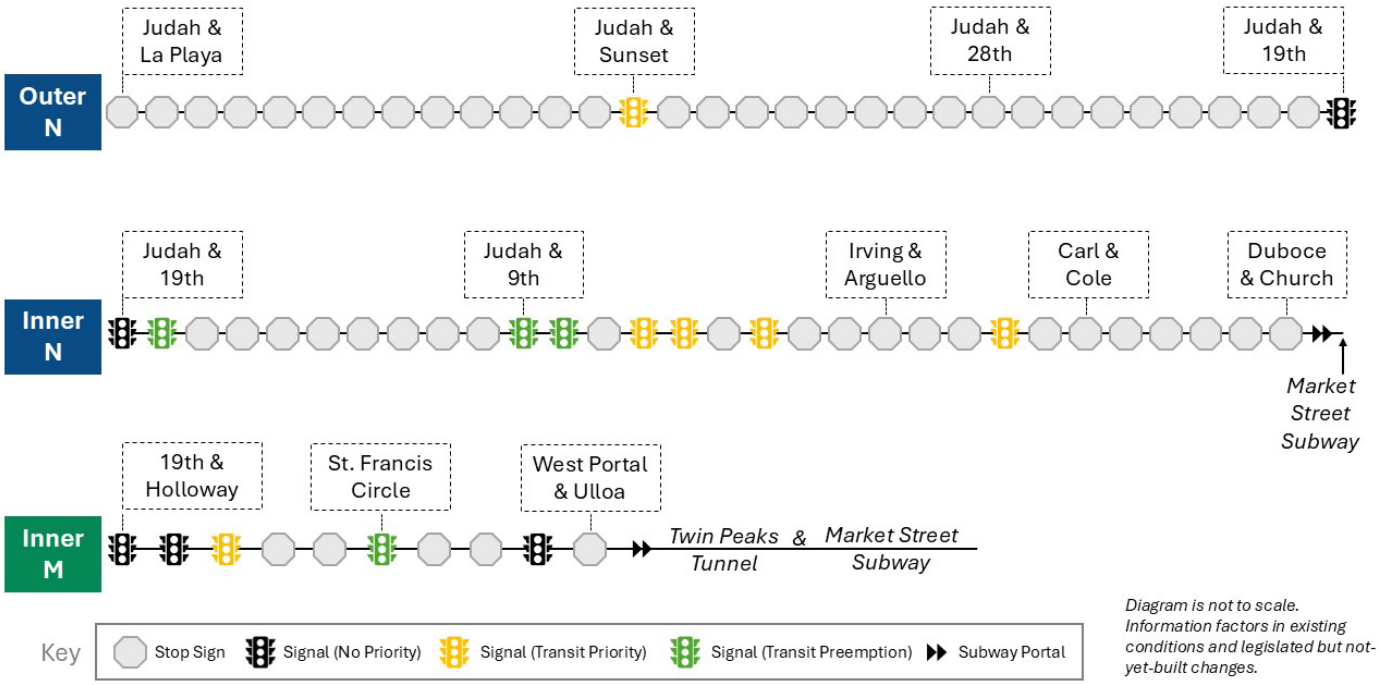

Figure 5

Existing status of transit signal priority and preemption at signalized intersections. The Study's recommendations are to upgrade more intersections with transit signal priority and consider pre-emption at select locations. The specific locations for this treatment would be identified later as a part of a community planning process. In the meantime, the SFMTA is working to optimize the performance of locations that have this technology today. [*Link to accessible text.*]

Potential ideas for the longer-term future – 2040s and beyond

Our forecast indicates we can meet capacity needs while continuing to serve each Muni Metro line's existing routing for the next 10-15 years.

However, even with these medium-term recommendations, if we reach the highest potential future ridership levels, we may still run out of capacity by 2050.

The Study team explored some possible route restructuring options. We did this to understand if route restructuring could add more capacity to the Muni Metro system.

Route restructuring involves changing one or more lines by

- Combining all or parts of lines
- Shortening lines
- And/or removing lines from the Market Street subway.

Some forms of route restructuring would improve capacity by allowing space in the subway for longer trains.

Two different route restructuring concepts could help address crowding if ridership is on the higher end of our 2050 forecasts. **Neither are recommended at this time, but both could be considered in the future if needed.**

Surface-only J Church (Figure 6)
The J Church could be changed to be a surface-only line. It could either end near Church and Market streets or continue on the surface of Market Street to Downtown.

How this increases Muni Metro capacity:
Currently, the one-car J Church takes up the same space in the subway as a longer train. By removing it from the subway we can allow that space to be used by Muni Metro lines with longer trains.

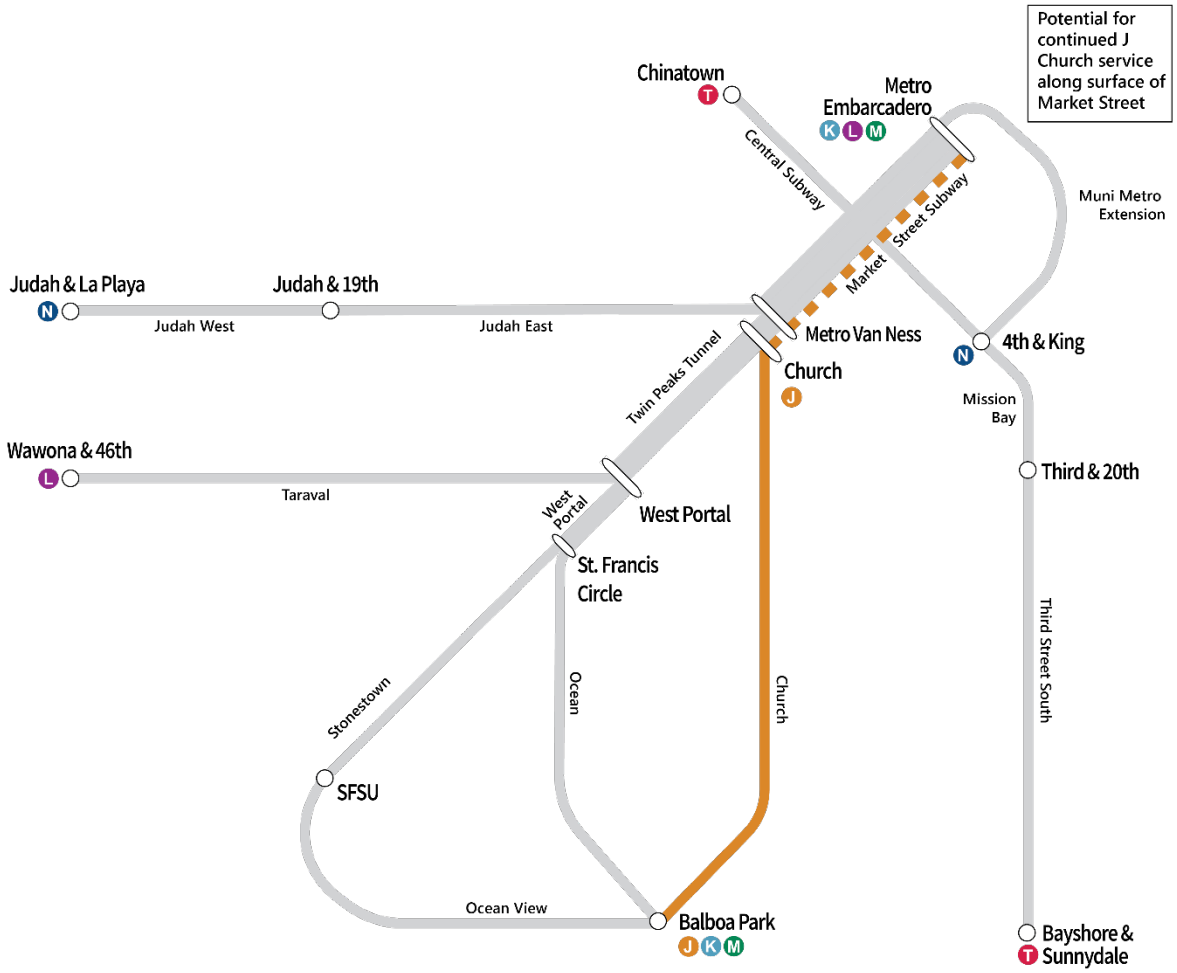

Figure 6

Restructuring concept showing a surface-only J Church with possible continued service along the surface of Market Street.

J Church/M Ocean View Swap (Figure 7)

This option would

- Change M Ocean View service to run between Embarcadero and Parkmerced instead of Balboa Park
- Extend J Church service between Embarcadero and Stonestown via Balboa Park

How this increases Muni Metro capacity:

Currently, we can only run two-car trains between Stonestown and Balboa Park. The J/M Swap would let us run all three-car trains on the M Ocean View.

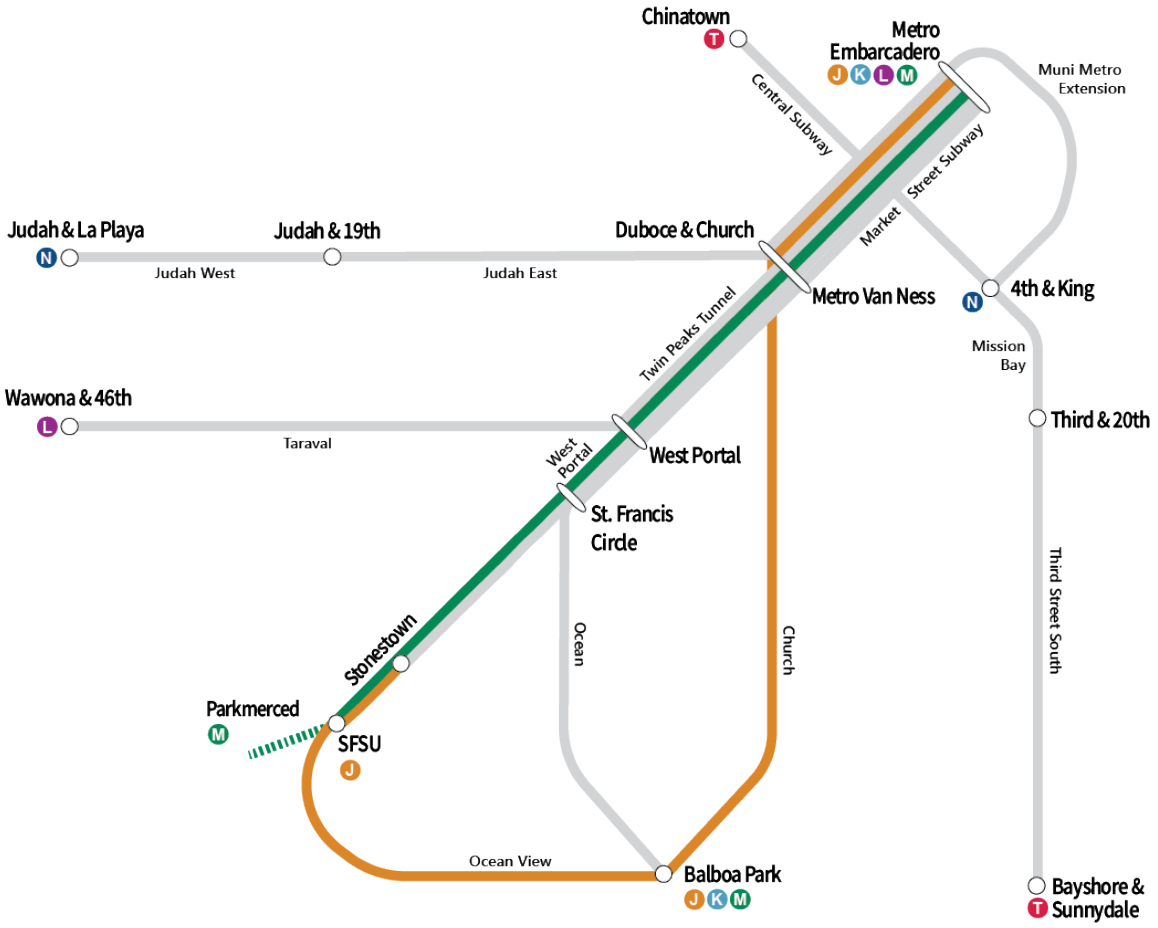

Figure 7

Map of the J/M Swap concept

At this time, we are not recommending any route restructuring. We can keep exploring this strategy as we track ridership increases and subway performance. If we need to consider this strategy further, we will consult with the community before we take any action.

We could also consider upgrading another line for longer trains instead of pursuing either of these route restructuring concepts. We did not analyze this in the Study but should consider it if future ridership levels warrant it.

If any potential route restructuring ideas are pursued in the future, they should include transfer improvements, like:

- Frequent enough service at all hours to shorten transfer times
- Operational changes to make connections smoother especially during non-peak hours, like holding trains at transfer locations
- Better transfer facilities like new or upgraded platforms, stairs and/or elevators

Other strategies we considered but are not recommending

Systemwide high-floor platforms

Accessible platforms are an important and necessary part of improving and modernizing Muni. One idea we studied to make platforms accessible was to build full-length high-level platforms at all Muni Metro stops. This would make the system completely accessible with level boarding for all train doors at every stop. All-door level boarding would make Muni Metro trips faster overall by reducing boarding time. It also would eliminate the need for maintenance-intensive movable stairs in trains.

The Study analyzed what it would take to fit such platforms along the Muni Metro system. For streets less than 60 feet wide, fitting in these platforms create hard tradeoffs. We would have to remove parking and possibly impact access to driveways. It would also be more difficult to fit other elements such as transit lanes.

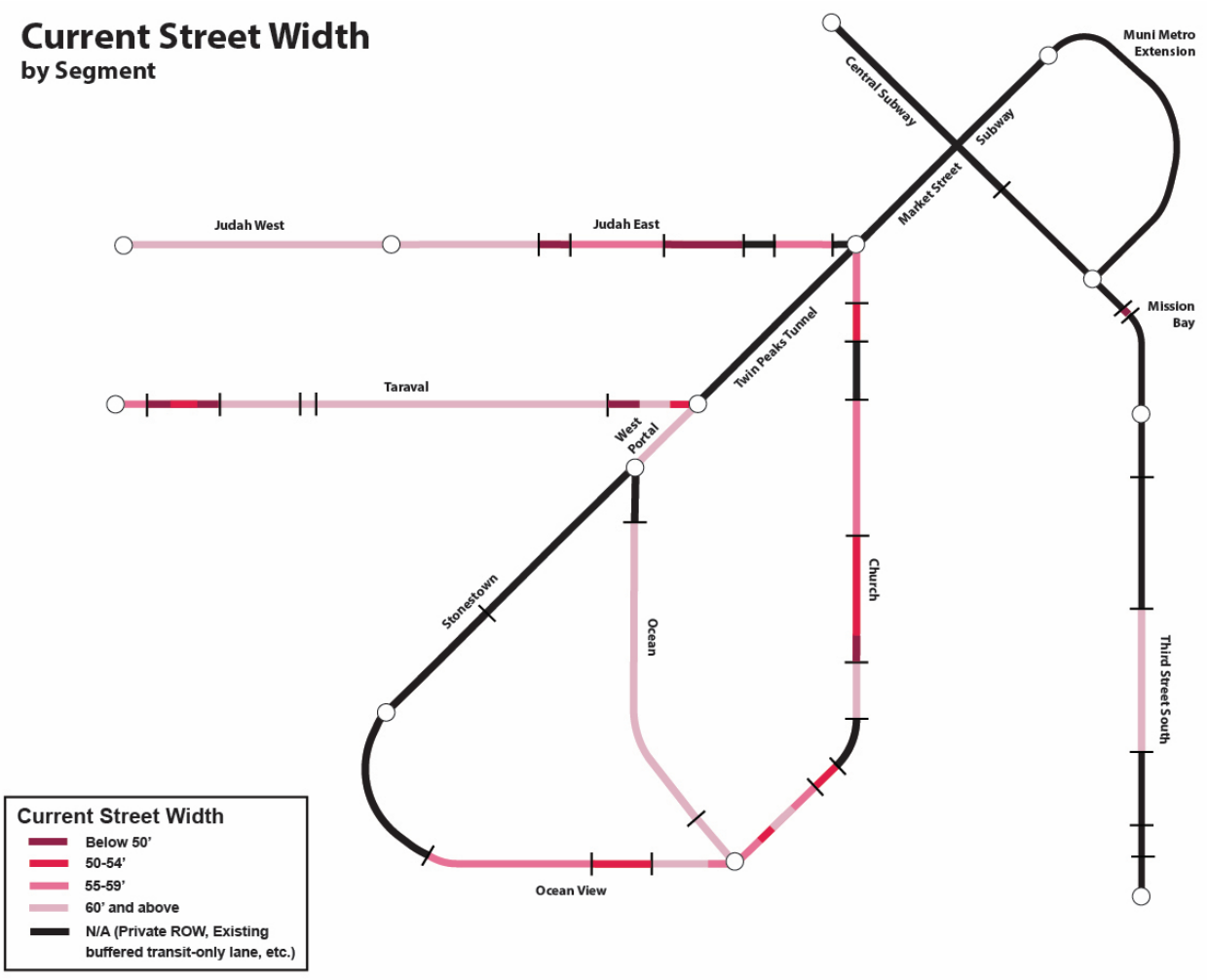

Figure 8

Current street widths (curb to curb) on the Muni Metro system. Link to accessible text

The Study recommends high-floor platforms for accessible all-door boarding along the M Ocean View between West Portal and SF State as a part of a 10-15-year capital program.

We also recommend mini-high accessible platforms at more Muni Metro street stops. These provide accessibility and can better fit within narrower streets.

Systemwide low-floor fleet

Most newer light rail systems in the United States have low-floor vehicles. Riders board from accessible platforms about 14 inches high. This is much lower than Muni Metro high platforms that are 33 inches off the ground. These low platforms are higher than the six-inch sidewalk-level platforms at some Muni Metro stops now. Low platforms that are 14 inches off the ground require shorter ramps than high platforms and have less visual impact.

The Market Street subway was built in the 1970s and designed before low-floor light rail vehicles were available.

We studied how to convert the entire Muni Metro system (except the T Third) to low-floor vehicles. We did this to understand if low-floor vehicles would make it easier to build accessible platforms on the street.

We found it might be possible to switch the system to low-floor vehicles, but it would be very expensive and cause a lot of disruption. Also, the benefits wouldn't be very big. Low platforms have shorter ramps than high platforms, but they still need to be the same length and width. That means we'd still face the same problems with limited space on the streets.

To shift to a systemwide low-floor fleet we would have to make several changes to the Twin Peaks Tunnel and Market Street Subway. We would need to:

- Rebuild subway station platforms at a lower level.
- Reroute utilities that currently run through hollow subway platforms.
- Extend or replace stairs, escalators and elevators in subway stations.
- Modify emergency access and exits, platform facilities, passenger amenities and fire, life and safety systems
- Lower emergency walkways between stations to match train heights. This would require extensive retrofitting in some sections.

Construction would likely require station or platform closures. All this work is projected to cost $250 million or more in 2025 dollars.

We would also need to buy a completely new low-floor fleet of trains. The current fleet is not due to be replaced during the 10-15-year capital program timeline. We would also need to convert our two rail maintenance facilities for a new low-floor fleet while still operating the current fleet. This would be very expensive.

If the J Church became a surface-only line, we could consider making it a low-floor line. This could make boarding easier. But we would still need to buy a new low-floor sub-fleet and adapt one of the Muni rail maintenance yards to be able to service low-floor vehicles. These potential benefits vs. costs would need to be further considered.

Surface-only L Taraval/K Ingleside line (Interlining)

We considered interlining (combining) the L Taraval and K Ingleside as a part of the Study's assessment of route restructuring. We looked at joining the surface portions of the L Taraval and K Ingleside to form a surface-only route between Balboa Park and the Zoo. LK riders would transfer to the subway at West Portal Station.

Inside the subway, riders would use the M Ocean View and subway shuttles trains. The SFMTA has used surface-only L Taraval/K Ingleside service in the past during subway closures. This routing is also used by a few trains in the early morning and late night when the subway is not open.

While it is possible to operate a surface-only LK, we found that it would not help address capacity constraints. Due to limitations at St. Francis Circle, we would not be able to operate the M Ocean View frequently enough to use all the extra subway space. Using the rest of the subway space with subway shuttle trains would require those trains to cross over and reverse at West Portal. This movement temporarily blocks train traffic in both directions. So, a surface-only LK service would not provide more capacity than running the K and L into the subway.

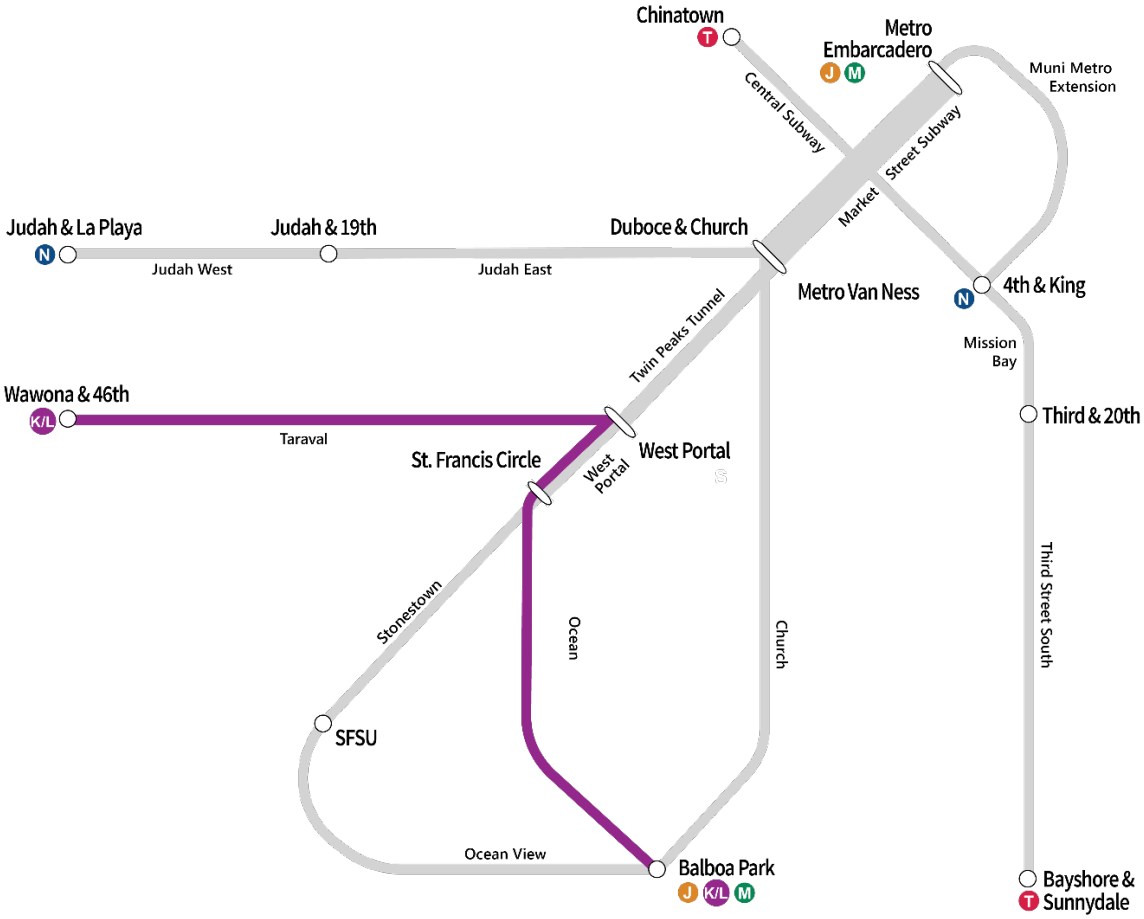

Figure 9

Map of the surface-only LK line concept

Four-car trains

The platforms in the Market Street subway and on the Embarcadero are long enough to serve four-car trains. Four-car trains could provide double the capacity of two-car trains. But along most of the rest of the Muni Metro lines, the street blocks are not long enough to fit four-car trains. Many intersections would have to be closed to cross traffic. Even at the highest projected demand, three-car trains would be enough to handle ridership for the next 25 years.

Accessible Text Appendix

Figure 1. Forecast future ridership on Muni Metro lines that run in the Market Street Subway (J/K/L/M/N)

Forecast future ridership on Muni Metro lines that run in the Market Street Subway (J/K/L/M/N). Ridership is average daily boardings for lines in the Market Street subway (J/K/L/M/N)

Year	High Ridership Scenario	Medium Ridership Scenario	Low Ridership Scenario
2016	150,000	150,000	150,000
2020	148,000	148,000	148,000
2025	88,000	87,000	84,000
2030	126,000	120,000	101,000
2040	177,000	159,000	123,000
2045	185,000	163,000	126,000
2050	193,000	167,000	129,000

Link to return to main section

Figure. 2 Future Crowding

A forecast of crowding in 2050. This analysis assumes planning capacity of 93 passengers per light-rail car.

- **N Judah, Including Market Street Subway, Metro Embarcadero to Judah & 19th**– Over capacity in ALL bands, about 1,000 – 1,999 rides per hour.
- **L Taraval, Including Market Street Subway and Twin Peaks Tunnel, Metro EmbarcaderoWest Portal-** Over capacity in ALL bands, about 1,000 – 1,999 rides per hour.
- **L Taraval**, **from West Portal to Wawona & 46th** – Over capacity in highest growth band ONLY, about 1,000 – 1,999 rides per hour.
- **M Ocean View, Including Market Street Subway and Twin Peaks Tunnel, Metro Embarcadero to West Portal -** Over capacity in ALL bands, about 1,000 – 1,999 rides per hour.
- **J Church, Including Market Street Subway, Church to Balboa Park -** Over capacity in ALL bands, under 1,000 rides per hour
- **K Ingleside** is over capacity in highest growth band ONLY, about 1,000 – 1,999 rides per hour.
- **T Third Street** is not included in growth forecasts

Link to return to main section

Figure. 3 Existing Accessibility at Surface Rail Stops

All stops in the Market Street Subway and Twin Peaks Tunnel are level boarding.

Outer N – Judah & La Playa to Judah & 19th	
Stop Name	**Existing accessibility at surface rail stops**
Judah & La Playa	Stop with one door accessible via ramp
Judah & 46th	Stop with no accessible boarding
Judah & 43rd	Stop with no accessible boarding
Judah & 40th	Stop with no accessible boarding
Judah & Sunset	Stop with one door accessible via ramp
Judah & 34th	Stop with no accessible boarding
Judah & 31st	Stop with no accessible boarding
Judah & 28th	Stop with one door accessible via ramp
Judah & 25th	Stop with no accessible boarding
Judah & 22nd	Stop with no accessible boarding
Judah & 19th	Stop with one door accessible via ramp

Inner N – Judah & 19th to Duboce & Church	
Stop Name	**Existing accessibility at surface rail stops**
Judah & 19th	Stop with one door accessible via ramp
Judah & 15th	Stop with no accessible boarding
Judah & Funston	Stop with no accessible boarding
Judah & 12th	Stop with no accessible boarding
Judah & 9th	Stop with one door accessible via ramp
Irving & 8th	Stop with no accessible boarding
Irving & 5th	Stop with one door accessible via ramp
Irving & Arguello	Stop with one door accessible via ramp
Carl & Hillway	Stop with no accessible boarding
Carl & Stanyan	Stop with no accessible boarding
Carl & Cole	Stop with one door accessible via ramp
Duboce & Noe	Stop with one door accessible via ramp
Duboce & Church	Stop with one door accessible via ramp

Inner M– 19th & Holloway to West Portal Station	
Stop Name	**Existing accessibility at surface rail stops**
19th & Holloway	Stops with level boarding
19th & Winston	Stops with level boarding
Eucalyptus	Stop with no accessible boarding
Ocean	Stop with no accessible boarding
St. Francis Circle	Stop with one door accessible via ramp
14th Avenue	Stop with no accessible boarding
West Portal Station	Stops with level boarding

Link to return to main section

Figure. 4 **Existing transit priority conditions at intersections**

Outer N – Judah & La Playa to Judah & 19th		
Transit Priority Condition	**# of Instances on Segment**	**Highlighted reference intersections**
4-Way Stops	13	Judah & La Playa, Judah & 28th
2-Way Stops	17	N/A
Signal	2	Judah & Sunset, Judah & 19th

Inner N – Judah & 19th to Duboce & Church		
Transit Priority Condition	**# of Instances on Segment**	**Highlighted reference intersections**
4-Way Stops	7	Carl & Cole, Duboce & Church
2-Way Stops	15	Irving & Arguello
Signal	8	Judah & 19th, Judah & 9th

Inner M – 19th & Holloway to West Portal & Ulloa		
Transit Priority Condition	**# of Instances on Segment**	**Highlighted referenceintersections**
4-Way Stops	3	West Portal & Ulloa
2-Way Stops	2	N/A
Signal	5	19th & Holloway, St. Francis Circle

Link to return to main section

Figure. 5 ***Existing status of transit signal priority and preemption at signalized intersections***

Outer N – Judah & La Playa to Judah & 19th		
Number and Type of Transit Signal Priority	**# of Instances**	**Highlighted Reference Intersections**
Stop Sign	30	Judah & La Playa, Judah & 28th
Signal (No Priority)	1	Judah & 19th
Signal (Transit Priority)	1	Judah & Sunset
Signal (Transit Preemption)	0	N/A

Inner N – Judah & 19th to Duboce & Church		
Number and Type of Transit Signal Priority	**# of Instances**	**Highlighted Reference Intersections**

Stop Sign	22	Irving & Arguello, Carl & Cole, Duboce & Church
Signal (No Priority)	1	Judah & 19th
Signal (Transit Priority)	4	N/A
Signal (Transit Preemption)	3	Judah & 9th

Inner M – 19th & Holloway to West Portal & Ulloa		
Number and Type of Transit Signal Priority	**# of Instances**	**Highlighted Reference Intersections**
Stop Sign	5	West Portal & Ulloa
Signal (No Priority)	3	19th & Holloway
Signal (Transit Priority)	1	N/A
Signal (Transit Preemption)	1	St. Francis Circle

Link to return to main section

Figure 8. Street Widths

Segment	Surface Length (miles)	Below 45 feet	45-49 feet	50-54 feet	55-59 feet	60 feet
Judah West	1.76	0%	0%	0%	0%	100%
Judah East	1.89	24%	7%	0%	38%	31%
Taraval	2.89	22%	0%	8%	2%	68%
West Portal	0.52	0%	0%	0%	0%	100%
Ocean View	2.04	0%	0%	15%	63%	22%
Ocean	1.66	0%	0%	8%	0%	92%
Church	2.65	7%	4%	35%	37%	17%
Total	13.41	10%	2%	12%	23%	54%

Link to return to main section