SFMTA
Municipal
Transportation
Agency

SFMTA Bus Fleet Management Plan

2017-2030

March 2017

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1. Introduction and Guiding Principles

The San Francisco Municipal Transportation Agency (SFMTA) is the principal multi-modal agency responsible for planning, implementing and operating transportation services in the City and County of San Francisco. It is governed by a Board of Directors and is a business unit within the City and County of San Francisco. The SFMTA has the primary responsibility for the transportation system in San Francisco, providing the Agency with the unique ability to plan, design, construct, operate and manage (with key partnership from other agencies) the transit, paratransit, streets, bicycle, pedestrian, parking, traffic, taxi and commercial vehicle systems in San Francisco.

The SFMTA operates the oldest and largest transit system in the San Francisco Bay Area, transporting close to 45 percent of all transit passengers in the region. In addition, it is one of the top ten largest transit systems in the nation based on boardings, carrying more than 230 million boarding annually. The Agency's transit fleet is among the most diverse in the world, featuring:

- Modern light rail vehicles;
- Renewable diesel and hybrid-electric renewable diesel buses;
- Electric trolley buses;
- Historic streetcars;
- Cable cars, and
- A range of paratransit services.

The SFMTA Bus Fleet Management Plan 2017-30 (FMP) maps out a systematic approach to the ongoing management and planning for rehabilitation and replacement of the SFMTA's rubber tire fleet, as well as discuss the ridership and service growth anticipated in the City.

1.1 Guiding Principles

SFMTA has implemented many effective rubber tire initiatives over the past several years that have contributed to ridership growth, our highest ever customer ratings and reduced vehicle breakdowns. These initiatives range from dramatically reducing the age of the fleet to increasing service 10 percent to address crowding and changing travel patterns. This Fleet Management Plan builds on these positive trends by laying out a series of guiding principles to inform maintenance practices, service planning and upcoming bus procurements.

- **Average Fleet Age:** Establish a consistent average fleet age of 5-8 years and smooth out peaks and valleys for vehicle maintenance.

- **Reliability.** Continue to improve service and prioritize reliability when procuring vehicles, maintaining vehicles and designing service enhancements.

- **Performance-Based Procurements:** Develop performance based specifications for procurements that prioritize vehicle safety and reliability and encourage industry innovation and maintainability through proven design & commonality of replacement parts.

- **Maintenance Standards:** Continue robust maintenance standards and practices established in 2014 including maintaining or exceeding Original Equipment Manufacturer (OEM) schedules and update based on fleet trends; and institutionalize a midlife overhaul program to promote excellent performance throughout the full lifecycle of the vehicle.

- **Sustainability:** Support the San Francisco Climate Action Plan and related City policies by investing in transit service to promote a high transit mode share, as well as continuing to invest in low and zero emission vehicles.

- **Growth:** Anticipate and accommodate vehicle expansion and fleet mix needs associated with current and future projected ridership growth, as well as major construction projects.

- **20% Spare Ratio:** Continue reducing the spare ratios to 20 percent for large sub-fleets and 30 percent for sub-fleets with less than 50 vehicles.

2. Service Overview

The SFMTA operates the eighth largest transit system in the nation based on boardings, carrying more than 230 million customers annually. As part of its mission, the SFMTA strives to provide a convenient, reliable, accessible and safe transportation system that meets the needs of all users within the City and County of San Francisco.

2.1 Bus Route Categories

The SFMTA Service Standards for bus routes establish minimum requirements for coverage, policy headways, passenger loads, service span hours, stop spacing and on-time performance. The SFMTA Service Policies for bus routes provide guidelines for vehicle assignment and transit amenities. These standards and policies are designed to enable San Franciscan residents, workers and visitors to conveniently travel by transit. Muni includes approximately 70 bus routes, which are categorized based on the role they play in the transit network. Muni's route categories are described in Table 1.

Table 1: Summary of Bus Route Categories

Category	Description	Routes
Rapid Bus	These heavily used bus lines include some of the busiest routes in the Muni network. With wider stop spacing, vehicles arriving frequently and transit priority enhancements along the routes, the Rapid bus routes delivers speed and reliability whether customers are heading across town, or simply traveling a few blocks.	5R, 7R, 9R, 14R, 28R, 38R
Frequent Local	These routes combined with Rapid Bus create the Transit Priority Network. They also include transit priority enhancements and frequent service but with more stops along the route than the Rapid bus system.	1, 7, 8, 9, 14, 22, 28, 30, 38, 47, 49
Grid	These citywide routes combine with the Transit Priority Network to form an expansive core grid that lets customers get to their destinations with no more than a short walk, or a seamless transfer. Depending on demand, they typically operate less frequently than the Rapid and Frequent Local routes.	2, 3, 5, 6, 10, 12, 18, 19, 21, 23, 24, 27, 29, 31, 33, 43, 44, 45, 48, 54
Connector	These bus routes are shorter than the Citywide grid routes and predominantly circulate through San Francisco's hillside residential neighborhoods, filling in gaps in coverage and connecting customers to major transfer hubs, including Muni Metro and BART stations.	25, 35, 36, 37, 39, 52, 55, 56, 57, 66, 67
Specialized	These routes augment existing service during specific times of day to serve a specific need, or serve travel demand related to special events. They include AM and PM commute service, weekend-only service, and special event trips to serve sporting events, large festivals and other San Francisco activities	1AX, 1BX, 7X, 8AX, 8BX, 14X, 30X, 31AX, 31BX, 38AX, 38BX, 41, 76X, 81X, 82X, 83X, 88, NX

Category	Description	Routes
Owl	These bus routes operate every 30 minutes from midnight to 6 am, ensuring a basic level of access across the City 24 hours per day.	5, 14, 22, 24, 25, 38, 44, 48, 90, 91, L bus, N bus

2.2 Service Standards

SFMTA Service Standards help the Agency design and improve transit service in an ever-changing environment. These guidelines ensure transparent, objective decision-making that is aligned with city and regional transportation goals for sustainability, equity and economic growth. SFMTA uses these guidelines to make decisions about expanding or reducing service, to evaluate service productivity, and to determine if service revisions are needed because of changes in rider demand or route performance. At the centerpiece of SFMTA's Service Standards is the expectation that all residential neighborhoods in San Francisco should be within a quarter mile of a transit stop. Additional standards for minimum policy headways, maximum loads, crowding, stop spacing, service span and on-time performance are detailed in Table 4. As discussed above, the Service Standards for policy headway, service span and on-time performance are specific to the route category. The service standards for maximum load and crowding per bus are based on the size of the vehicle.

Average maximum load and crowding per bus were updated as part of the development of this document and have also been incorporated into the SFMTA's 2017 Short Range Transit Plan. These guidelines reflect the typical seating configuration of the new buses plus square footage available for standees. The guidelines reflect the shift to new low-floor vehicles, as we are currently in the process of replacing the entire fleet. Additionally, these guidelines were updated to better align with industry standards, which typically restrict standees to 1.0 to 1.6 times the seated loads. SFMTA's standee to seat ratio ranges from 1.4 to 1.6, which takes into consideration that San Francisco is a dense urban area with relatively short trip lengths and all door boarding. Our vehicle layouts are designed to prioritize passenger flows and standing space, in addition to access needs for people with disabilities. Below is a summary of SFMTA's updated load standards. These guidelines were also informed by the *Transit Capacity and Quality of Service Manual*.

Two distinct guidelines were developed for passenger loads. The first is *average maximum load*, which is used to schedule service and evaluates how many people pass through the most crowded point of the route over a 30 or 60 minute interval divided by the number of scheduled buses. For this analysis, SFMTA assumed 4.5 square feet per standee to determine the total seated and standing capacity of each vehicle. The second metric evaluates *crowding per bus* and assumes 3.0 square feet per standee, which the Transit Capacity Manual considers to represent when most customers would consider a bus to be full.[1] SFMTA typically measures crowding as the percent of trips that bus loads exceed the crowding metric.

[1] SFMTA considers a vehicle to be at crush load when the space per customer is 1.5 square feet per passenger (APTA Standard Bus Procurement Guidelines, "Gross Load" definition, pg. 5)

Table 2: Average Maximum and Crowding Loads

	32ft bus	40ft bus	60ft bus
Maximum load *(total seated and standing passengers)*	33	44	69
% of standees to seats	140%	145%	155%
Crowding per bus *(total seated and standing passengers)*	38	51	81
% of standees to seats	160%	165%	185%

Table 3: Stop Spacing Policy

	Type of Vehicle and Appropriate Zone Length			
Stop Position	**40ft Bus**	**2x40ft Bus**	**60ft Bus**	**2x60ft Bus**
Midblock	120	185	140	205
Nearside	100	145	120	185
Farside	80	125	100	165
Farside (after right turn)	140	145	160	230

Table 4: Summary of Bus Service Standards

Standard Type	**Standard**			
Coverage	All residential neighborhoods in San Francisco should be within a quarter of a mile of a Muni bus stop or rail line stop.			
Policy Headways	The minimum weekday and weekend headways for transit service established by Muni route type. Note: frequencies of individual routes may be higher based on demand.			
	Weekday			
	Route Type	**Day**	**Evening**	**Late Night**
	Rapid/Frequent	10	15	20
	Grid	20	20	30
	Connector	30	30	--
	Specialized	Based on demand		
	Weekend			
	Route Type	**Day**	**Evening**	**Late Night**
	Rapid/Frequent	12	15	20
	Grid	20	20	30
	Connector	30	30	--
	*Based on demand, frequencies may be higher			

<table>
<tr><th>Standard Type</th><th colspan="3">Standard</th></tr>
<tr><td rowspan="5">Average Maximum Load and Crowding per Bus</td><td colspan="3">Average maximum load – Muni service should be planned to operate such that the peak hour, peak direction load factor does not exceed the Average Maximum Loads listed below (established by vehicle type)

Crowding per bus – Measured as the percentage of buses where passenger volumes exceed the crowding loads listed below.</td></tr>
<tr><td>Vehicle Type</td><td>Average Maximum Load</td><td>Crowding per bus</td></tr>
<tr><td>32ft bus</td><td>33</td><td>38</td></tr>
<tr><td>40ft bus</td><td>44</td><td>51</td></tr>
<tr><td>60ft bus</td><td>69</td><td>81</td></tr>
<tr><td rowspan="5">Service Span</td><td colspan="3">Minimum number of hours that service is available.</td></tr>
<tr><td>Route Type</td><td colspan="2">Service Span Standard</td></tr>
<tr><td>Rapid/Frequent</td><td colspan="2">18 hours</td></tr>
<tr><td>Grid</td><td colspan="2">18 hours</td></tr>
<tr><td>Connector</td><td colspan="2">Based on demand</td></tr>
<tr><td rowspan="6">On-Time Performance (OTP)</td><td>Specialized</td><td colspan="2">Based on demand</td></tr>
<tr><td>Route Type</td><td>Definition</td><td>OTP Standard</td></tr>
<tr><td>Rapid/Frequent</td><td>% of trips with a service gap of five minutes above the scheduled headway</td><td>Less than 14% of trips with a service gap</td></tr>
<tr><td>Grid</td><td rowspan="3">% of timepoints served within one minute early to four minutes late of the scheduled time</td><td rowspan="3">85% on-time (schedule adherence)</td></tr>
<tr><td>Connector</td></tr>
<tr><td>Specialized</td></tr>
<tr><td>Owl</td><td></td><td></td></tr>
</table>

2.3 Service Policies

SFMTA's Service Policies for vehicle assignment and transit amenities are designed to ensure equitable distribution of resources. Vehicle assignment refers to the process by which transit vehicles are placed into service throughout the SFMTA's system. The SFMTA has one of the largest zero emissions fleets in the country, as well as a growing hybrid bus fleet. Additionally, all motor buses use renewable diesel.

The SFMTA has five bus facilities described in Table 5.

Table 5: Vehicle Types by Bus Fleet Facility

Fleet Facility	Vehicle Type(s)
Flynn/Islais Creek Division	60-foot Motor Coaches
Kirkland Division	30 & 40-foot Motor Coaches
Potrero Division	40-foot/60-foot Trolley Coaches
Presidio Division	40-foot Trolley Coaches
Woods Division	30-foot/40-foot Motor Coaches

The SFMTA policy is to assign vehicles in a manner that prevents discrimination to minority and low-income communities and considers technical criteria including peak load factors, route type, physical route characteristics such as street widths and grades, required headways, vehicle availability and transit operator availability. Smaller 32ft motor buses are typically assigned to connector routes that serve neighborhoods with steep grades, tighter turning radii and narrower clearances, as well as lighter passenger loads. The largest buses (60ft articulated motor and trolley buses) are typically assigned to routes serving major corridors carrying high passenger loads. SFMTA's 40ft hybrid vehicles are deployed throughout the City from the Woods Division, which has a high concentration of routes that travel through minority and low income census tracts. As additional vehicles arrive, hybrids are also being used out of Kirkland Division.

The SFMTA has both articulated motor coaches and trolley coaches available for service and has established the following evaluation criteria for determining whether articulated coaches should be assigned to a route:

- Articulated coaches will be deployed on routes if they can meet demand at equal or lower operating costs as compared to standard coaches;
- Articulated coaches will be considered for routes that experience consistent overcrowding.

Transit Amenities

Transit amenities refer to items of comfort and convenience available to the general riding public. To the extent location and distribution of a particular transit amenity is within the control of the SFMTA, it is agency policy that amenities are distributed throughout the transit system so that all customers have equal access to these amenities, without regard to race, color, national origin or income status. SFMTA applies neutral standards such as boarding activity, geographical limitations, etc. in deciding the location of transit amenities and applies these standards to both rail and bus routes. The primary types of stop amenities currently provided include basic informational amenities (generally signs or painted markings indicating the location of stops and providing information about lines serving stops) and amenities that enhance the waiting environment (such as transit shelters, real-time vehicle arrival information displays and expanded boarding or seating areas). SFMTA does not provide public restrooms, timetables at transit stops or park-and-ride facilities.

Below is a description of amenities and the SFMTA's standards for distributing said amenities system-wide.

- **Stop Markings and Flags:** There are nearly 3,500 transit stops in the Muni service area. Every Muni transit stop should have a marking or sign indicating the route(s) that serve the stop. Stops may be marked by one or more of the following: painted on-street bus zones; painted red curbs along sidewalk bulb-outs; painted markings on street poles; painted markings on street surfaces; flag signage with the route information and hours of service; transit shelters with system maps and route information. SFMTA is in the process of designing a new flag sign "Landors" that will provide hours of operation in

addition to the route number. SFMTA will install Landors at all surface transit stops in the Muni system.

- **Stop IDs:** All transit stops have a unique five digit stop identification number to be used by customers to access real-time vehicle arrival predictions and information about planned service changes. Real-time vehicle arrival predictions can be easily accessed by using the stop ID number and calling the regions 511 automated transit information line, the City's 311 multilingual customer information line or accessing the information on line via the NextBus website.
- **Transit Shelters and System Maps:** The SFMTA has approximately 1,100 transit shelters distributed at transit stops throughout the service area. In addition to providing weather protection, most transit shelters include lighting and transit system maps. Shelters that are not located on boarding islands also include seating. Transit shelters are installed and maintained through a contract with Clear Channel Outdoor, Inc. The shelters are inspected and cleaned at least twice weekly, and more frequently along Market Street, where there is very high customer activity.

  To the extent possible, the SFMTA endeavors to provide transit shelters in as many locations as possible system-wide to ensure that all customers benefit equally from their placement. SFMTA staff both responds to requests from customers for specific new shelter locations and seeks to find additional sites in locations throughout the City. However, it is vital to note that while the SFMTA can initiate the process to request new transit shelters, including providing all of the supporting information, final approval resides with the Department of Public Works, who must issue an encroachment permit before a shelter can be installed. DPW takes into account physical constraints, such as sidewalks that are too narrow to allow the access required by Federal and State law (sidewalks are not equally wide throughout the City—downtown sidewalks tend to be wider than neighborhood sidewalks) and sidewalk obstacles such as trees, fire hydrants and sub-sidewalk basements that can impact the location of a shelter. In addition, the permit process requires either a public hearing or the consent of all fronting property owners within 100 feet of the proposed site. Further, shelters are prioritized at stops with more than 125 boardings per day.
- **Real-Time Arrival Predictions:** Through the stop ID program, customers can access real-time arrival predictions at all stops by calling 511, 311 or accessing predictions on-line. Additionally, over 900 locations have electronic informational displays that provide real-time vehicle arrival information to waiting customers. The new shelters also include a Push-to-Talk system to read the real-time arrival information for those who are visually impaired. Audio announcements are also made to accommodate the needs of customers with visual impairments.

In summary, stop markings and stop IDs are included at all stops. Shelters and system maps are placed at stops with greater than 125 boardings per day. In addition, real-time arrival predictions are placed at stops in shelters were electricity is available.

2.4 Current Bus Fleet Overview

The SFMTA has one of the most diverse service fleet. For its rubber tire fleet, there are two propulsion systems – motor bus (fueled by renewable diesel) and trolley bus (fueled by electricity via overhead wires).

2.4.1 Motor Bus Sub-Fleet

The motor bus sub-fleet is the backbone of Muni service, carrying over 43 percent of all daily riders. By the second quarter of 2018, the 40ft and 60ft motor bus fleet will be made up entirely of New Flyer hybrid-electric vehicles. At the end of 2016, the Agency had 295 new hybrids in service, with more being introduced each week. The agency is in the process of retiring and transitioning out several older generations of vehicles including vehicles produced by Neoplan and Orion. Additionally, the Agency retired the last 28 North American Bus Industries (NABI) vehicles in 2016. SFMTA has 30 32ft Orion hybrid-electric vehicles that are scheduled to be replaced by 2019.

In the previous 2014 Fleet Plan, the SFMTA laid out its goal of increasing capacity on its Rapid and Local Frequent routes by upgrading from 40ft buses to 60ft buses. By 2018 the 60ft motor bus fleet will have achieved that goal by increasing from 124 in 2014 to 224 total 60ft motor buses.

2.4.2 Trolley Bus Sub-Fleet

The SFMTA operates the largest trolley bus fleet in North America, carrying about 27 percent of all system riders. The trolley fleet currently consisting of 202 ETI 40ft buses and 60 60ft New Flyer buses. An additional 33 60ft New Flyer buses will arrive by March 2018 and all ETI buses will be replaced with New Flyer buses beginning at the end of 2017 through 2019.

With no major plans for expansion of the trolley bus network, the sub-fleet size will be adjusted to meet forecasted ridership demand over the course of the upcoming replacement cycle. By the end of 2019, SFMTA will have 93 60ft trolley buses and 185 40ft trolley buses.

Table 6: Current Rubber Tire Fleet

Vehicle Type	Make, Year	Vehicle Number	
60ft trolley bus	New Flyers, 2015-2016	7201-7260	

Vehicle Type	Make, Year	Vehicle Number	
60ft hybrid electric motor bus	New Flyers, 2015-2017	6500-6554, 6560-6628 6700-6730	
40ft hybrid electric motor bus	New Flyers, 2013-2017	8601-8692, 8701-8750, 8800-8901	
32ft hybrid electric motor bus	Orion, 2007	8501-8530	
40ft hybrid electric motor bus	Orion, 2006	8401-8456	
40ft trolley bus	ETI, 2001-2004	5401-5640*	
60ft diesel motor bus	Neoplan, 2000-2002	6200-6299*, 6401-6424*	

Vehicle Type	Make, Year	Vehicle Number	
40ft diesel motor bus	Neoplan, 2000-2002	8101-8235*, 8301-8371*	

*See Appendix A which details the retirement plan by year

3. Maintenance Program

Over the past several years, the SFMTA has made a significant investment in the bus fleet, with the goal of improving reliability and reducing the average age of the fleet. That investment is already paying off – breakdowns are down 10 percent and customer feedback is extremely positive about the cleaner, quieter and more comfortable riding experience. By 2019 the SFMTA will have completely replaced the bus fleet, with the bulk of the replacement completed by early 2018.

The Bus Maintenance division has a comprehensive program to prioritize the reliability and cleanliness of the rubber tire fleet.

The primary goals of the Bus Maintenance team are to:

- Maintain vehicles in safe operating condition
- Ensure each vehicle is operating at peak efficiency
- Maximize vehicle life
- Minimize vehicle service failures (road calls)
- Minimize loss of accessibility due to equipment failure
- Meet or exceed manufacturers' maintenance requirements
- Maintain vehicle exterior and interior appearance
- Maintain a system of permanent vehicle maintenance records
- Adhere to a strict preventive maintenance schedule
- Administer an efficient equipment warranty recovery program
- Allocate resources effectively

3.1 Maintenance Standards

Preventative maintenance is critical to maximizing the life of the bus and key system components. Vehicle breakdowns are also reduced through the systematic replacement of parts at set intervals. The preventive maintenance program at the SFMTA consists of daily inspections and mileage based inspections and are designed to realize the overall goals of the maintenance program described above.

3.1.1 Daily Inspections

SFMTA's maintenance program has established a zero graffiti and zero body damage policy to ensure that vehicles leave the yard in exceptional condition for the riding public. This policy is carried out through a pre-service inspection conducted by maintenance staff as part of the fueling and servicing process and is further enforced through the mandatory operator pre-service inspection.

Pre-Service Inspection

The general operating condition of each vehicle is checked before being placed in service through the following two procedures:

1. Fueling and Service
   Vehicles are serviced at the end of each day. During the servicing process, the following maintenance procedures are followed:

- Tires are visually checked and the fuel tank is filled.
- Interior is swept and cleaned. Exterior is washed as needed.
- Engine belts and general engine condition are checked.
- Motor oil, transmission fluid, coolant, diesel exhaust fluid (DEF) are checked.
- Exterior lights are checked
- Interior is checked – seats, windows, lights, etc.

2. Driver Pre-Trip Inspection
   Every day of the week, drivers perform a pre-trip inspection prior to the start of their shift. The first driver to pull the bus out of the yard for the day performs the pre- service cycling of the wheelchair lift. Problems are reported immediately to the Dispatcher. Other items on the pre-trip inspection include testing of safety mechanisms such as wipers, mirrors, wheelchair lifts, etc. For trolley bus operators, additional inspections are required for the trolley poles. If a problem is identified that may affect safety, service, accessibility or cause further component damage, the vehicle is removed from service.

Defect Cards

Operators report mechanical problems to maintenance staff and operations supervisors through a Defect Card. All mechanical problems identified during the pre-trip inspection or driving shifts are recorded by the Operator or Dispatcher on a Defect Card. The Defect Card identifies the bus, the problem, and the date of the failure. The Defect Card is forwarded to the either the lead Mechanic or the shift Supervisor on duty for repair coordination. Upon completion of repairs, a copy of the card with the repairs performed is placed into the bus history file and in Shop History & Online Parts System (SHOPS).

3.2 Maintenance Process

Maintenance consists of several programs – preventative maintenance to minimize unexpected failures, corrective maintenance when issues arise during service and campaigns/capital projects which require updating a portion or the entirety of the fleet.

3.2.1 Preventative Maintenance

SFMTA has a diverse fleet of motor and trolley buses ranging from a 2000 model up to 2017 models. This diversity requires different approaches to maintenance scheduling. There are two main schedules described below – safety inspections, which are performed every 1,000 miles for the motor buses and every 1,500 for the trolley buses and preventative maintenance inspections, which are performed in 6,000 mile increments in accordance with the original equipment manufacturer (OEM) specifications. SFMTA's maintenance window for safety and preventative maintenance inspections is plus or minus 10 percent. For example, the window for the 6,000 mile inspection is 5,400 to 6,600 miles.

Safety Inspections:

Motor Bus Safety Inspections are scheduled every 1,000 miles and Trolley Bus Safety Inspections are scheduled every 1,500 miles.

Preventive Maintenance Inspections:

Both motor and trolley buses have a Preventive Maintenance Inspection every 6,000 miles. Each 6,000 mile inspection has the same basic maintenance requirements based on the manufacturers recommended maintenance. Additional maintenance inspections are added

on the preventative maintenance program in 6K intervals (e.g., 6K, 12K, 18K). After the 108K inspection, the cycle starts over.

Each 6K inspection interval includes a separate cycle page, for example there is a different cycle page for the 18K and 60K inspection. The cycle page represents additional maintenance items based on OEM recommendation, along with in house modifications that exceed the OEM. The maintenance program is continuously updated based on component wear, items identified by road call trends, as well as analysis from SFMTA's maintenance diagnostic software, New Flyer connect.

New Flyer hybrid buses have an independent Oil Change schedule of 4,000 miles, all older buses are at 6,000 miles. Additional maintenance may be performed seasonally as needed such as washing out radiators in the fall and rinsing salt off wheelchair lifts and radiators in the winter.

The mechanic performing the inspection will repair minor defects at the end of the inspection. This includes minor Defect Card repairs deferred until inspection. Repairs that cannot be completed in the allotted inspection time are reported to the Supervisor or Maintenance Controller and scheduled for a later date.

Buses are washed every other day and a limited amount of buses are reserved for an intense interior cleaning.

3.2.2 Corrective Maintenance

While SFMTA strives to maximize performance through our preventative maintenance program, there continues to be a need for corrective maintenance, which is often a function of vehicle miles, fleet age, etc. A key objective of the maintenance program is to minimize this type of maintenance – including road calls. Constantly reviewing and improving upon the existing Vehicle Maintenance Plan is helping to accomplish this.

The corrective vehicle maintenance policy is as follows:

- All problems are to be reported, no matter how minor
- Campaigns are performed to eliminate known aging problems
- The supervisor, on duty/on call will make an immediate determination whether the vehicle should be removed from service
- Failures of accessibility equipment require prompt resolution. An alternate vehicle or immediate repair will be provided
- The Operator records all defect problems on a Defect Card
- All repairs are documented in the SHOPS maintenance software

Road Call Service Program

SFMTA minimizes the impacts of corrective maintenance through an extensive road call service program. On a typical weekday, SFMTA has three motor bus and two trolley bus road call trucks stationed at strategic locations within the system (e.g., at the layover point of multiple routes). The road call trucks are systematically equipped with parts, laptops, diagnostic equipment, fluids and fuels. The parts on each truck are standardized and include

an inventory system to ensure that they are restocked at the end of each day. Mechanics have New Flyer Connect and on-line database work history access. The road call truck supply is continuously updated based on breakdown trends and mechanic input.

The trucks are dispatched to breakdowns through the Operations Control Center (OCC). The mechanics in the field are allotted 20 minutes to repair a vehicle. If it cannot be fixed within that time window, or the issue is quickly identified as requiring more extensive repair, the vehicle is driven or towed back to the yard.

Response times have improved significantly since launching the road call program in 2014 and we are able to address issues and put back an increasing number of vehicles into service. This improves service reliability and minimizes the impacts of breakdowns for customers.

3.2.3 Documentation and Evaluation of Vehicle Maintenance

Documentation and evaluation of vehicle maintenance activities is the primary means by which the maintenance program can attain its goals. The SFMTA utilizes the following documentation in its maintenance program:

- *Data Maintenance:* Vehicle failure and repair information is transferred from employee work orders into the collective data system (SHOPS). A log of repairs segregated by unit number, equipment class and equipment type can be retrieved from the program.
- *Defect Card:* As outlined previously, this form is used by the Operator to report any mechanical problems to the maintenance staff.
- *Parts Log:* A log of the parts used in repairing buses is kept in the parts room.
- *Daily Commodities Usage:* Automatic mileage collection system driven by an onboard GPS system (Fleetwatch) software records daily mileages along with fuel and fluids consumption. This data is also exported to SHOPS to track fuel and fluid use.
- *Road Call Log:* The Operational Central Control records all reported failures in service (Road Calls), failures in service are also tracked in SHOPS and monitored for patterns or trends of failures.
- *Inspection Schedule:* The Maintenance Controllers monitor failures in service, schedule preventive maintenance inspections via SHOPS, and distribute daily reports.

3.2.4 Vehicle Accessibility Equipment

The SFMTA holds a long-standing commitment to universal access and prioritizing passengers with disabilities when designing the vehicle layout. The Multimodal Accessibility Advisory Committee (MAAC), established in 1979, predates the Americans With Disabilities Act of 1990 and has been involved in the design of multiple generations of SFMTA equipment. For the new buses, currently being purchased, MAAC was heavily involved in vetting the bus design, particularly the digital signage, seating layout and securement systems and lift/ramp deployment. Iterative design adjustments have been made to ensure each procurement optimizes boarding and alighting for passengers with disabilities.

In addition, Bus Maintenance has developed high standards in order to maintain service availability to persons with disabilities, the following procedures are followed:

- Operators are required to test the wheelchair lift/ramp during their pre-trip inspection or at the end of their first trip
- In-service vehicles experiencing equipment failures are removed from service and given a new vehicle for immediate service
- Replacement of wheelchair lifts/ramps occurs when the unit cannot be repaired
- Equipment maintenance and inspection is incorporated into the preventive maintenance inspection procedures. The lifts are evaluated as part of the safety inspection every 1,000 miles for motor bus and every 1,500 miles for trolley bus. They also receive servicing, including lubricating all pivot points and chain, adjusting micro-switches and testing sensitive edges as part of every 6,000 mile preventative maintenance inspection.

3.2.5 Campaigns/Capital Projects

Beginning in 2019, SFMTA plans to initiate a comprehensive midlife overhaul program designed to optimize performance in the second half of the vehicle's lifecycle. The Midlife Overhaul program is described below in Section 3.3. In addition to the Midlife program, SFMTA may conduct campaigns to a smaller set of subsystems to replace a portion or entirety of the fleet for parts that have reached the end of their useful life per manufacturer warranty claims or due to major failures.

In addition to the midlife overhaul program and other scheduled campaigns, the bus fleet is also affected by capital projects that require adjustments to the fleet and requite periods of non-service for implementation. An example of a capital project is the installation of the new radio, which began first of kind testing in fall 2016.

3.3 Midlife Overhaul Approach

SFMTA is committed to keeping the current vehicles in the best shape possible through the maintenance program described above, as well as through a fleet-wide midlife overhaul program. The first group of 40ft motor buses reach their midlife in 2019. The midlife overhaul program is described below and aims to rebuild a consistent number of vehicles each month in order to maintain consistent vehicle availability for service and maintenance needs.

3.3.1 Assumptions

In designing the midlife overhaul program, SFMTA fleet engineering and maintenance staff developed the following parameters (see Table 7):

- Vehicles would enter into the midlife overhaul program between 5-7 years of age for both motor and trolley buses.
- Depending on the vehicle type, the period of time to complete an individual bus overhaul ranged from 5 to 8 weeks.

Table 7: Assumptions and Parameters for Schedule

Vehicle Type	Overhaul Length	Cycles per Year	Maximum Vehicles Out at a Given Cycle
32ft, 40ft MC	5 weeks	10 cycles	10-12
60ft MC	6 weeks	8 cycles	10-12
40ft TC	7 weeks	7 cycles	10-12
60ft TC	8 weeks	6 cycles	10-12

3.3.2 Midlife Overhaul Schedule

Given the parameters above, staff designed a schedule that accommodated both the various cycle lengths by fleet type and maximum number of vehicles that could be out at a given time. The graph below details the number of vehicles that will undergo a midlife rebuild annually and Table 8 summarizes the number of vehicles that are estimated be out at any given time.

Figure 1: Mid-Life Overhaul Schedule 2019-2026

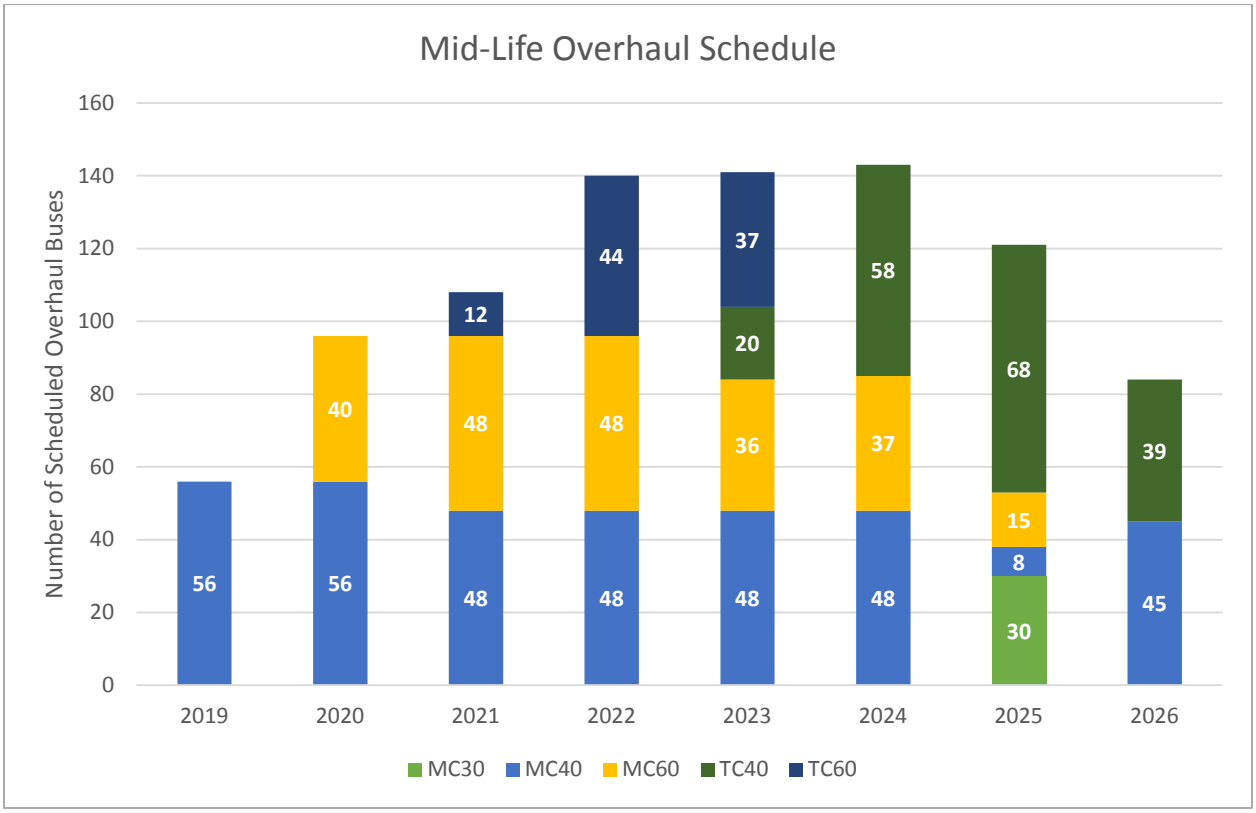


Table 8: Number of Vehicles Being Rebuilt at Any One Time

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
MC30	0	0	0	0	0	0	3	0	0	0	0	0
MC40	6	6	5	5	5	5	1	5	0	0	4	5
MC60	0	5	6	6	5	5	2	0	0	0	3	2
TC40	0	0	0	0	2	6	7	4	0	0	0	0
TC60	0	0	2	6	5	0	0	0	0	0	0	0
Total	**6**	**11**	**13**	**17**	**17**	**16**	**13**	**9**	**0**	**0**	**7**	**7**

3.4 Fuel

SFMTA currently has one of the cleanest rubber tire vehicle fleets in North America. Thirty percent of the fleet uses electrical power sourced primarily from the Hetch Hetchy Dam. For the motor bus fleet, the agency is currently transitioning to all hybrid vehicles by early 2018. In December 2015, the agency switched from B20 biodiesel fuel to renewable diesel, a cleaner, equally effective fuel source that cuts carbon emissions by 60 percent compared to petroleum diesel or B20 biodiesel. SFMTA is the first transit property in the country running 100 percent renewable diesel. The agency has seen immediate benefits from the renewable diesel program including reduced filter changes on board the vehicles and at the fuel tanks, increased injector and injection pump life, reduced fuel system clogging, improved fuel efficiency and increased reliability.

3.5 Vehicle Performance

Bus Maintenance measures vehicle performance primarily by two functions: mean distance between failures (MDBF) and preventative maintenance (PM) compliance.

3.5.1 Mean Distance Between Failures

SFMTA defines mean distance between failures per sub-fleet per the FTA guidelines as an in service mechanical failure that cannot be fixed in the field divided into the total service miles per sub-fleet. SFMTA's MDBF is continuously working to improve MDBF and enhance the maintenance program. In addition to lowering the average age of the fleet substantially over the past 5 years, SFMTA has also made numerous improvements to the maintenance program include:

- Implementing a road call truck deployment program
- Introducing the use of on-board diagnostics
- Adhering to an on-time PM program that meets or exceeds the OEM
- Adding a significant increase in mechanic training hours

Figures 2 and 3 display the MDBF by fleet age. The first chart represents the oldest vehicles in the fleet. Although most of the older fleet is at least twelve years of age, the MDBF has steadily increased over the past four years through the programs described above. The second chart represents the newer equipment.

Figure 3 represents the newest vehicles in the fleet. Performance on the 60ft buses has been challenging. For example, the 60ft hybrid buses have required retrofits and software errors that have forced vehicles to be pulled out of service incorrectly. Additionally, the arrival of 60ft trolley buses experienced a number of setbacks with major issues with the traction motor and adjustments with the different trolley pole mechanisms. However, starting in FY16-17, both fleet types' MDBF have improved after making adjustments with the manufacturers.

The Bus Maintenance Program is committed to continual refinement of the maintenance program to maximize these positive trends.

Figure 2: MDBF by Vehicle Type, Older Fleet (2000-2007)

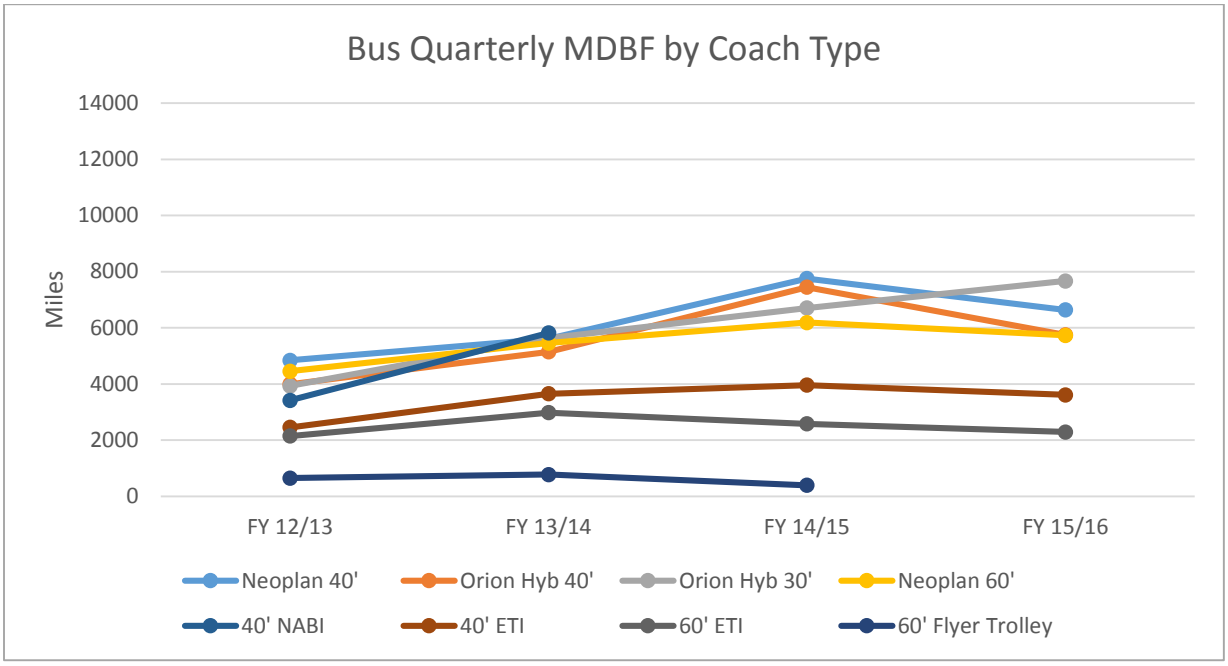
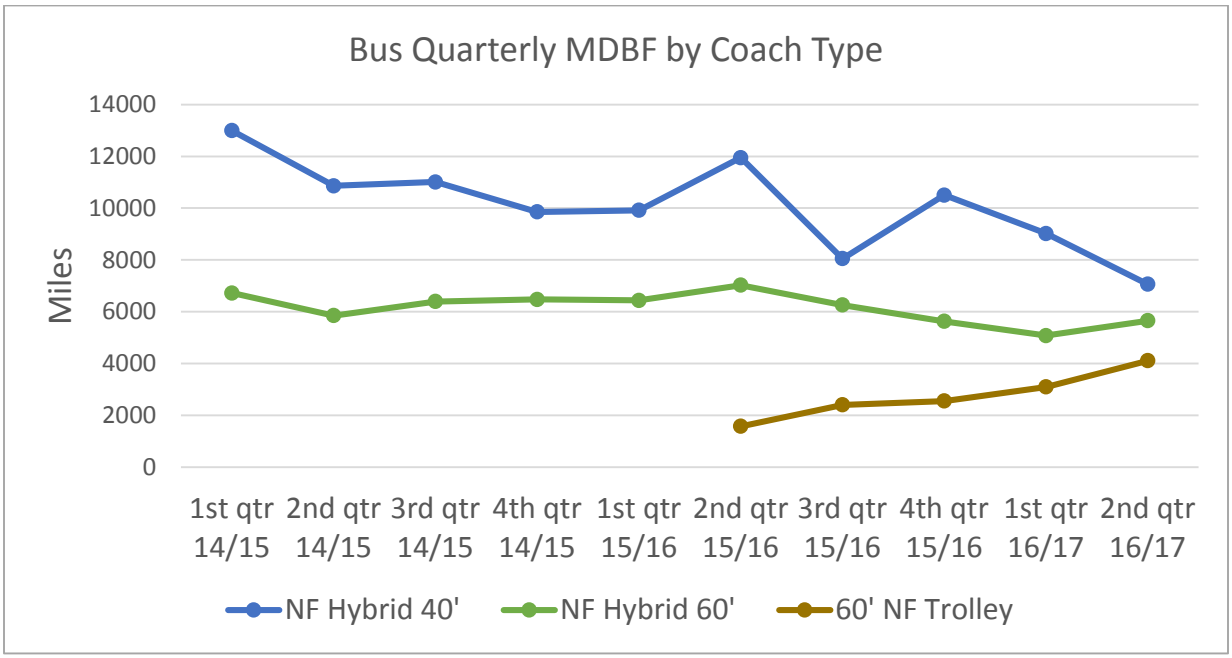


Figure 3: MDBF by Vehicle Type, Newer Fleet (2013-16)



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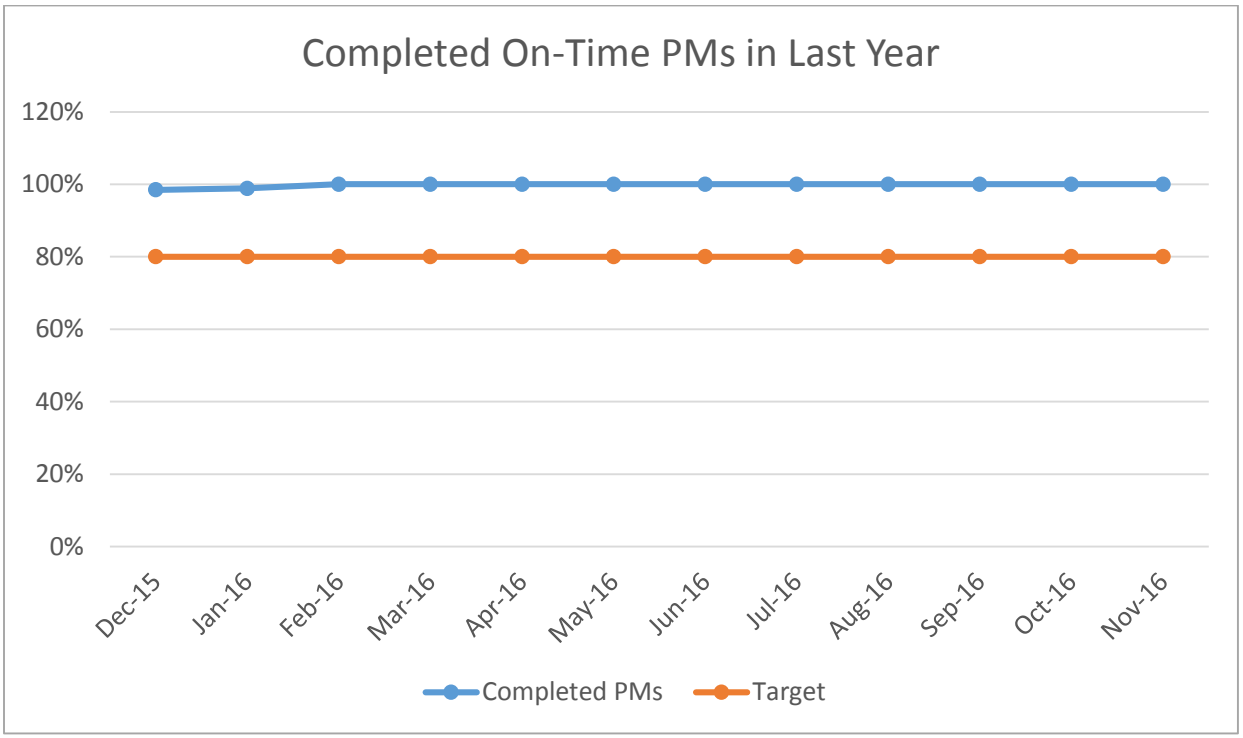
3.5.2 Preventative Maintenance Compliance

Bus Maintenance tracks preventative maintenance compliance on a monthly basis. SFMTA's maintenance window for safety and preventative maintenance inspections is plus or minus 10 percent. The FTA performance goal is a minimum of 80 percent on-time PM inspections for every 6,000 miles driven. Over the course of the last year, Bus Maintenance has exceeded the target of 80 percent on-time PM inspections and completed nearly all PMs on-time. Figure 4 shows the monthly completion percentage for SFMTA's PM program.

Figure 4: 2016 On-Time Preventative Maintenance Inspections



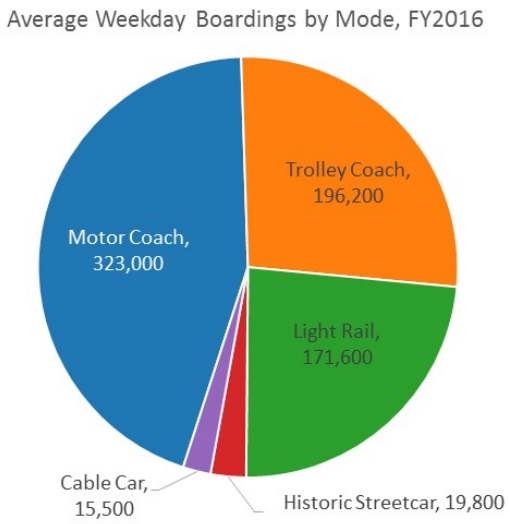
4. Ridership Patterns and Future Growth

The SFMTA transports roughly 45 percent of the region's transit trips and ridership is growing yearly. Buses are the backbone of Muni service, carrying 71 percent of all boardings. Based on forecasted job and population growth and the investments SFMTA is making in its transit network, transit ridership is anticipated to grow steadily in the coming decades, with buses continuing to play a central role in transporting residents and commuters in San Francisco. The following section summarizes existing ridership patterns and delves into the development factors and other trends that will drive ridership growth in the near future.

4.1 Ridership on Muni Buses

The Muni system carries over 726,000 passengers daily. As shown in Figure 5 below, buses are the backbone of the Muni system: 71 percent of Muni boardings are on buses, with 44 percent on motor/hybrid bus and 27 percent on trolley bus. In total, Muni buses carry 520,000 trips on an average weekday.

Figure 5: System-wide Average Weekday Boardings by Mode



Source: 2014 Muni On-Board Survey

San Franciscan's use bus service throughout the City and every residential neighborhood is within a short walk of a bus stop. However, there are also eight families of routes that make up the majority of bus trips and collectively carry almost 60 percent of total bus boardings. For example, the family of routes traveling on Mission and Van Ness carry almost 80,000 boardings per day. All of our top ridership corridors are included in the Transit Priority Network and are prioritized for traffic protection strategies, such as dedicated lanes, to maximize safety and reliability. Table 9 summarizes the routes associated with each corridor and the average daily boardings:

Table 9: Ridership on Major Corridors

Corridor	Annual Ridership (2016)
Mission/Van Ness (14, 14X, 14R, 47, 49)	79,800
Geary (38, 38R, 38AX, 38BX)	53,800
Stockton (30, 30X, 41, 45)	39,600
Bayshore (8, 8AX, 8BX)	35,200
California (1, 1AX, 1BX)	26,600
Fulton (5, 5R)	21,500
Haight (6, 7, 7R, 7X)	21,100
San Bruno (9, 9R)	20,900
Total	**300,000**

4.2 Passenger Profile

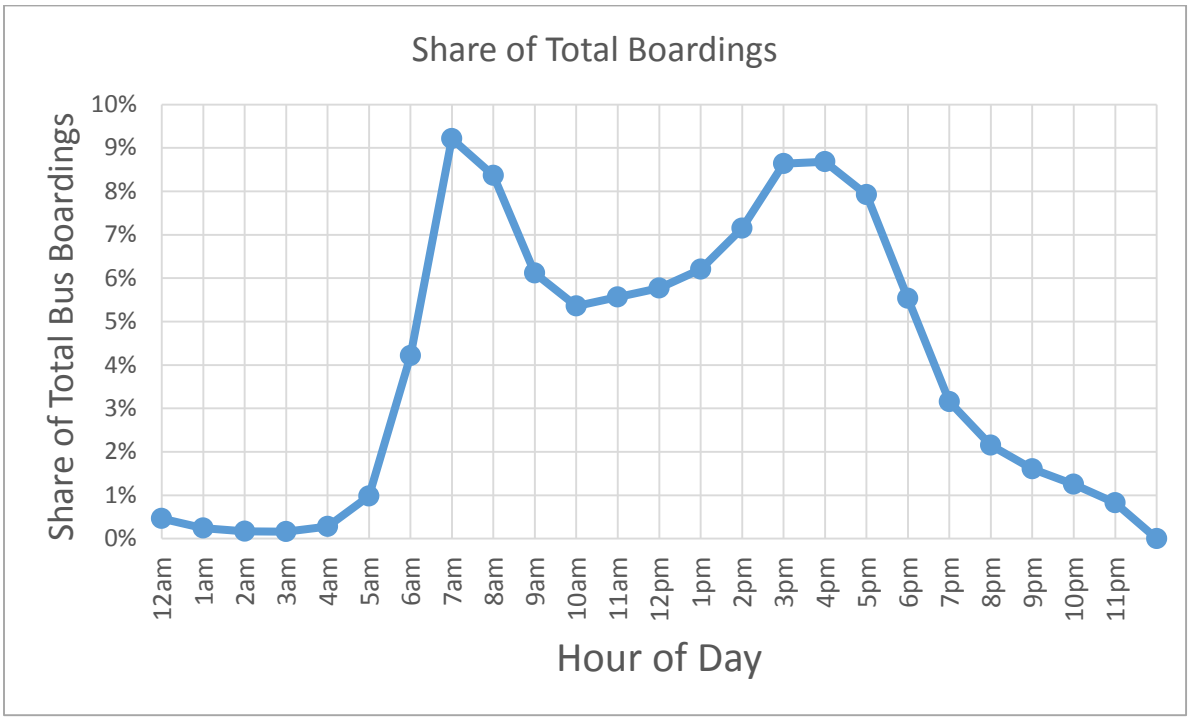
Below are additional passenger details that include ridership by time of day and passenger demographic information.

4.2.1 Ridership by Time of Day

Ridership on Muni is strong throughout the day compared to many transit agencies that are more heavily commute-focused, but the peak period is still well defined and drives the total demand for vehicles. As shown in Figure 6 below, over forty percent of total bus boardings occur during the AM peak (22 percent) and PM peak (22 percent) periods.[2] Boardings in the morning are slightly more concentrated than in the evening, with most of the AM peak boardings occurring between 7 and 9 AM, and over 9 percent of all boardings occurring in the one-hour window between 7 and 8 AM, the busiest hour of the day. The PM peak is slightly flatter than the AM peak, with boardings spread out more evenly between 5 and 7 PM.

2 Based on trip departure time. Depending on when a trip leaves and where a stop is located along a trip, actual boardings may occur in a following hour.

Figure 6: System-wide Average Weekday Boardings

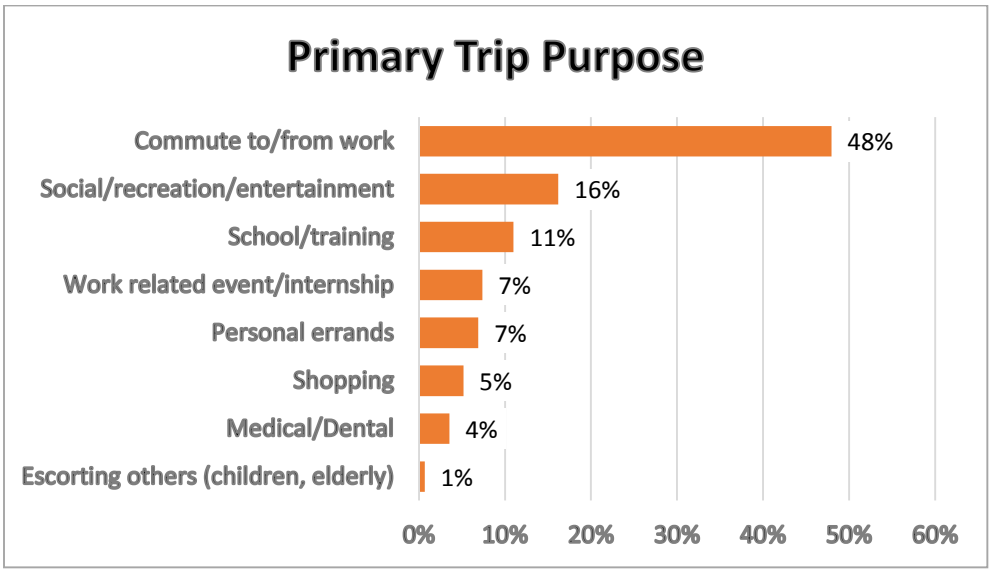


Source: 2014 Muni On-Board Survey

4.2.2 Trip Purpose

Most customers are riding the bus network to commute to work, school, or a work-related event (66 percent), as summarized in Figure 7. Sixteen percent of trips are for social and/or recreation purposes. While not everyone commutes during the peak period, the high percentage of commute related trips helps explain the high share of peak period trips, discussed above.

Figure 7: Trip Purpose

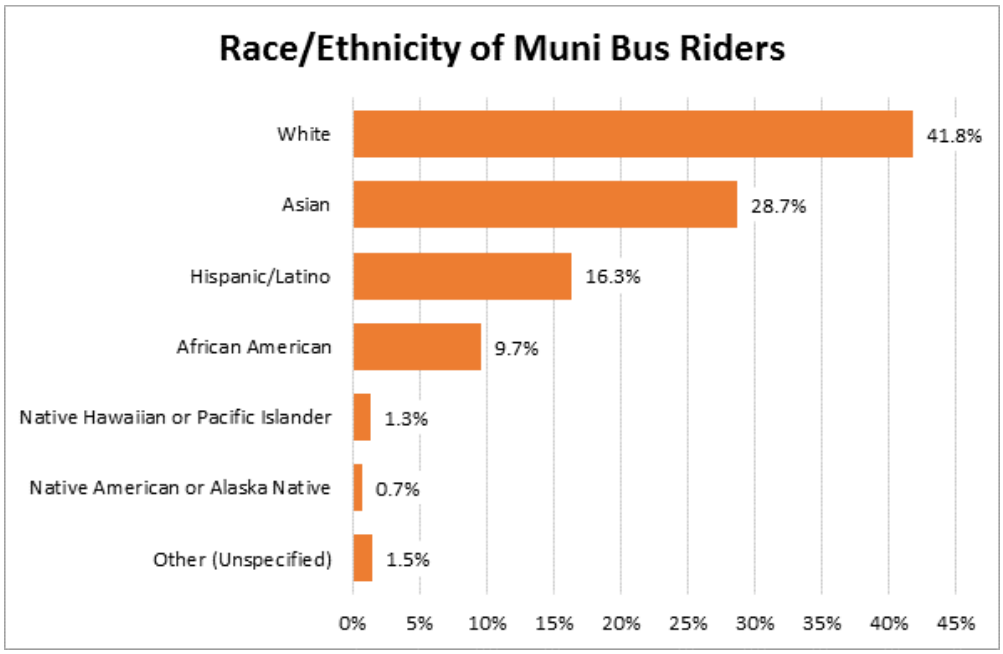


Source: 2014 Muni On-Board Survey

4.2.3 Race and Ethnicity

Based on the 2013 Customer On-board Survey, the majority of Muni bus riders, 58 percent, are non-white. These figure indicates the minority population disproportionately rides Muni based on the citywide minority population of 51 percent (2014 ACS 5-Year Estimates). As shown in Figure 8, about 29 percent of riders identify as Asian, 16 percent as Hispanic/Latino, and 10 percent as African American.

Figure 8: Ridership Race/Ethnicity



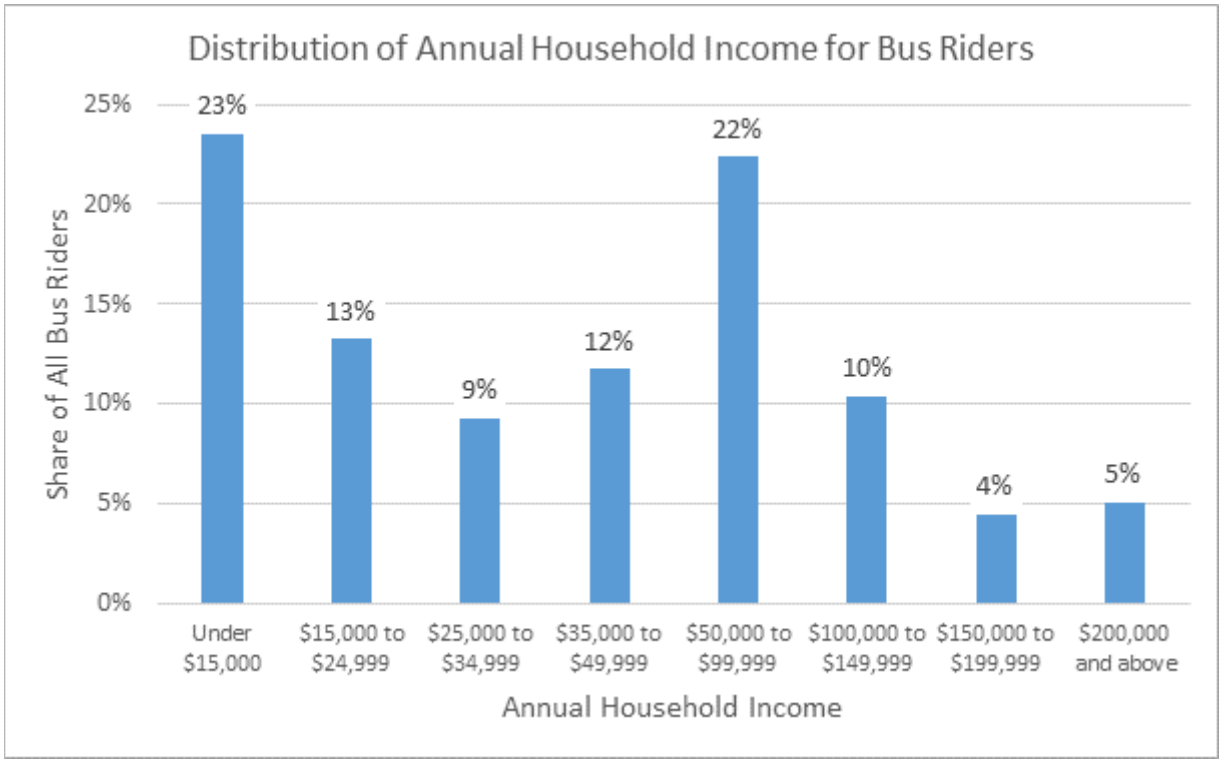
Source: 2014 Customer On-Board Survey

Figure 8 above shows the distribution of race/ethnicity system wide but these demographics vary by route. For purposes of Title VI monitoring, the SFMTA defines a route as a *minority route* if its non-white ridership exceeds the system-wide average of 58 percent. Based on the latest on-board survey data of its customers, the SFMTA classifies 30 of its 69 bus routes as minority routes. Routes that operate in neighborhoods with high concentrations of customers from low-income households and people of color are candidates for inclusion in the Muni Service Equity Strategy, discussed in the following section, which identifies critical service improvements that can affect vehicle demand.

4.2.1 Income

The 2013 Customer On-board Survey showed 51 percent of Muni riders are low income coming from households whose income is less than 200 percent of the federal poverty level. The city wide population of low income is 28 percent (2014 ACS 5-Year Estimates) which indicates low income riders disproportionately ride Muni compared to non-low income riders. The following chart in Figure 9 shows the distribution of annual household income for Muni bus riders.

Figure 9: Distribution of Annual Household Income for Bus Riders



Source: 2014 Customer On-Board Survey

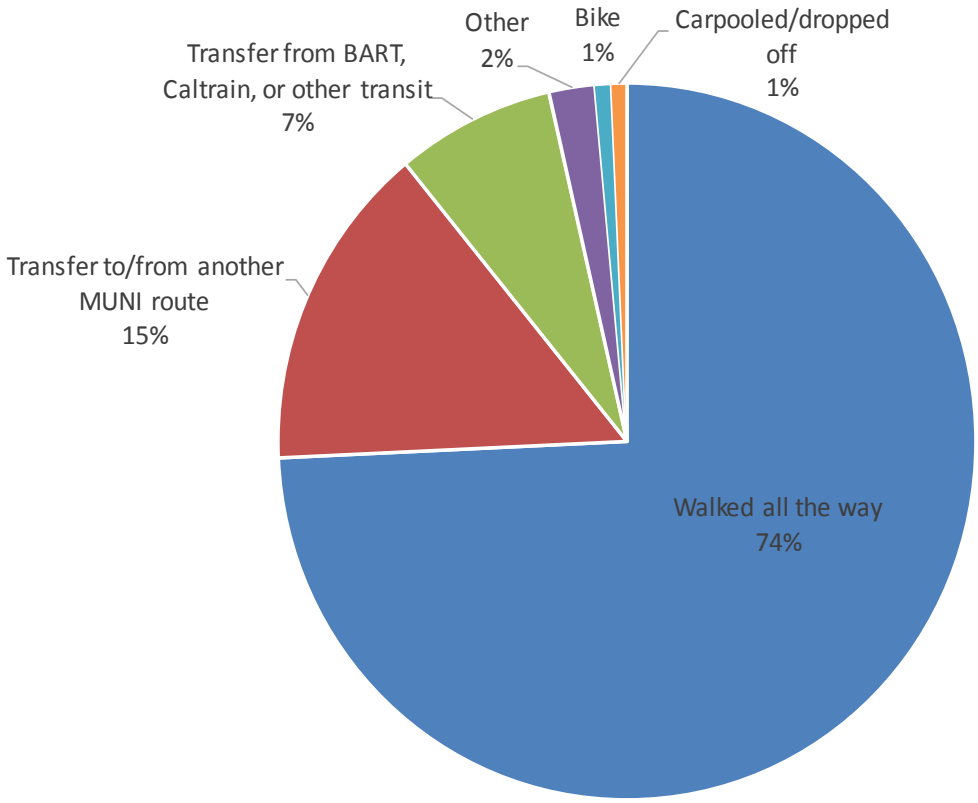
Figure 9 above shows the distribution of race/ethnicity system wide but these low income ridership varies by route. For purposes of its Title VI monitoring, the SFMTA defines a route as a *low-income route* if its low-income ridership exceeds the system wide average of 51 percent. Based on the latest on-board survey data of its customers, the SFMTA classifies 35 of its 69 bus routes as low-income routes. Similar to minority routes, low-income routes may

be candidates for inclusion in the Muni Service Equity Strategy, and in some cases are identified as candidates for service improvements that may affect vehicle demand.

4.2.2 Access

The vast majority of customers access Muni bus service by walking or transferring from another transit route. As illustrated in the following pie chart, nearly three-quarters of bus riders walk to the bus. In contrast to transit systems that rely heavily on a park-and-ride model, only 1 percent of Muni trips involve driving alone, carpooling, or getting dropped off to get to a stop. This fact highlights the value Muni provides to the City in reducing traffic congestion, as virtually every Muni trip removes a car trip.

Figure 10: Access to Transit



Source: 2014 Muni On-Board Survey

4.3 Recent Ridership Trends

Ridership on the Muni system has grown by 11 percent in the past decade, as illustrated in Figure 11 below. Ridership grew between 2006 and 2009, but budget cuts forced the SFMTA to reduce service in 2010, and ridership declined temporarily. However, strong economic growth in San Francisco over the past five years, combined with a 10 percent service increase over the past two years, has spurred continued ridership growth to a recent high of over 726,000 average daily boardings.

Figure 11: System-wide Average Weekday Boardings

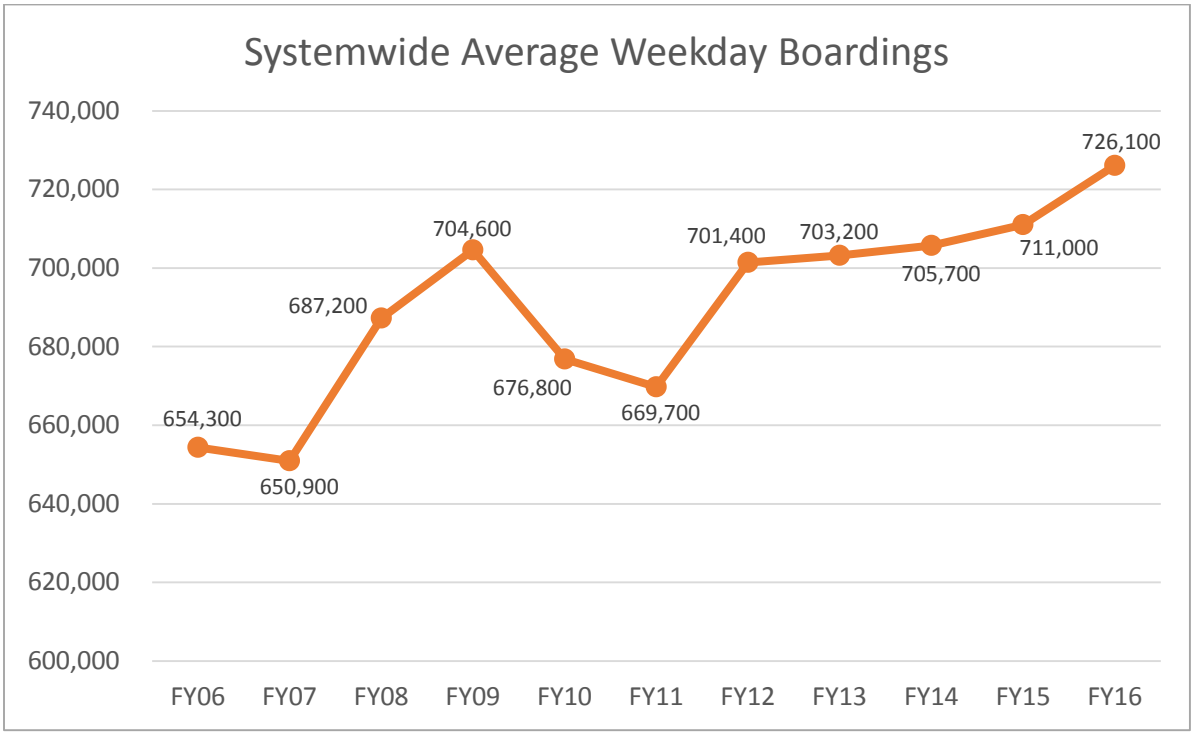


Table 10 below highlights bus routes and corridors that have seen the strongest growth in the past five years. Many of these are on the Transit Priority Network, highlighting the ridership growth benefits that have accompanied capital and service investments in these corridors. The SFMTA has focused its efforts on building and branding the Rapid routes, and will continue to make capital investments to improve travel time and safety along these major corridors.

Table 10: FY16 Daily Ridership Growth on Selected Bus Routes

Route	FY11	FY16	% Change
9/9R San Bruno	17,540	20,860	19%
44 O'Shaughnessy	13,800	16,410	19%
5/5R Fulton	18,690	21,480	15%
14/14R/14X Mission	43,110	46,430	8%
8/8AX/8BX Bayshore	21,940	23,310	6%
38/38R Geary	48,470	51,020	5%

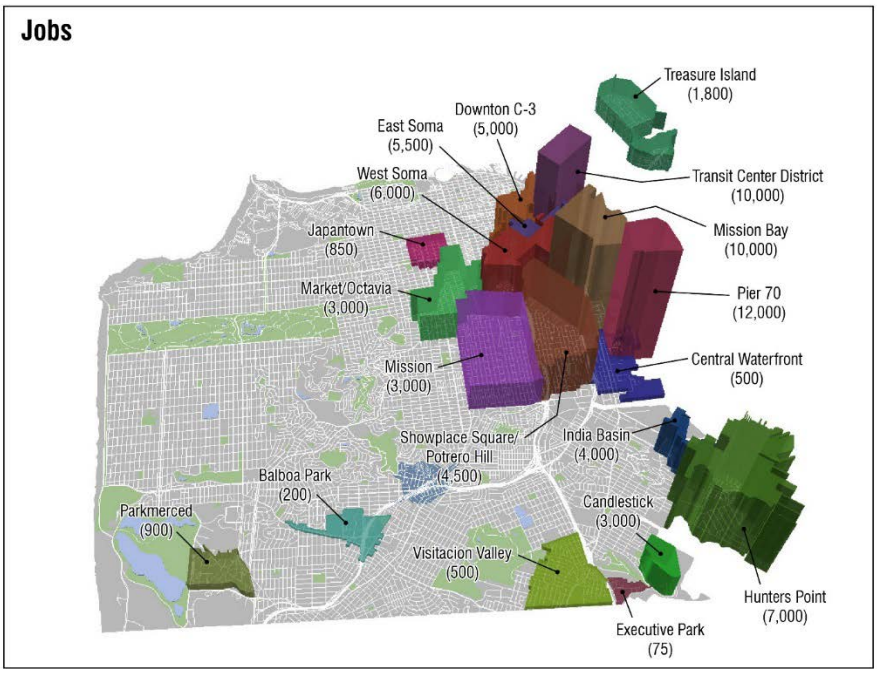
4.4 Future Ridership Growth

Bus ridership is projected to grow at a steady pace in the coming decades as major new development projects and growth in established neighborhoods bring more jobs and residents to San Francisco. The city is expected to add 140,000 households and 300,000 jobs between 2010 and 2040. As illustrated in Figure 12 below, much of this development will be concentrated in and around San Francisco's downtown core, as well in as several major

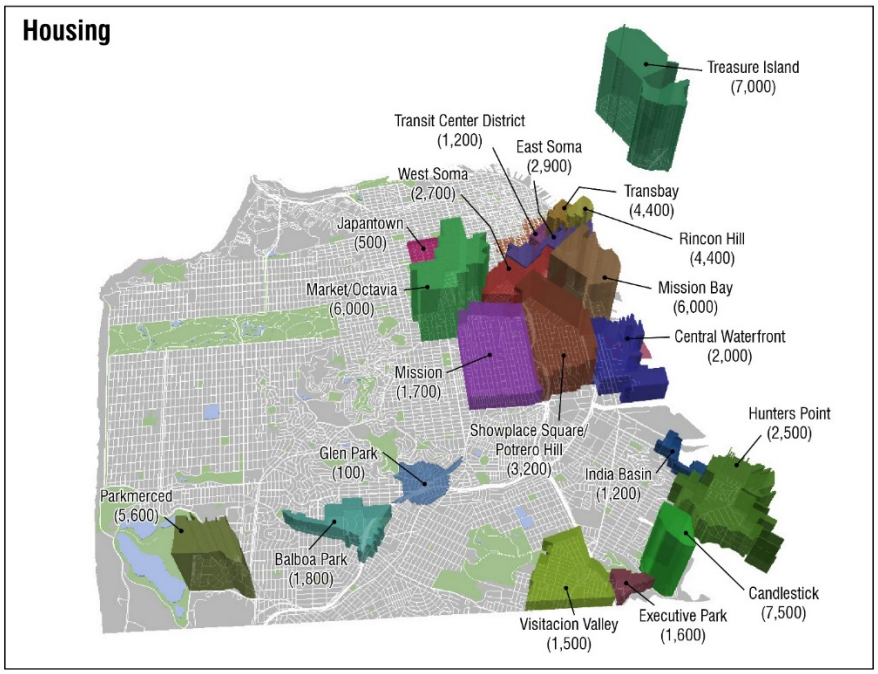
development projects including Candlestick/Hunters Point, Treasure Island and Parkmerced. Many high-frequency Muni routes provide direct access to downtown, and will see added ridership demand from growth in and around the downtown core. In total, bus ridership is expected to grow by 30 percent by 2040, and much of this growth will be frontloaded, with a substantial share of ridership growth occurring by 2025. [3]

Nearly all the major developments discussed in the following sections will include large increases in both housing units and jobs, creating bi-directional demand for transit trips throughout the day. Many of the major new developments also involve a requirement for the developer to provide "turnkey" transit infrastructure, with features such as bus rapid transit and light rail extensions built into the project. Transit service increases will leverage this bi-directional travel demand and new transit infrastructure provided by developers

Figure 12: Jobs and Housing Growth by 2040



[3] Updated travel demand forecasts based on the final draft preferred land use for San Francisco are expected in the summer of 2017 and will be further refined based on the MTC and ABAG adopted Plan Bay Area 2040. The updated forecasts are expected to predict even higher bus ridership growth than the current estimate of 30 percent because they will incorporate updated development numbers, including increased jobs at Hunters Point and job densification in existing office buildings.



Several other trends will contribute to ridership growth. In addition to growth in areas with major development projects or other neighborhood plans described in the following sections, there is ongoing "background growth" happening in many San Francisco neighborhoods. Smaller-scale infill development is adding more housing and jobs and increasing demand for transit outside of the major developer project areas discussed above.

San Francisco residents and office workers are also squeezing into less space in existing buildings. San Francisco added over 59,000 residents between 2010 and 2015, while adding only about 7,000 housing units.[4] Office workers are following a similar trend. While traditional offices such as law firms often require as much as 250-350 square feet on average per employee, some tech companies are reportedly planning for just 100-120 square feet per employee.[5] As tech and related industries continue to grow as a share of employment in San Francisco, the densification of existing office space is likely to continue, adding jobs in areas of downtown even where no new office space is planned.

Residents in San Francisco are also choosing transit and other non-driving modes in higher numbers. In 2014, about 59% of San Francisco residents commuted to work via non-private auto modes.[6] This is a dramatic shift since 2000, when less than half of residents commuted without a car. Millennials in San Francisco also seem to be using transit in higher numbers than previous generations. While San Francisco residents between 35 and 54 years old take transit for just 18 percent of trips, residents between 18 and 34 years old use transit for 32 percent of

[4] Population data from US Census Bureau. For change in housing units, see the San Francisco's Planning Department's 2015 San Francisco Housing Inventory: http://default.sfplanning.org/publications_reports/2015_Housing_Inventory_Final_Web.pdf

[5] http://mtc.ca.gov/sites/default/files/CCTS_SF_MktAssessment_FINAL.pdf

[6] https://www.sfmta.com/sites/default/files/reports/2016/2015%20SFMTA%20Transportation%20Factsheet.pdf

trips.[7] Driving alone accounts for just 22 percent of trips among Millennials. If this trend continues, transit ridership growth will outpace the rate of employment and population growth.

4.4.1 Development Driving Ridership Growth

The following section summarizes the major development projects and other area plans that are the primary contributors to expected bus ridership growth in San Francisco.

Hunters Point Shipyard and Candlestick Point

Hunters Point Shipyard and Candlestick Point are currently being redeveloped by a single developer, FivePoint. The Hunters Point Shipyard/Candlestick Point development project includes affordable and market-rate housing, economic development, and retail and recreational options near the southeastern waterfront of San Francisco. The project will greatly increase jobs and housing, leading to bi-directional demand for transit at all times of day. Hunters Point Shipyard Phase 1 is already well into construction, with an expected 1,600 residential units occupied by 2020 along with 20,000 square feet of retail. The future Candlestick Point and Hunters Point Shipyard Phase 2 is expected to provide an additional 10,700 residential units, 440 hotel rooms over 5 million square feet of commercial/R&D space, over 400,000 square feet of community facilities and school space, and extensive new parks/open space facilities.[8]

The project sets an ambitious goal of no more than 45 percent auto use for PM peak hour work trips, and at least 30 percent transit use. On-site transit facilities to be built by the developer will include a Hunters Point Transit Center and exclusive transit lanes that can be used by local routes and a new bus rapid transit (BRT) route. There will also be major offsite improvements, including exclusive transit lanes or facilities on Harney Way, Geneva Avenue, and possibly Innes Avenue; and transit preferential treatments on Palou Avenue and Gilman Avenue. A Bayshore Multimodal Facility is planned to improve transfers among Caltrain, BRT, the T-Third line, company shuttle buses/vans, and other Muni and Samtrans bus lines.

Treasure Island

Treasure Island is a repurposed military base that currently holds about 900 housing units. The Treasure Island/Yerba Buena development project is planned as a highly walkable urban neighborhood with convenient transit access to downtown San Francisco. The project includes 8,000 residential units, 500 hotel rooms, 140,000 square feet of retail and 100,000 of office space, and extensive parklands and open space.[9] Extensive transit improvements and frequent service will be provided to limit the impacts of the development on Bay Bridge congestion and the environment.

The neighborhood will be centered on a new transit hub served by ferries, on-island shuttle service, and bus service to San Francisco and the East Bay. This transit hub will be within a

[7] https://www.sfmta.com/sites/default/files/reports/2016/Travel%20Decision%20Survey%202015%20Report-Accessible_FINAL.pdf

[8] Five Points is currently in the process of revising and increasing their land use assumptions for Hunters Point. To the extent that this adds additional vehicle requirements, we will capture it in future updates of the Fleet Plan.

[9] http://www.sfcta.org/TIMMA_FAQ

10-minute walk for 50 percent of residents, and within a 15-minute walk of 90 percent of residents.

Figure 13: Projected Walking Times in Treasure Island

Image: Treasure Island Development Authority

Peak bus demand off the island to San Francisco is expected to increase by over 300 percent. The mix of jobs and housing is expected to generate travel demand in both directions, which will make for more efficient use of transit resources.

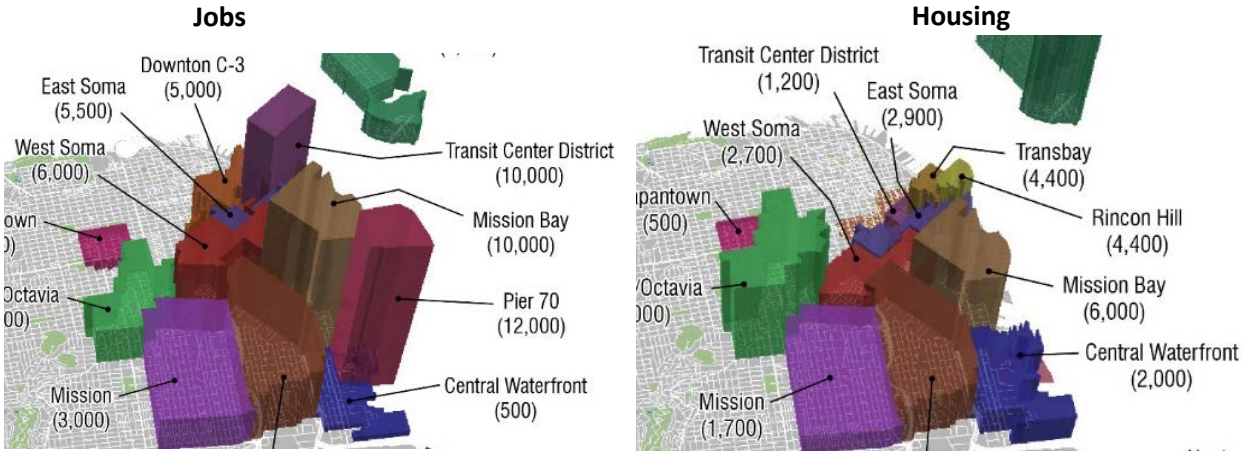
Parkmerced

Parkmerced is a 152-acre site under single ownership in the southwestern part of the City. The existing site contains 3,221 housing units in a combination of high-rise towers and two-story townhouses. The owner of Parkmerced has approval from the City to undertake a long-term comprehensive re-design, redevelopment and improvement of the site. The project, which will be implemented over the course of three decades, includes new residential buildings, retail uses, parks, streets, and other amenities. The final buildout would add approximately 5,700 net new housing units and up to 310,000 square feet of commercial use.

While the added demand for transit service will primarily be addressed through increased capacity on the M-line, addressed separately in the SFMTA's LRV Fleet Plan, as well as a free shuttle to Daly City BART, provided by the developer, increases in Muni bus ridership are also expected.

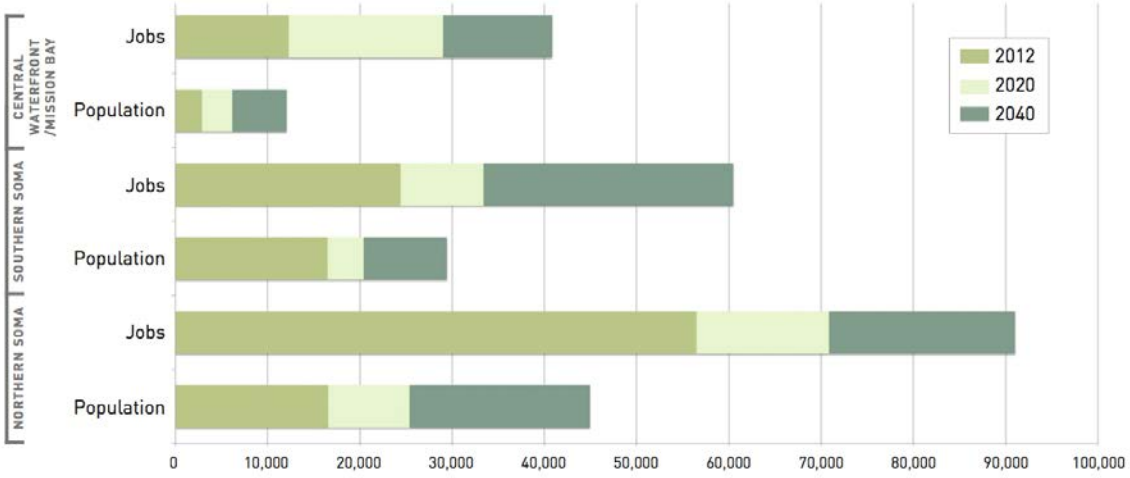
Growth in Eastern Neighborhoods, Rincon Hill and Transbay Center

Figure 14: Jobs and Housing Growth by 2040 in Eastern Neighborhoods, Rincon Hill and Transbay



In addition to the major developments described above, there are several area plans that are anticipated to generate a significant increase in bus ridership. Approved plans (e.g. Transbay Center District, Rincon Hill, Eastern Neighborhoods, Mission Bay) are building out and additional development is under discussion in these neighborhoods (see Figure 14 above). In effect, a "second downtown" will grow up around the Transit Center District, and Mission Bay will become a major urban hub outside the downtown core. Due to substantial growth in jobs and population (see chart below), overall travel demand in these neighborhoods is expected to increase by 50 percent by 2040.

Figure 15: Jobs and Housing Growth by 2020 and 2040 in Selected Neighborhoods



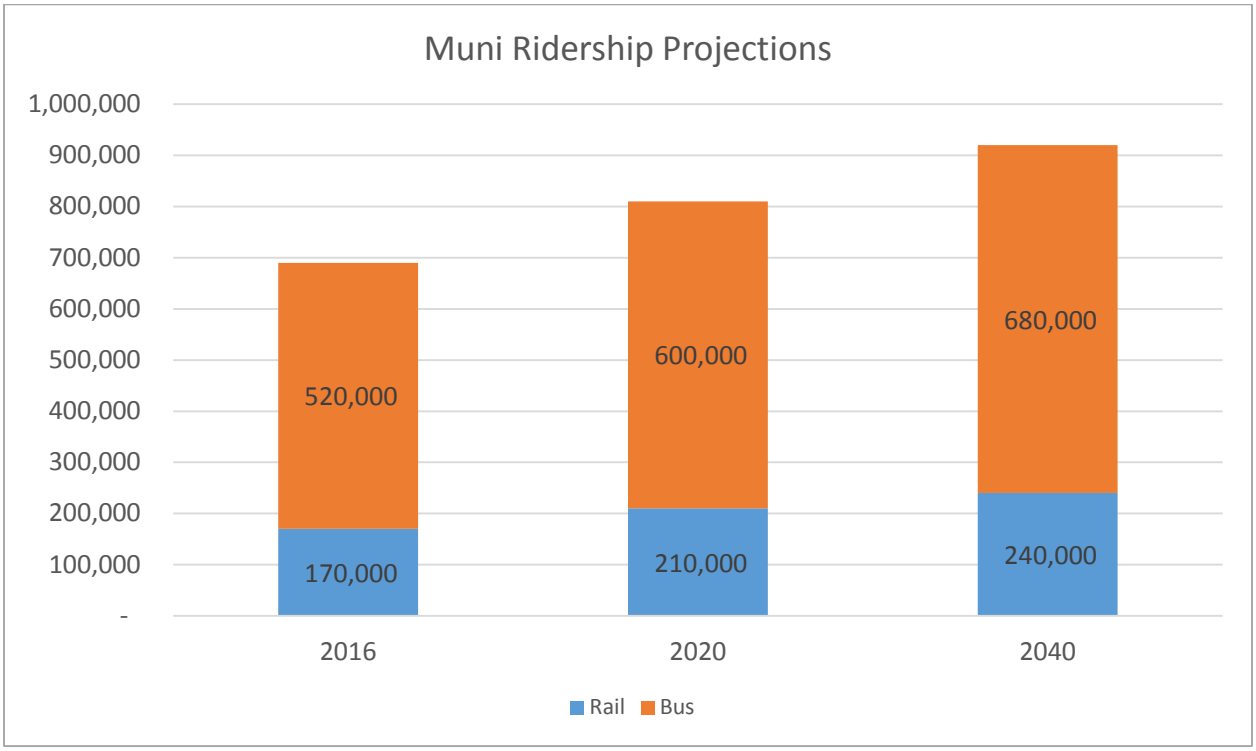
Source: Waterfront Transportation Assessment.

4.4.2 Estimated Ridership Growth

The most recent model projections, from 2012, estimate a 30 percent growth in bus boardings by 2040 as a result of the development trends discussed above. This translates into about 160,000 additional average weekday bus boardings. Updated travel demand forecasts based on the final draft preferred land use for San Francisco are expected in the summer of 2017 and will be further refined based on the MTC and ABAG adopted Plan Bay Area 2040. The updated forecasts are expected to predict even higher bus ridership growth than the current estimate of 30 percent because they will incorporate updated development numbers, including increased jobs at Hunters Point and job densification in existing office buildings.

The estimated growth will be front-loaded, with the majority of ridership growth anticipated to occur by 2025, with most ridership growth focused on bus lines. This rapid increase in ridership will require immediate investments in more frequent bus service, which is described in greater detail in the following section.

Figure 16: Muni Ridership Projections to 2040



Source: 2012 SF-CHAMP Model and SFMTA Ridership Data

5. Service Expansion Plan

The following section describes future bus service expansions that are needed to meet expected ridership increases in the near future. Over the past two years, SFMTA has made a significant investment in transit service, including a 10 percent service increase and the launch of the Muni Forward program, which is building over 40 miles of transit priority streets on Muni's highest ridership routes. While the recent service increases were extensive, they primarily focused on existing crowding and latent demand for more service. The City's continued growth will require additional transit service and bus fleet expansions.

Looking to the near future, SFMTA anticipates a continued need for service investments to match the rapidly growing job and housing markets, described above, and to meet the City's and Region's ambitious sustainability goals. Additionally, major infrastructure projects, including the Muni Forward program, as well as the Van Ness and Geary bus rapid transit projects, are also anticipated to attract new customers to transit and require expanded fleet needs. SFMTA is committed to growing in a cost effective and sustainable way. Where possible, operations efficiencies will be pursued, including shifting routes from 40- to 60-foot buses.

The anticipated service changes can be grouped into the following categories:

- Equity Strategy expansion needs
- Background growth and congestion delay
- Rapid bus expansion including Muni Forward, Geary BRT and Van Ness BRT
- Central Subway service restructuring
- Service for major development projects and other planned growth

In addition to the categories above, SFMTA also plans to purchase additional vehicles to maintain fleet availability during the midlife overhaul program. One of the primary benefits of spreading the vehicle procurements is to create a steady state midlife program that requires a consistent number of vehicles to be rehabilitated each year. This allows for more stability in the maintenance program and allows the SFMTA to proactively maintain adequate vehicle availability needs. More details on the midlife overhaul program are available in Section 3.3.2

The Fleet Plan is intended to be a living document and the future service assumptions will be revisited periodically based on resource availability, growth trends, and other factors.

5.1 Equity Strategy Expansion Needs

The Muni Service Equity Strategy focuses on improving transit performance in San Francisco neighborhoods with high percentages of people from low-income households and people of color. The neighborhoods were selected based on percentage of low-income households, private vehicle ownership and race and ethnicity demographics. SFMTA staff also identified routes that were heavily used by seniors and people with disabilities as part of the analysis. Equity Strategy neighborhoods are called out (in green) in many of the maps on the following pages. As these maps highlight, many of the investments described below directly benefit Equity Strategy neighborhoods.

With the help of a Working Group, which is comprised of affordable housing, social justice and transit equity advocates, SFMTA staff developed preliminary key needs based on system data

such as crowding and on-time performance. In April 2016, SFMTA completed its first bi-annual Muni Service Equity Strategy Report, and work is underway on the 2018 Strategy.

The Equity Strategy identifies key needs in each neighborhood and then links those needs to new actions, as well as existing actions underway. In some instances, recommendations include service increases (for example to address crowding on the 29 Sunset); however, capital investments and service management strategies are also considered. The SFMTA Board adopts an updated Muni Service Equity Strategy every two-years as part of the budget development process and there will be 5 to 6 Strategy updates throughout the tenure of this plan. Although the recommendations for future Strategies are not known at this time, periodic placeholders were included for future service increases. Additionally, many of the planned service improvements will directly benefit equity strategy neighborhoods. For example, the Central Subway will reduce travel time and address crowding for Chinatown and the Bayview. The growth on the 8 Bayshore and 14R Mission Rapid will improve travel in Visitacíon Valley, the Outer Mission and the Inner Mission.

5.2 Rapid Bus Expansion

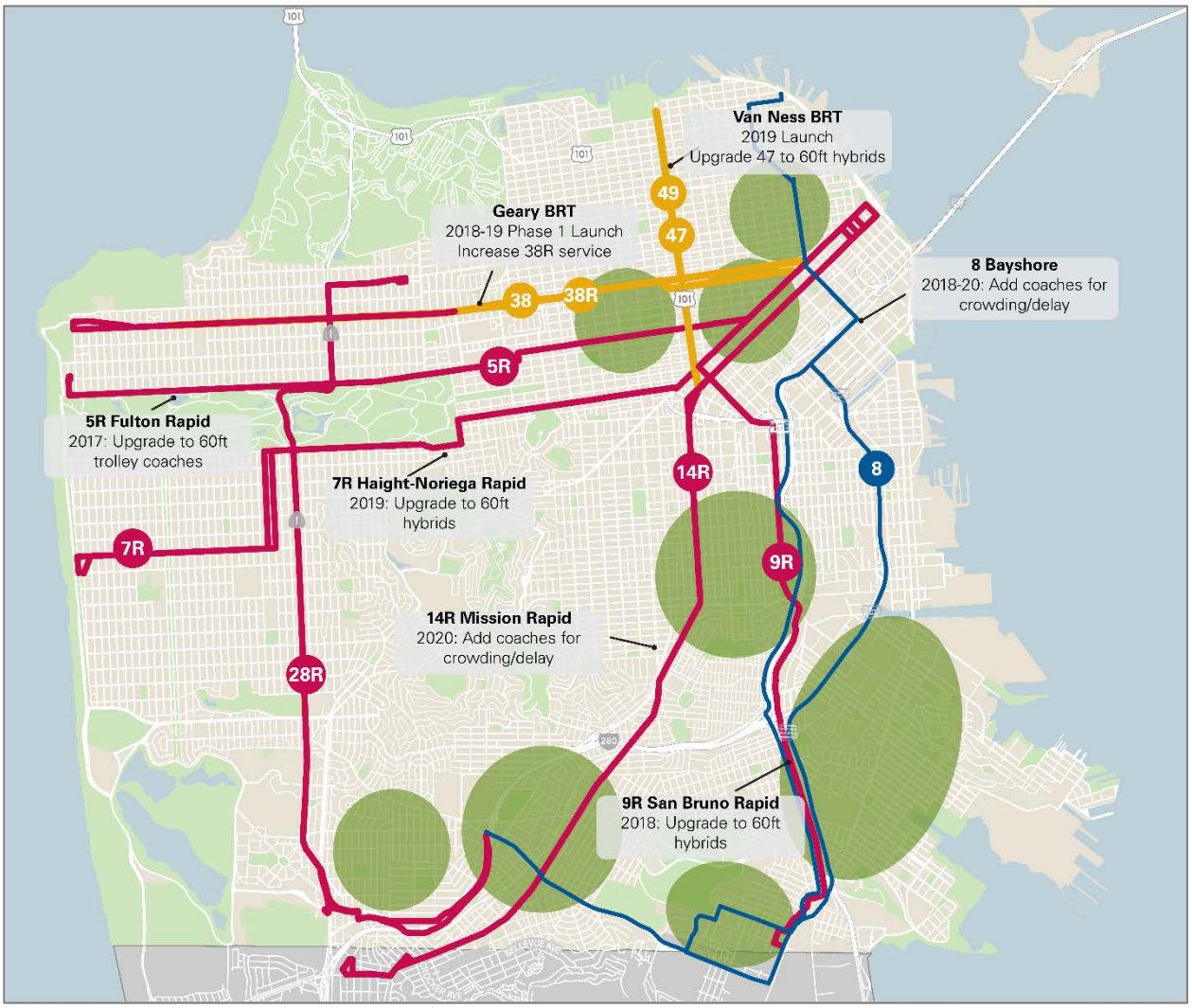
In 2015, SFMTA launched Rapid routes, which consist of high-frequency, limited-stop routes that are designed to get people to and from major destinations quickly and reliably (see Figure 17 below). The program is complemented by the Muni Forward capital program, which aims to implement transit priority treatments on all Muni corridors with 10 minute or better service.

These capital investments include:

- Bus rapid transit on Van Ness Avenue and Geary Boulevard
- Better Market Street, which is a complete multimodal street rebuild designed to improve transit reliability and travel times, bicycle connectivity and pedestrian safety and urban design
- Muni Forward transit priority treatments including dedicated transit lanes and queue jumps, bus bulbs and islands, stop optimization, turn restrictions and parking management
- System-wide transit signal priority

The investments described above will make Muni more efficient, reliable, safe, and comfortable for its existing passengers – as well as prepare the system for future growth. These projects address the root causes of delay and passenger frustration like traffic congestion, stops that are spaced too close together, narrow travel lanes, and slow boarding times. Over the past three years, ridership on the Rapid routes has increased by 22 percent, and is expected to growth as more people are attracted to quicker and more reliable service.

Figure 17: Rapid Bus/BRT Expansion Map 2020



Note: Areas in green are neighborhoods identified in the SFMTA Equity Strategy

5.2.1 Rapid Bus Service Expansion

To meet growing demand and reduce crowding on several of the highest-ridership Rapid lines, SFMTA will be converting several Muni Rapid lines from 40ft to 60ft buses (7R and 9R), increasing the number of 60ft trolleys on the 5R, and increasing service on lines that already have 60ft buses on all trips (8 and 14R). By converting all Rapid lines to 60ft buses, SFMTA is increasing capacity in a cost-effective way that does not require adding more vehicles to a route. As illustrated in the map above in Figure 17, Rapid routes travel through nearly every Equity Strategy neighborhood, and improvements to these routes will directly benefit disadvantaged communities as well as the city as a whole.

Table 11: Rapid Bus Expansion Plan

Route	Description	Current Peak Vehicle Demand	Proposed Peak Vehicle Demand	Implementation Year
5R	Upgrade to 60ft trolley buses	14 60ft TC 6 40ft TC	20 60ft TC	2018
7R	Upgrade to 60ft hybrid buses	15 40ft MC	15 60ft MC	2019
8	Add additional buses for growth/crowding	40 60ft MC	Up to 46 60ft MC	2018, 2019, 2030
9R	Upgrade to 60ft hybrid buses	16 40ft MC	16 60ft MC	2018
14R	Add additional buses for growth/crowding	17 60ft MC	20 60ft MC	2020

5.2.2 Van Ness Improvement Project

Van Ness Avenue will have bus rapid transit and other infrastructure upgrades by late 2019, bringing a premium level of Rapid bus service to this high-frequency transit spine. In addition to creating efficient and reliable transit service along the Van Ness Avenue corridor between Mission and Lombard streets, the project will promote pedestrian safety and accessibility, enhance urban design, and strengthen the identity of Van Ness Avenue. Van Ness BRT will improve transit reliability for the 47 and 49 Muni routes and provide reliable transit connections to transfer routes. The SFMTA started construction in 2017 and plans to implement service in 2019.

The transit service and infrastructure changes are expected to reduce transit travel times by over 30 percent. By 2035, with the implementation of BRT, ridership is projected to be greater than 60,000 passengers per day. To meet this increased demand, all existing service on the 49 Van Ness- will be converted from 40ft to 60ft trolley buses. Additionally, at the conclusion of construction, the 49 Van Ness-Mission route, which is currently motorized, will be restored to 60ft trolley buses.

Table 12: Van Ness BRT Service Plan

Route	Description	Current Peak Vehicle Demand	Proposed Peak Vehicle Demand	Implementation Year
47	Upgrade to 60ft hybrid buses	17 40ft MC	17 60ft MC	2019
49	60ft trolley buses	21 60ft MC*	21 60ft TC	2019

*Due to motorization needs

5.2.3 Geary BRT

The Geary BRT Project is a coordinated set of transit and pedestrian improvements along the 6.5-mile Geary corridor between Market Street and 34th Avenue, adding major transit priority upgrades and more frequent service.

Improvements offer solutions to meet rising transportation demands and make travelling on Geary Boulevard, Geary and O'Farrell streets more efficient, safe and vibrant for everyone. Crowded buses and uneven wait times are all too common for the over 54,000 people who take the 38 Geary, 38 rapid service and 38 rush-hour express routes. These issues persist even with frequent service on Geary bus routes provided by new buses scheduled to run every 2.5 minutes during rush hour, and near-term upgrades to bus lanes implemented recently under Muni Forward. Muni ridership on Geary is expected to increase in the coming years and Geary BRT will help break the cycle with upgrades to street design and traffic signals proven to make bus service quicker and more reliable.

The project is nearing completion of environmental review. The San Francisco County Transportation Authority Board certified the Final Environmental Impact Report in January 2017 and approved the Locally Preferred Alternative (LPA). Later in 2017, SFMTA's Board will also act to approve CEQA findings and approve the LPA. In addition, SFCTA and SFMTA and working with the Federal Transit Administration to publish a Final Environmental Impact Statement and receive of Record of Decision in 2017. Phase 1 of the project, described below, will then go to the SFMTA Board for approval. Phase 1 includes improvements between Market and Stanyan streets, which would extend the existing side-running bus-only lanes to Stanyan Street, upgrade traffic signals and add pedestrian safety improvements. Phase 2 contains the remaining improvements west of Stanyan Street, which include redesigning the street for center-running dedicated bus lanes between Palm and 27th avenues. Phase 2 construction is anticipated to begin no sooner than 2019.

Upon completion of Phase 1 and 2, model estimates predict a 40 percent increase in Geary boardings. To accommodate this ridership, both the 38 and 38R would need more service. To accommodate this demand cost effectively, a short version of the 38R Rapid service will be introduced as well. Finally, the Geary BRT service plan calls for existing 38AX and 38BX express routes to be combined into a single express service, the 38X, which will make all Rapid stops west of Masonic and then express to downtown, with higher frequency than the existing Geary express routes.

Table 13: Geary BRT Service Plan

Route #	Description	Current Peak Vehicle Demand	Proposed Peak Vehicle Demand	Implementation Year
38	Single service pattern for local	16 60ft MC	21 60ft MC	2019 Phase 1 2024 Phase 2
38R	Short and long pattern for rapid	30 60ft MC	37 60ft MC	2019 Phase 1 2024 Phase 2
38X	Express route making rapid stops west of Masonic, express from Masonic to Financial District	12 40ft MC	15 60ft MC	2019 Phase 1 2024 Phase 2

Figure 18 details the Rapid Bus changes in 2030, which outlines the full roll-out of the Geary BRT project as well as the Better Market Street and Geneva Harney BRT projects.

Figure 18: Rapid Bus/BRT Expansion Map 2030

Note: Areas in green are neighborhoods identified in the SFMTA Equity Strategy

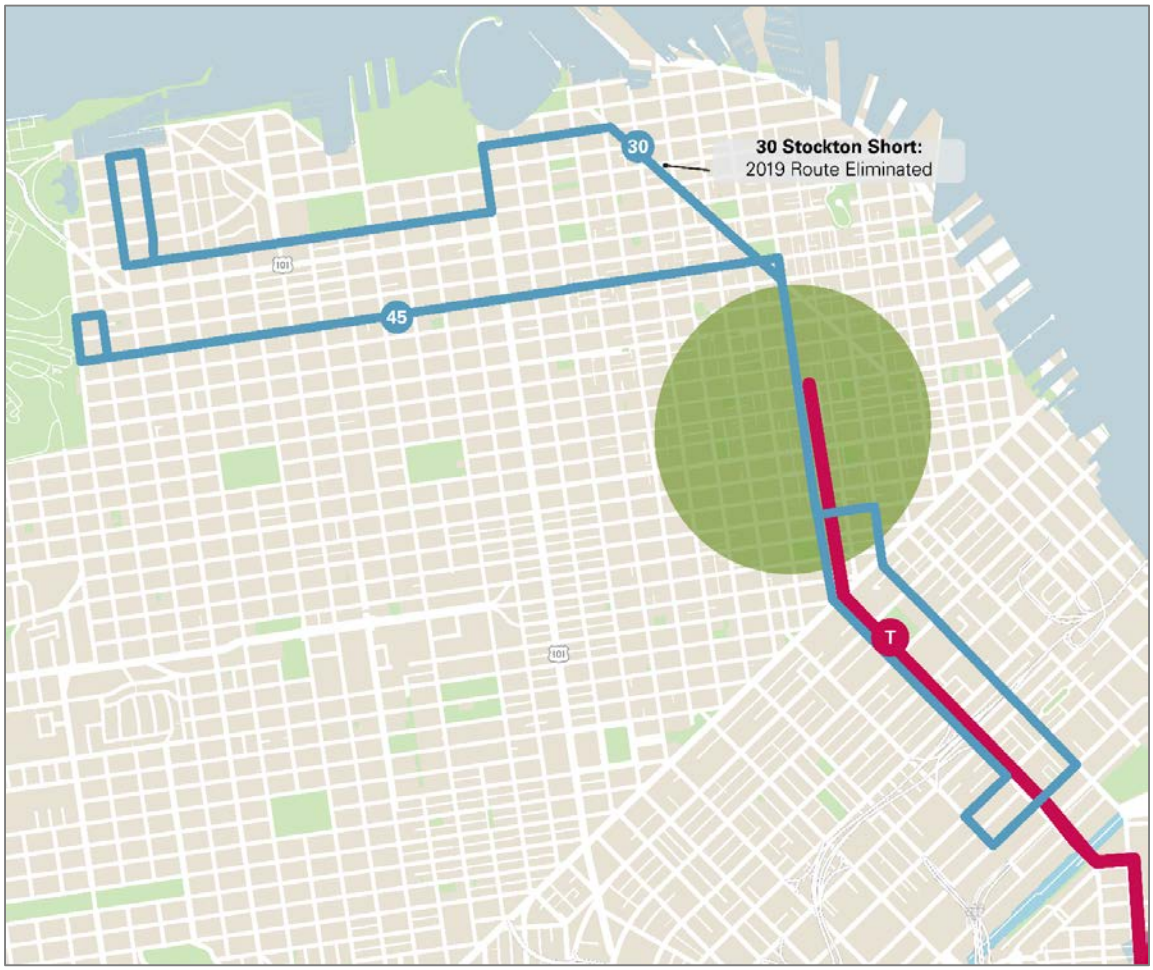
5.3 Central Subway Service Adjustments

The SFMTA's most prominent transit enhancement project is the Central Subway, a 1.7-mile extension of the existing Third Street light rail line to Chinatown that will greatly improve transportation to and from some of the City's busiest, most densely populated areas. This transformational project will provide direct connections to major retail, sporting, and cultural venues while efficiently transporting people to jobs, educational opportunities, and other destinations. With stops in South of Market (SoMa), Yerba Buena, Union Square, and Chinatown, the Central Subway will vastly improve transit options for the residents of these

neighborhoods. As illustrated in the map below in Figure 19, Chinatown is an Equity Strategy neighborhood, and this major capital investment in transit service will greatly benefit residents who depend disproportionately on transit to get around the City. Construction began on the subway tunnels in 2013, and the Central Subway is scheduled to open in 2019.

Once the Central Subway is in service, SFMTA will implement changes to the 30 and 45 lines to connect to the new subway stations and take advantage of operational efficiencies that are possible with the addition of rail service. The 30 Stockton short line will be discontinued and local bus service will be designed to complement the light rail service. The 30 Stockton long line and 45 Union-Stockton will continue to provide connections from the Marina and Cow Hollow neighborhoods, through North Beach and Chinatown, to South of Market.

Figure 19: Central Subway 2019 Map



Note: Areas in green are neighborhoods identified in the SFMTA Equity Strategy

Table 14: Central Subway Bus Service Plan

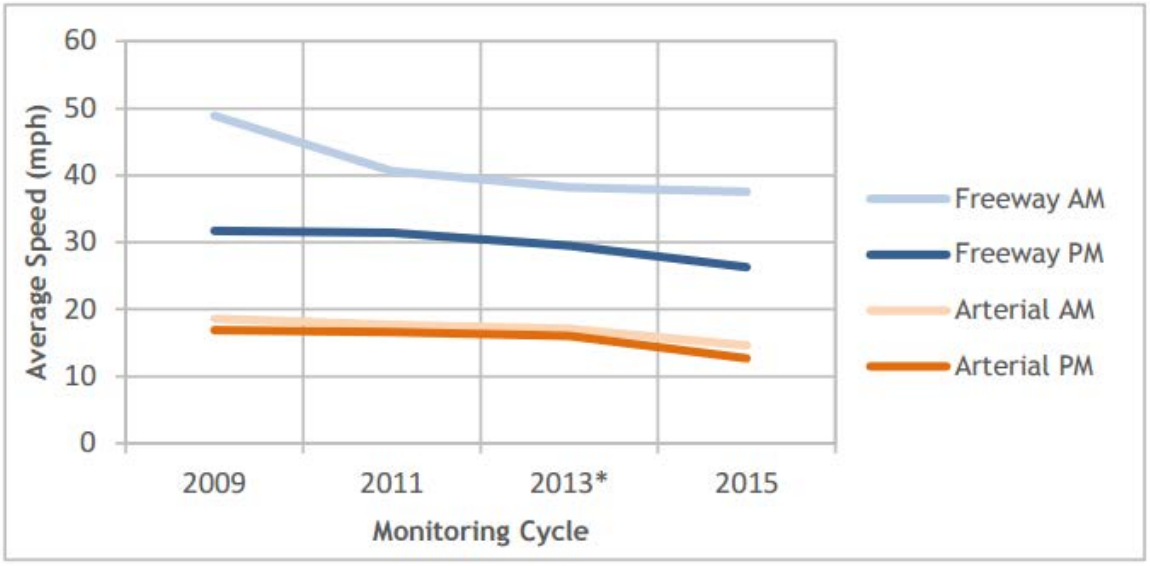
Route #	Description	Current Peak Vehicle Demand	Proposed Peak Vehicle Demand	Implementation Year
30	8-9 min frequency	10 40ft TC	9 40ft TC 7 60ft TC	2019
30 Short	Eliminated due to opening of Central Subway	15 60ft TC	-	2019
45	8-9 min frequency	13 40ft TC	12 40ft TC	2019

5.4 Background Growth and Congestion Delay

San Francisco's strong economic growth has led to increased traffic congestion, with more vehicles registered in the City than ever before. Even as a higher share of people are using transit and other alternatives to driving to get to work than at any time in the past five decades,[10] overall population and job growth has put more vehicles on the road, increasing traffic delay on Muni routes. As shown in the chart below, the San Francisco County Transportation Authority's (SFCTA) analysis of traffic data shows a 20.6 percent decrease in average travel speed on arterial streets in San Francisco between 2009 and 2015, where many Muni routes operate. While it is SFMTA's policy to protect as much of the Muni network as possible from traffic congestion, there are still many corridors where the buses are operating in mixed traffic conditions. As a result, SFMTA has had to increase the number of vehicles on certain routes that do not have protection from traffic to provide the same level of service that existed previously. This trend is likely to continue as the City grows in the coming decades, and will particularly affect routes that operate in congested corridors that do not have transit priority treatments.

[10] MTC's Vital Signs, http://www.vitalsigns.mtc.ca.gov/commute-mode-choice

Figure 20: SFCTA Travel Speed Model



Source: SFCTA Congestion Management Program 2015

In addition to delay, some additional capacity on transit vehicles will also be needed to service the "background growth" happening in many San Francisco neighborhoods where smaller-scale infill development is adding more residents, and demand for transit, outside of the major developer project areas. In some instances, this growth can be accommodated by shifting resources from underutilized routes and in other instances the background growth is also captured in other investments cited above (e.g., Rapid bus expansion). However, we have included a small placeholder for background growth as we anticipate an incremental need for more vehicles, or switching from 40ft to 60ft buses to meet increased demand.

5.5 Service Plans for Major Development Projects

As discussed in Section 4.4.1, these development projects – Hunters Point Shipyard, Candlestick Point, Treasure Island, Parkmerced, Mission Bay and Pier 70 are promising significant jobs and housing group in these neighborhoods. The following section details the service plans for these projects that are in the pipeline through 2030.

5.5.1 Hunters Point Shipyard/Candlestick Point Service Plan

Candlestick Point and Hunters Point are currently being redeveloped by a single developer. The project will include an expected 12,300 residential units, 20,000 square feet of retail, 440 hotel rooms, over 5 million square feet of commercial/R&D space, over 400,000 square feet of community facilities and school space, and extensive new parks/open space facilities.[11] On-site transit facilities to be built by the developer will include a Hunters Point Transit Center and exclusive transit lanes that can be used by BRT and other service.

The transit plan includes extensive service increases, including new Geneva-Harney BRT service, shown in Figure 21, which will connect the development project to major regional

[11] FivePoint is currently in the process of revising and increasing their land use assumptions for Hunters Point. To the extent that this adds additional vehicle requirements, we will capture it in future updates of the Fleet Plan.

transit hubs at the Caltrain Bayshore Station and Balboa Park Station. The BRT may be served by extending the current 28R 19th Avenue Rapid into the development or by a new route between Balboa Park Station and Hunters Point. The service plan also calls for several routes to be extended into the development area, including the 24,[12] 29, 44 and 19. Finally, the service plan includes two new express routes (HPX, CPX) that will provide peak service to and from downtown San Francisco. At build out, the plan is anticipated to require approximately 50 new peak period buses, with a mix of 40ft and 60ft hybrid buses. As illustrated in Figure 21 below, these service enhancements will also benefit several Equity Strategy neighborhoods through increased frequency.

Figure 21: Candlestick Point/Hunters Point 2030 Map

Note: Areas in green are neighborhoods identified in the SFMTA Equity Strategy

[12] The plan's phasing calls for the 24 to be extended into the site by 2030, when the developer extends the overhead infrastructure. Earlier phases of the plan call for the 23 Monterey to be extended to provide connectivity to Mission Street and Muni Metro at St. Francis Circle.

Table 15: Candlestick Point/Hunters Point Bus Service Plan Present-2030

Route	Description	Current Peak Vehicle Demand	Proposed Peak Vehicle Demand	Implementation Year
Candlestick Point				
29	Extension into Candlestick Point to serve planned retail center	19 40ft MC	21 40ft MC	2020
CPX	New express route to downtown from Candlestick Point	-	8 40ft MC	2021
28R	Geneva-Harney BRT: extension into Candlestick Point, frequency increase from 10 min to 8 min	11 40ft MC	19 40ft MC	2023
29	Peak frequency to increase from 10 minutes to 5 minutes.	21 40ft MC	28 40ft MC	2023
CPX	Upgrade to 60ft hybrid buses	8 40ft MC	8 60ft MC	2025
28R	Upgrade to 60ft hybrid buses, frequency increase from 8 min to 5 min	19 40ft MC	23 60ft	2030
Hunters Point				
19	Extension into Hunters Point	10 40ft MC	12 40ft MC	2020
HPX	New express route to downtown from Hunters Point	-	10 40ft MC	2023
44	Extension into Hunters Point	23 40ft MC	25 40ft MC	2024, 2025
23	Temporary extension of 23 to Hunters Point (replaced by 24 extension in 2030)	6 40ft MC	8 40ft MC	2025-2030
19	Peak frequency increase from 15 min to 10 min	12 40ft MC	16 40ft MC	2025
24	Extension into Hunters Point, peak frequency increase from 10 min to 7.5 min	15 40ft TC	15 40ft TC 10 40ft buses	2030
44	Upgrade to 60ft hybrid buses	25 40ft MC	25 60ft MC	2030
HPX	Peak frequency increase from 15 min to 10 min	10 40ft MC	14 40ft MC	2030

5.5.2 Treasure Island Service Plan

Treasure Island is a repurposed military base that will be redeveloped to add 8,000 residential units, 500 hotel rooms, 140,000 square feet of retail and 100,000 of office space, and extensive parklands and open space.[13] The neighborhood will be centered on a new

[13] http://www.sfcta.org/TIMMA_FAQ

transit hub served by ferries, on-island shuttle service, and bus service to San Francisco and the East Bay.

The 25 Treasure Island route will be converted to a point-to-point route between the Transit Center and the Transbay Terminal, and circulation on the island will be provided by a developer sponsored shuttle system. Peak bus demand off the island to San Francisco is expected to increase by over 300 percent. As a result, SFMTA is planning to shift from a 15-minute to a 5-minute headway on the 25 Treasure Island and to convert from 40ft buses to 60ft buses. The route will have a dedicated off-ramp from the bridge to the upper deck of the terminal.

The Treasure Island transportation plan also includes a second route connecting the island transit center to the Civic Center. This route is not anticipated to be needed until 2030. As the Island develops we anticipate learning more about origin-destination patterns and will determine closer to 2028 if an additional route to a second transportation hub is warranted versus increased service on the 25 Treasure Island route.

Figure 22: Treasure Island 2030 Map

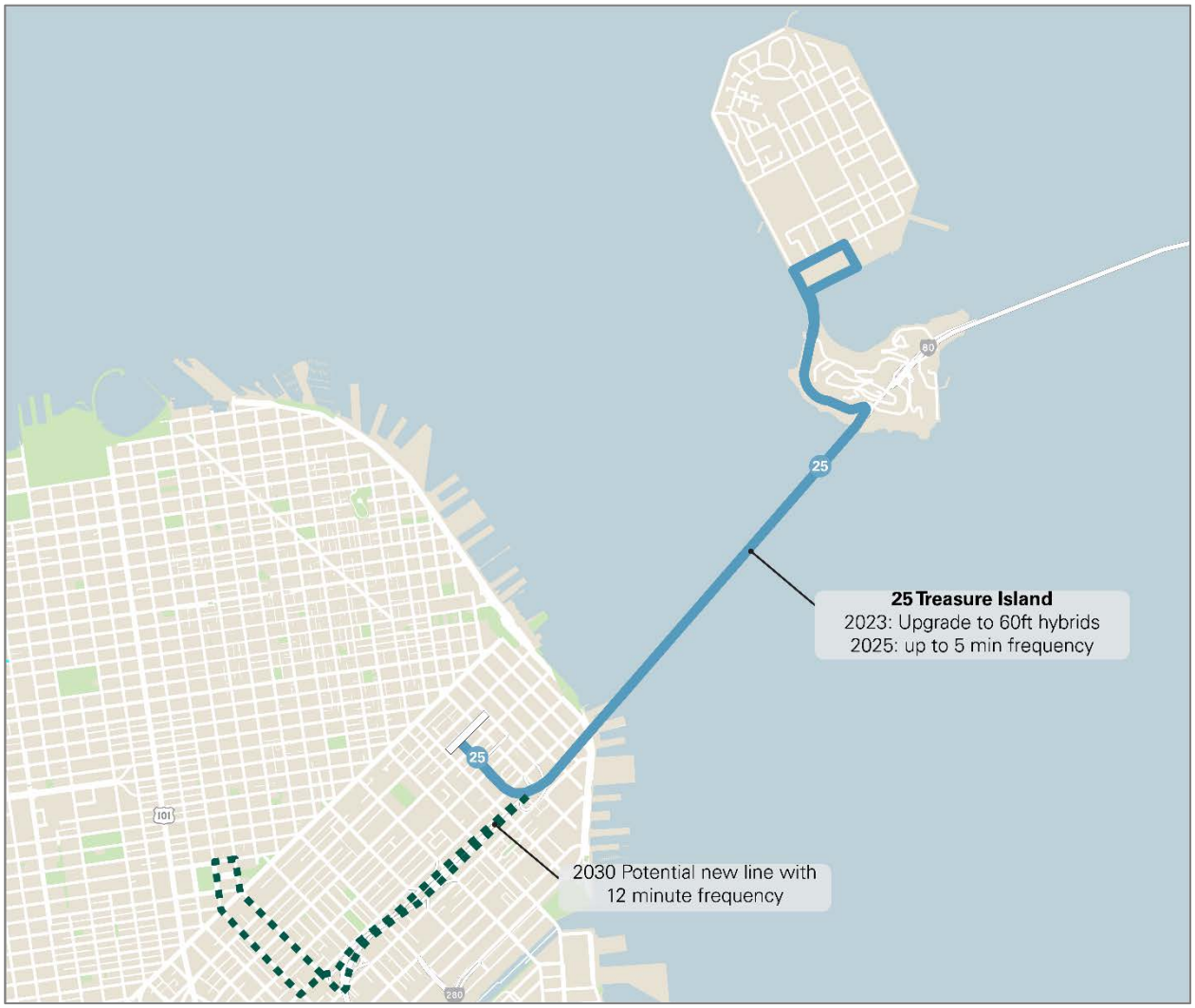


Table 16: Treasure Island Bus Service Plan Present-2030

Route	Description	Previous Peak Vehicle Demand	Proposed Peak Vehicle Demand	Implementation Year
25	New point to point service between the bus/ferry terminal on the Island and the new upper deck of the Transbay Terminal.	3 40ft MC	6 60ft MC	2023 for upgrade to 60ft buses 2025 for service increase
TBD	Potential new route depending on growth to Civic Center or other major destination	-	4 40ft buses	2030

5.5.3 Parkmerced Service Plan

Parkmerced is a 152-acre site that will be redeveloped by a single developer to add approximately 5,700 net new housing units and up to 310,000 square feet of commercial use. The project will increase demand for transit service within San Francisco, which will primarily be addressed through increased capacity on the M-line, as well as a free shuttle to Daly City BART, provided by the developer. Additional vehicles were also assumed for the 28 19th Avenue to address crowding and/or potential delays by 2020.

Table 17: Parkmerced Bus Service Plan Present-2030

Route	Description	Current Peak Vehicle Demand	Proposed Peak Vehicle Demand	Implementation Year
28	Additional buses for potential increase in demand	15 40ft MC	17 40ft MC	2020

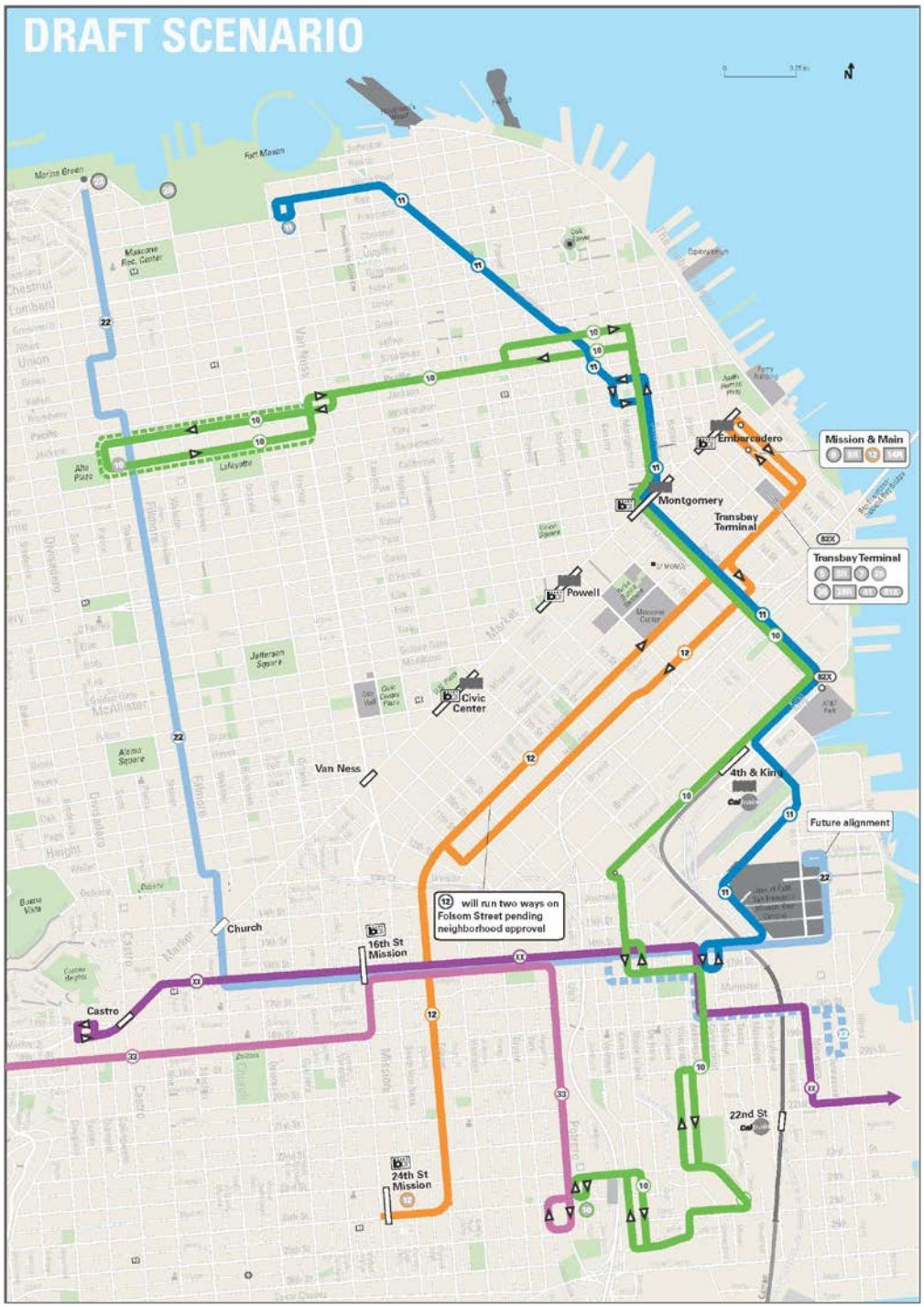
5.5.4 Eastern Neighborhoods, Rincon Hill, and Transbay Center Service Plan

In addition to the major development plans discussed above, there are several area plans that are anticipated to generate a significant increase in bus ridership. Approved plans (e.g. Transbay Center District, Rincon Hill, Eastern Neighborhoods and Mission Bay) are building out and additional development is under discussion in these neighborhoods. Significant transportation investments are needed in these neighborhoods to meet this demand. An interconnected system of routes is anticipated to be modified to provide new connections and support the increased demand generated in this area.

In Mission Bay, the 22 Fillmore will be extended to provide service into the neighborhood, replacing the existing 55 16th Street hybrid bus service. A short-line version of the 22 will also operate during the peak hour to increase capacity on 16th Street, with 60ft trolley buses. A new service will be introduced in Potrero Hill to replace the service currently provided by Route 22 in Potrero Hill and the Dogpatch, and is also being evaluated to provide a new connection to the redevelopment project at Pier 70. Outreach is planned for summer and fall 2017 to solidify the service plan in the Rincon Hill, Mission Bay, Dogpatch and Potrero Hill

neighborhoods. In addition to the service described above, preliminary proposals include increasing frequency on the 10 Townsend, creating a new route to connect Mission Bay to the financial district and Potrero Hill, and rerouting the 12 Folsom to Rincon Hill.

Figure 23: Eastern Neighborhoods, Rincon Hill, Transbay Center Map DRAFT



6. Peak and Total Vehicle Demands

Based on the ridership growth trends discussed in Section 4 and the service plans discussed in Section 5, the following sections outlines the agency's plan for allocating resources to accommodate the growth and construction while balancing the need to maintain a 20% spare ratio for the rubber tire fleet.

6.1 Upcoming Fleet Transitions and Construction Support

SFMTA determines total vehicle needs based on the peak service demands, along with the needs of the capital program and major construction efforts. SFMTA is currently in a period of unprecedented construction and anticipates needing vehicles to support motorization of rail and trolley routes through 2019. Major projects are listed in Table 18:

Table 18: Construction Projects 2017-19

Route	Project	Peak Vehicles	Timeline
10-15 day major rail motorization for Twin Peaks, Warriors, Islais Creek Bridge, Cable Car Gear Box and Inner Sunset Improvement Project		10-50 buses	Present-Fall 2019
L Taraval	Rerailing, sewer, water, paving, Muni Forward	15 60ft buses	Summer 2018-Summer 2019
T Third (southern portion)	Replacement of the Islais Creek Bridge	13 60ft buses	3-4 months (date TBD)
6 Haight-Parnassus	Haight Street paving project	12 40ft buses	Present – Summer 2018
49 Van Ness	Van Ness Improvement Project	21 60ft buses	Present – Fall 2019

The next few years are a transition period for SFMTA. In addition to the construction, by March 2018 SFMTA will increase its fleet of 60ft hybrids from 180 to 224. A portion of these vehicles will replace 40ft buses on the 1AX California Express and will enable service to be shifted to the 38R Geary Rapid and 8 Bayshore routes. The majority of the extra vehicles will initially go towards supporting the L Taraval motorization and other major rail construction planned in 2018 and 2019 including Twin Peaks track replacement, building the Warriors platform, and the Inner Sunset Improvement Project. SFMTA is also using 60ft hybrids to motorize the 49 Mission-Van Ness as part of the Van Ness Improvement Project.

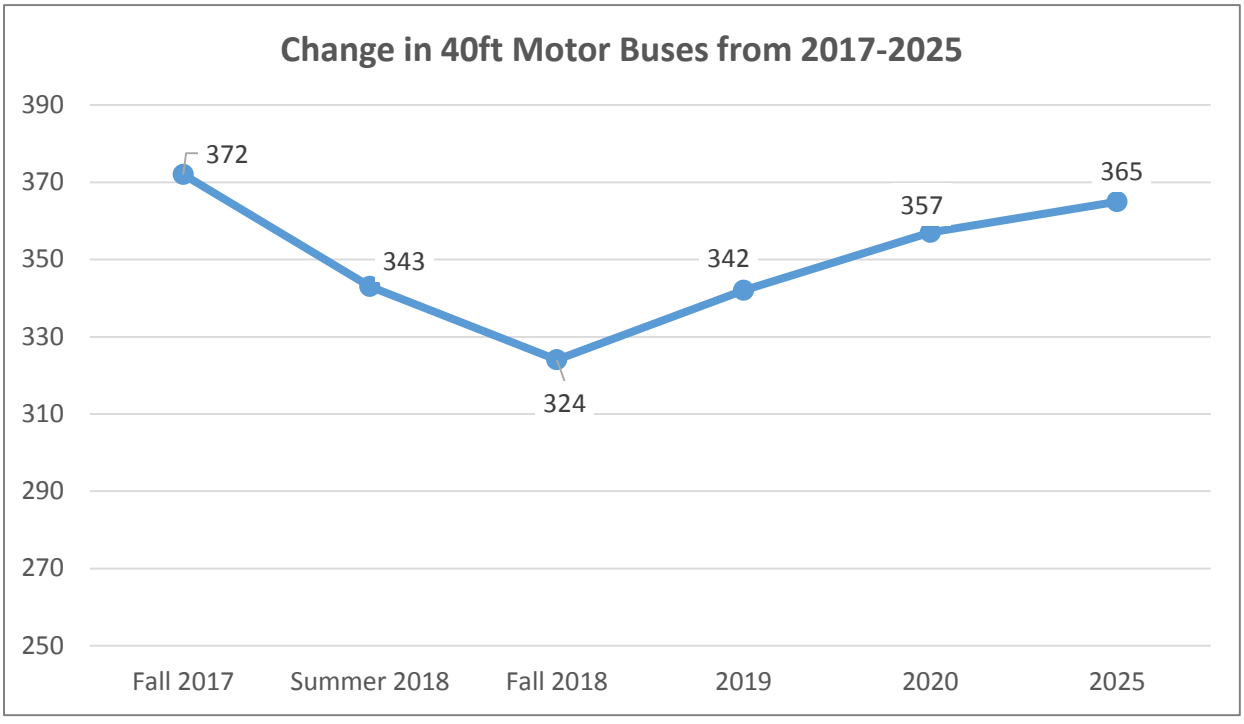
As the construction projects reach completion, SFMTA plans to upgrade the 9R San Bruno Rapid to 60ft buses (fall 2018), the 7R Haight-Noriega Rapid (fall 2019) and the 47 Van Ness (fall 2019) as described in Table 19. These routes were selected based on current and estimated ridership growth and as a cost effective way to increase capacity.

Table 19: 40ft to 60ft hybrid bus conversions

40 to 60ft Conversions	When	Where do the buses come from?
9R San Bruno Rapid	Fall 2018	Buses will be available after the completion of major rail motorizations including Warriors, Twin Peaks, Sunset Improvement Project (Irving)
7R Haight-Noriega Rapid	Fall 2019	Buses will be available after the completion of the L Taraval motorization for the Muni Forward and infrastructure replacement project (note: Route 7 already uses 60ft buses on weekends)
47 Van Ness	Fall 2019	Buses will be available when VN Improvement Project construction is completed and trolley service is restored on Route 49

As the 60ft hybrid fleet increases, the 40ft hybrid fleet will initially contract. The SFMTA currently has 372 40ft motor buses. This number is expected to decline to 324 in 2018 as the Haight Street paving project and the major rail motorizations wind down. The total number will come back up in 2019 and 2020 as new vehicles are purchased, capping at 365 in 2025.

Figure 24: Changes in 40ft Motor Bus Fleet from 2017 through 2025



The SFMTA is also in the process of replacing its 60ft trolley fleet and will receive 33 additional buses by March 2018. These buses will go on busy routes, such as the 5R Fulton

Rapid and the 30 Stockton to cost effectively increase capacity. At the end of 2019 they will also be used on the 49 Van Ness-Mission Route at the completion of the Van Ness Improvement Project. However, until that project is completed, SFMTA will carry an elevated spare ratio on the 60ft trolley subfleet. The SFMTA is in the process of reducing the size of the 40ft trolley fleet to better correlate with demand. The fleet was recently reduced from 239 to 202 and will be further reduced to 185 by 2019.

Table 20: 40ft to 60ft hybrid bus conversions

Route	Buses	Description
5R Fulton Rapid	7 (6 peak)	All 60ft trolleys on 5R Fulton Rapid
22 Fillmore	9 (7 peak)	Introduce new shortline from Geary to Mission Bay
30 Stockton	17 (14 peak)	60ft trolleys on 30 long line in the Marina.
49 Van Ness-Mission	25 (21 peak)	Route 49 converted back to trolley when VN construction is complete. Some vehicles from the 30 Stockton shortline shift to Route 49 after Central Subway.

6.2 Spare Ratio

SFMTA currently has a combined 26 percent spare ratio on the 40 and 60ft rubber tire fleet and anticipates that the spare ratio will be reduce to 20 percent by the end of 2019. SFMTA has taken several actions to reduce its spare ratio including:

- Implementing 1 for 1 vehicle replacement as new buses arrive
- Reducing the 40ft motor bus and trolley fleet

By the end of 2019 (with the completion of the Van Ness Improvement Project), the spare ratio for all our large fleets will be 20 percent. The 32ft motor bus fleet will be at 30 percent, which is also consistent with FTA's requirements for fleet sizes smaller than 50. Below is a summary of peak vehicle and total vehicle needs, along with maintenance spares through 2030.

Table 21: Peak Vehicle Demand and Spare Ratios, 2017-2030

Total 40ft and 60ft Fleet	Winter 2017	Fall 2018	Fall 2019	Fall 2020	2025	2030
Peak vehicle demand	607	620	678	702	747	792
Add'l Peak Demand (motorization)	42	44	15	0	0	0
Maintenance demand (20%)	130	133	139	140	149	158
Capital Program Support			10	15	15	15
Total Vehicle Demand	779	797	842	857	911	965
Total Fleet Size	815	826	844	859	912	967
Spare Ratio	26%	24%	20%	20%	20%	20%

7. Vehicle Procurement Plan

SFMTA has modernized its procurement program over the past five years with the goal of stabilizing the average age of the bus fleet, continuing to support San Francisco's environmental policies and anticipate and accommodate vehicle expansion and fleet mix needs. SFMTA's Fleet Engineering team approaches each procurement by preparing performance based specifications that prioritize vehicle safety and reliability and encourage industry innovation and maintainability through proven design and commonality of replacement parts.

The following sections describe the procurements underway, as well as upcoming and future planned procurements. Additionally, this section outlines the new mid-life overhaul program, which is a key component of the overall robust maintenance standards and practices established in 2014 including maintaining or exceeding Original Equipment Manufacturer (OEM) schedules and update practices based on fleet trends.

7.1 Procurements Underway

The current round (2015-2019) of rubber tire procurement has been staggered over several years with the intent of dropping the average fleet age from a high of 12 years in 2014 to an overall average age of five to eight years. By March 2018, all 60ft trolley replacements, 40ft hybrid bus replacements and 60ft hybrid buses (replacements and expansion) in the current round of procurement will arrive. Below is a summary of the current procurement:

Table 22: Summary of Current Procurement

SR	Length (ft)	Bus #	Quantity	Propulsion Type	Arrival Date
1849	60	7201-7260	60	Trolley	Mar 2015
1907	60	6500-6554	55	Hybrid	Apr 2015
1955	60	6700-6705	6	Hybrid	Dec 2015
1961	60	6560-6584	25	Hybrid	Jan 2016
1962	60	6706-6730	25	Hybrid	Apr 2016
1963	40	8824-8847	24	Hybrid	May 2016
1964	40	8800-8823	24	Hybrid	May 2016
2043	40	8848-8901	54	Hybrid	Oct 2016
2044	60	6585-6628	44	Hybrid	Sep 2016
2116	60	6629-6697	69	Hybrid	May 2017
2117	40	8902-8969	68	Hybrid	2018
2118	40	8751-8780	30	Hybrid	Jun 2017

7.2 Planned Procurements

Staff is preparing a new RFP for 32ft motor bus replacements. This procurement will be bundled with an additional 45 40ft buses to arrive in 2019 and 2020.

After 2020, the next procurement is expected to be a multi-year program that includes replacing the New Flyers purchased from 2013-2018 and purchasing expansion vehicles to accommodate the service expansion needs described in Section 5. Due to the increasingly innovative battery-electric bus industry and the declining market for trolley buses, it is likely that the current replacement cycle will be the last trolley procurement. Tables 23-24 details the procurement breakdown by year.

Table 23: 40ft, 60ft Hybrid Bus Planned Procurements

	32ft Hybrid Bus		**40ft Hybrid Bus**		**60ft Hybrid Bus**	
	Replacement	Expansion	Replacement	Expansion	Replacement	Expansion
2017	-	-	76	-	76	-
2018	-	-	68	-	21	-
2019	30	-	-	30	-	-
2020	-	-	-	15	-	-
2023	-	-	80	-	-	25
2024	-	-	-	8	-	20
2025	-	-	32	-	-	-
2026	-	-	-	-	48	-
2027	-	-	41	-	79	-
2028	-	-	-	-	76	-
2029	-	-	91	-	-	35
2030	-	-	68	-	21	20
Total	**30**	**-**	**456**	**53**	**321**	**100**

Table 24: 40ft, 60ft Trolley Bus Planned Procurements

	40ft Trolley Bus		**60ft Trolley Bus**	
	Replacement	Expansion	Replacement	Expansion
2017	2	-	20	-
2018	104	-	13	-
2019	79	-	-	-
2030	-	-	12	-
Total	**185**	**-**	**45**	**-**

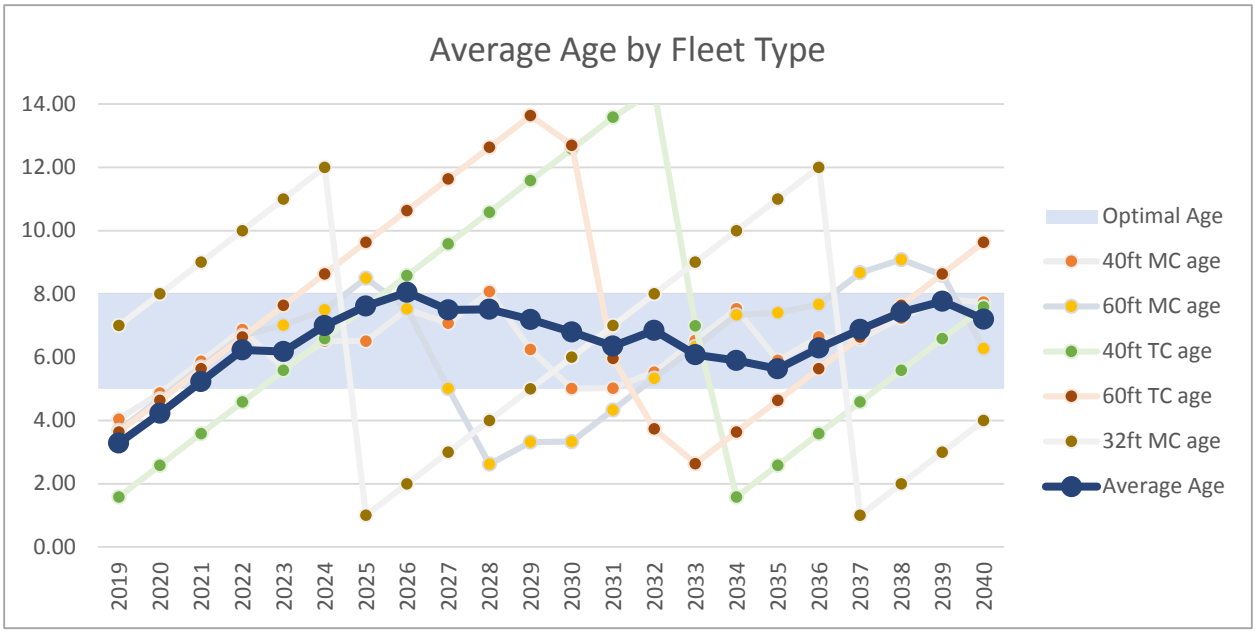
7.3 Average Fleet Age

Over the past four years, SFMTA has retired 273 vehicles and continues to retire vehicles on a one-for-one basis as new vehicles arrive. See Appendix A for the retirement breakdown by year and vehicle type. Vehicles are prioritized for retirement based on age of the asset, low miles between failures, and/or repetitive or major breakdowns.

When the current fleet program started, SFMTA had one of the oldest fleets in the country; however, through various interventions we have been able to reduce and stabilize the average age of the fleet. The agency's goal is to stabilize the average age of the fleet within a 5-8 year window to avoid major fluctuations in vehicle reliability and maintenance resource demands.

Beginning in 2013, SFMTA took several key steps to lower and stabilize the average age of the fleet. This work will continue through 2030. Figure 25 tracks the average age of the fleet by vehicle type and average age of the rubber tire fleet.

Figure 25: Average Age of Fleet (2019-2040)



8. Summary of Maintenance Facilities

SFMTA currently has five fully operational bus maintenance facilities. Additionally, the Agency conducts bus acceptance at Marin Yard and conducts limited storage and washing/fueling functions at Islais Creek. Later this year Islais Creek is scheduled to open as a full maintenance and operations facility, which will support the procurements underway, including growing the 60ft motor bus fleet to 224 vehicles by early 2018.

Table 25: List of Facilities and Functions

Division/Facility	Year Open	Function/Vehicle Types
Presidio	1912	40ft trolley buses
Potrero	1914	40ft and 60ft trolley buses
Kirkland	1950	40ft buses
Woods	1974	40ft buses
Flynn	1989	60ft buses
Marin	1990	Bus acceptance only
Islais Creek	2017 (construction)	40ft and 60ft buses

Figure 26: Map of Facilities and Divisions

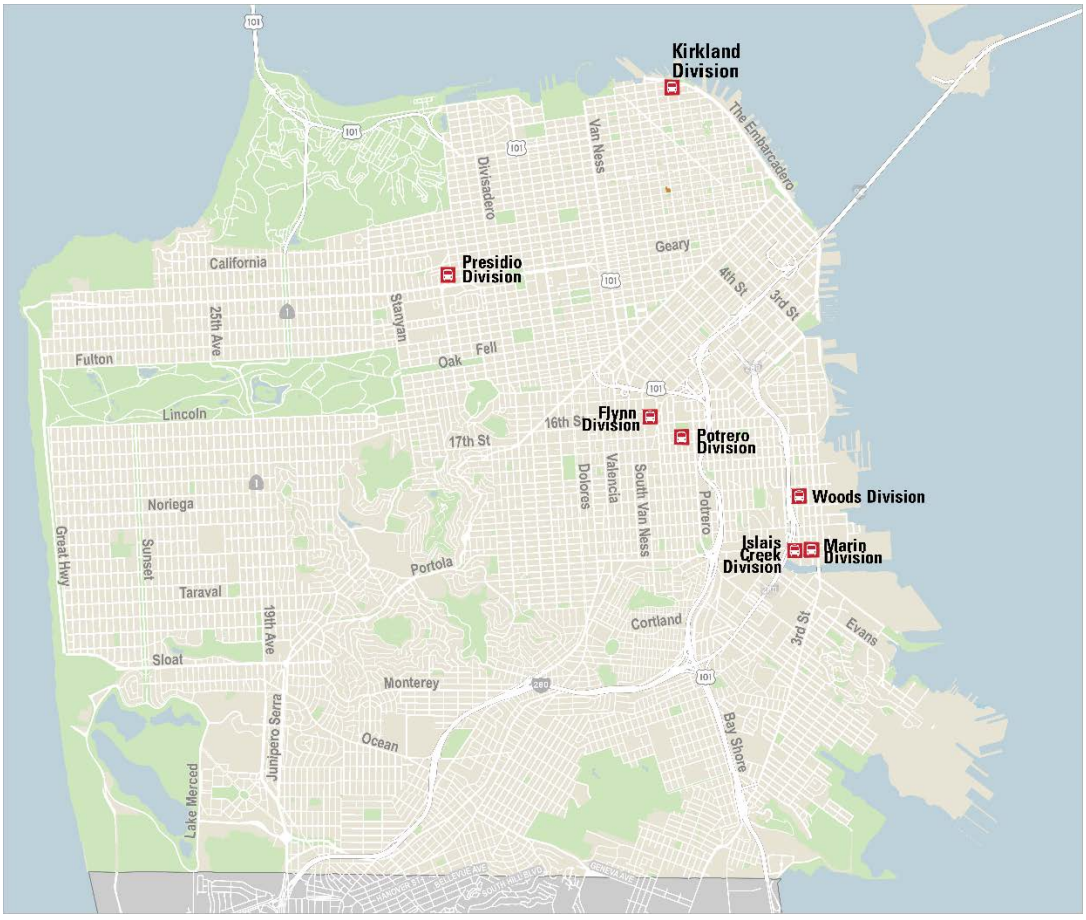


Table 26 describes the maintenance functions that are currently carried out at each division. It ranges from limited maintenance functions at facilities such as 1399 Marin and Islais Creek to the Woods facility, which performs everything from running and heavy repair to body paint.

Table 26: Divisions and Maintenance Features

Division/ Facility	Running Repair	Heavy Duty	Unit Repair	Fuel & Service	Body Shop	PM Dept.	WC Room	Steam Clean	Body Area Lt.	Paint Booth	Fuel Lanes	Yard Shack	Washing Lanes	# of Pits	# of Hoists
1399 Marin	Y	N	N	Y	N	Y	N	N	Y	N	2	N	1	0	7
Islais Creek (now)	Y	N	N	Y	N	N	N	N	Y	N	3	Y	3	0	1
Kirkland	Y	N	N	Y	N	Y*	N	Y	Y	N	2	N	1	3	0
Flynn	Y	Y	N	Y	N	Y	N	Y	Y	N	2	Y	2	1	11
Woods	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	3	Y	2	8	23
Potrero	Y	Y	N	N	Y	Y	N	N	N	N	0	Y	1	6	0
Presidio	Y	Y	N	N	N	Y	N	N	Y	N	0	Y	1	2	4
Islais Creek (mid 2017)	Y	Y	N	Y	N	Y	N	Y	Y	N	3	Y	3	0	12

* Kirkland maintenance yard cannot lift a bus so PM work is slightly impacted, some PM work is sent to Woods for Heavy Duty shop to complete

Many of SFMTA's facilities are overcrowded and current storage needs exceed their design capacity. Furthermore, we are currently expanding our 60ft hybrid fleet and project future vehicle growth to accommodate the growing and changing travel patterns to, from and within San Francisco (shown in Sections 4 and 5). Finally, three of our facilities are at the end of their useful life and need to be rebuilt. Some of the near-term fleet expansion will be addressed by the full opening of Islais Creek in late 2017.

SFMTA is in the process of developing and implementing a 20-year facility program designed to accommodate growing fleet needs and to modernize our oldest facilities. The Facility Assessment and Workspace Planning document produced in January 2017 lays out a roadmap for selecting a facility expansion preferred scenario and initiating work in early 2018. The Facility Assessment builds on the 2013 Real Estate and Facilities Vision for the 21st Century and the 2014 Addendum (Vision Report).

At the time this document is being published, SFMTA has narrowed its facilities approach from five to two scenarios. Both scenarios accommodate expanded vehicle sub-fleets, particularly motor coaches, as well as replace some of the oldest transit storage and maintenance facilities in the country at Presidio and Potrero facilities over a timeline of 25 years. Scenario 1 assumes

a new facility would be created for motor bus and other facility needs. Scenario 2 focuses on more dense development of the Presidio and Potrero sites that are rebuilt as multi-level facilities and the introduction of a temporary bus facility at the Muni Metro East rail yard during the rebuilding process. Further details of the facilities modernization and expansion can be found in the *Facility Assessment*. The program is currently entering the environmental review process, with the first projects entering design in 2019, and the final projects of this phase complete in 2031. The Facility Assessment will be updated every five years to describe and plan for the next phase of SFMTA's facility capital program.

Appendix A: SFMTA Rubber Tire Retirement Plan (Present-2019)

	40ft Gilligs	60ft Neoplans	40ft Nabis	40ft Neoplans	40ft ETIs	60ft ETIs	32ft Orions	40ft Orions	60ft Old NF	Annual Total
Pre2015	45	3	15	2	1	0	0	0	32	**98**
2015	0	1	2	0	0	0	0	0	28	**31**
2016	0	66	28	28	17	33	0	0	0	**172**
2017	0	54	0	83	24	0	0	0	0	**161**
2018	0	0	0	92	111	0	0	44	0	**247**
2019	0	0	0	0	87	0	30	12	0	**129**
Total	45	124	45	205	240	33	30	56	60	**838**

SFMTA Spare Ratio Adjustment Program

60ft Motor Coach	Winter 2017	Fall 2018	Fall 2019	Fall 2020	2025	2030
Peak vehicle demand	124	151	172	187	225	271
Add'l Peak Demand (motorization)	21	36	15			
Maintenance demand (20%)	29	37	37	37	45	54
Midlife Overhaul/Campaigns						
Total Vehicle Demand	174	224	224	224	270	325
Total Fleet Size	181	224	224	224	269	324
Spare Ratio	25%	20%	20%	20%	20%	20%

40ft Motor Coach	Winter 2017	Fall 2018	Fall 2019	Fall 2020	2025	2030
Peak vehicle demand	292	262	276	285	292	291
Add'l Peak Demand (motorization)	21	8				
Maintenance demand (20%)	63	54	55	57	58	58
Midlife Overhaul/Campaigns			10	15	15	15
Total Vehicle Demand	372	324	341	357	365	364
Total Fleet Size	372	324	342	357	365	365
Spare Ratio	19%	20%	20%	19%	19%	19%

60ft Trolley Coach	Winter 2017	Fall 2018	Fall 2019	Fall 2020	2025	2030
Peak vehicle demand	45	72	77	77	77	77
Add'l Peak Demand (motorization)						
Maintenance demand (20%)	9	14	15	15	15	15
Midlife Overhaul/Campaigns						
Total Vehicle Demand	54	86	92	92	92	92
Total Fleet Size	60	93	93	93	93	93
Spare Ratio	33%	29%	21%	21%	21%	21%

40ft Trolley Coach	Winter 2017	Fall 2018	Summer 2019	Fall 2020	2025	2030
Peak vehicle demand	146	135	153	153	153	153
Add'l Peak Demand (motorization)						
Maintenance demand (20%)	29	27	31	31	31	31
Midlife Overhaul/Campaigns						
Total Vehicle Demand	175	162	184	184	184	184
Total Fleet Size	202	185	185	185	185	185
Spare Ratio	38%	37%	21%	21%	21%	21%

Total 40 and 60 ft Fleet	Winter 2017	Fall 2018	Fall 2019	Fall 2020	2025	2030
Peak vehicle demand	607	620	678	702	747	792
Add'l Peak Demand (motorization)	42	44	15	0	0	0
Maintenance demand (20%)	130	133	139	140	149	158
Midlife Overhaul/Campaigns			10	15	15	15
Total Vehicle Demand	779	797	842	857	911	965
Total Fleet Size	815	826	844	859	912	967
Spare Ratio	26%	24%	20%	20%	20%	20%

30ft Motor Coach	Winter 2017	Fall 2018	Fall 2019	Fall 2020	2025	2030
Peak vehicle demand	21	21	23	23	23	23
Add'l Peak Demand (motorization)						
Maintenance demand (30%)	4	4	5	5	5	5
Midlife Overhaul/Campaigns		2				
Total Vehicle Demand	21	23	23	28	28	28
Total Fleet Size	30	30	30	30	30	30
Spare Ratio	43%	43%	30%	30%	30%	30%

40 Foot Motor Coach																				
	Coach Number	Manfacturer	Year In Service	Type	Original Qty	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing Fleet	8101-8159	Neoplan	2002	Diesel	59	48														
	8305-8371	Neoplan	2003	Diesel	67	63	63													
	8160-8235, 8301-8304	Neoplan	2002	Diesel	80	64	29													
	8401-8456	Orion	2007	LF Hybrid	56	56	56	12												
	8601-8662, 8701-8730	New Flyer	2013	LF Hybrid	92	92	92	92	92	92	92	92	12	12						
	8731-8750	New Flyer	2014	LF Hybrid		20	20	20	20	20	20	20	20	20						
	8800-8855	New Flyer	2016	LF Hybrid		56	56	56	56	56	56	56	56	56	56	56				
Planned Procurements		New Flyer	2017	LF Hybrid			76	76	76	76	76	76	76	76	76	76	76	76		
		New Flyer	2018	LF Hybrid				68	68	68	68	68	68	68	68	68	68	68	68	
		TBD	2019	LF Hybrid					30	30	30	30	30	30	30	30	30	30	30	30
		TBD	2020	LF Hybrid						15	15	15	15	15	15	15	15	15	15	15
		TBD	2023	LF Hybrid									80	80	80	80	80	80	80	80
		TBD	2024	LF Hybrid										8	8	8	8	8	8	8
		TBD	2025	LF Hybrid											32	32	32	32	32	32
		TBD	2027	LF Hybrid													41	41	41	41
		TBD	2029	LF Hybrid															91	91
		TBD	2030	LF Hybrid																68
Fleet Statistics				Total Vehicles at Start of Calendar Year		373	399	392	324	342	357	357	357	357	365	365	365	350	350	365
				Vehicles Replaced		56	76	68					80		32		56		76	68
				Expansion/Contraction					30	15				8						
				Total Fleet		399	392	324	342	357	357	357	357	365	365	365	350	350	365	365
				Average Vehicle Age (Years)		9.0	7.0	3.7	4.0	4.9	5.9	6.9	5.6	6.5	6.5	7.5	7.1	8.1	6.2	5.0

60 Foot Motor Coach																				
	Coach Number	Manfacturer	Year In Service	Type	Original Qty	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing Fleet	6200-6225	Neoplan	2002	Diesel	26	10														
	6226-6299, 6401-6424	Neoplan	2003	Diesel	98	44														
	6500-6547	New Flyer	2015	LF Hybrid		48	48	48	48	48	48	48	48	48	48					
	6548-6585, 6700-30	New Flyer	2016	LF Hybrid		79	79	79	79	79	79	79	79	79	79	79				
Planned Procurements		New Flyer	2017	LF Hybrid			76	76	76	76	76	76	76	76	76	76	76			
		New Flyer	2018	LF Hybrid				21	21	21	21	21	21	21	21	21	21	21	21	
		TBD	2023	LF Hybrid									25	25	25	25	25	25	25	25
		TBD	2024	LF Hybrid										20	20	20	20	20	20	20
		TBD	2026	LF Hybrid												48	48	48	48	48
		TBD	2027	LF Hybrid													79	79	79	79
		TBD	2028	LF Hybrid														76	76	76
		TBD	2029	LF Hybrid															35	35
		TBD	2030	LF Hybrid																41
Fleet Statistics				Total Vehicles at Start of Calendar Year		168	181	203	224	224	224	224	224	249	269	269	269	269	269	304
				Vehicles Replaced		76										48	79	76		21
				Expansion/Contraction		3	76	21					25	20					35	20
				Total Fleet		181	203	224	224	224	224	224	249	269	269	269	269	269	304	324
				Average Vehicle Age (Years)		5.2	1.9	2.7	3.7	4.7	5.7	6.7	7.0	7.5	8.5	7.5	5.3	3.2	3.8	3.8

40 Foot Trolley Coach																					
	Coach Number	Manfacturer	Year in Service	Type	Original Qty	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing Fleet	5401-5481	ETI	2001	Trolley	21	18														
	5401-5640	ETI	2002	Trolley	108	93	87													
	5482-5640	ETI	2003	Trolley	94	94	94	70												
	5482-5640	ETI	2004	Trolley	17	17	17	17												
Planned		New Flyer	2017	LF Trolley			2	2	2	2	2	2	2	2	2	2	2	2	2	2
		New Flyer	2018	LF Trolley				104	104	104	104	104	104	104	104	104	104	104	104	104
		New Flyer	2019	LF Trolley					79	79	79	79	79	79	79	79	79	79	79	79
Fleet Statistics					Total Vehicles at Start of Calendar Year	239	222	200	193	185	185	185	185	185	185	185	185	185	185	185
					Vehicles Replaced		2	104	79											
					Expansion/Contraction															
					Total Fleet	222	200	193	185	185	185	185	185	185	185	185	185	185	185	185
					Average Vehicle Age (Years)	14.5	15.2	7.7	1.6	2.6	3.6	4.6	5.6	6.6	7.6	8.6	9.6	10.6	11.6	12.6

60 Foot Trolley Coach																					
	Coach Number	Manfacturer	Year in Service	Type	Original Qty	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing Fleet	7000-7059	New Flyer	1994	Trolley	60															
	7101-7133	ETI	2002	Trolley	33															
	7201-7211	New Flyer	2015	LF Trolley		12	12	12	12	12	12	12	12	12	12	12	12	12	12	
	7212-7260	New Flyer	2016	LF Trolley		48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
Planned Procur	7261-7293	New Flyer	2017	LF Trolley			20	20	20	20	20	20	20	20	20	20	20	20	20	20
		New Flyer	2018	LF Trolley				13	13	13	13	13	13	13	13	13	13	13	13	13
		TBD	2030	TBD																12
Fleet Statistics					Total Vehicles at Start of Calendar Year	45	60	80	93	93	93	93	93	93	93	93	93	93	93	93
					Vehicles Replaced	48	20	13												12
					Expansion/Contraction															
					Total Fleet	60	80	93	93	93	93	93	93	93	93	93	93	93	93	93
					Average Vehicle Age (Years)	1.2	1.9	2.6	3.6	4.6	5.6	6.6	7.6	8.6	9.6	10.6	11.6	12.6	13.6	12.7

32 Foot Motor Coach																					
	Coach Number	Manfacturer	Year In Service	Type	Original Qty	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Existing Fleet	8501-8530	Orion	2007	LF Hybrid	30	30	30	30												
Plan		TBD	2019	LF Hybrid					30	30	30	30	30	30	30	30	30	30	30	30
Fleet Statistics					Total Vehicles at Start of Calendar Year	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
					Vehicles Replaced				30											
					Expansion/Contraction															
					Total Fleet	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
					Average Vehicle Age (Years)	10.0	11.0	12.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0

Entire Rubber Tire Fleet	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Total Vehicles at Start of Calendar Year	855	892	905	864	874	889	889	889	914	942	942	942	927	927	977
Vehicles Replaced	180	98	185	109	0	0	0	80	0	32	48	135	76	76	101
Expansion/Contraction	3	76	21	30	15	0	0	25	28	0	0	0	0	35	20
Total Fleet	892	905	864	874	889	889	889	914	942	942	942	927	927	977	997
Average Vehicle Age (Years)	9.12	7.35	4.48	3.28	4.23	5.23	6.23	6.18	7.00	7.61	8.05	7.58	7.68	7.35	6.95

Route	Vehicle Type				AM Peak Vehicles				PM Peak Vehicles			
	Existing (2017)	2020	2025	2030	Existing (2017)	2020	2025	2030	Existing (2017)	2020	2025	2030
1	T Std	T Std	T Std	T Std	28	28	28	28	30	30	30	30
1AX	M Std	M Artic	M Artic	M Artic	6	6	6	6	5	5	5	5
1BX	M Std, M Artic	M Artic	M Artic	M Artic	9	9	9	9	5	5	5	5
2 short	T Std	T Std	T Std	T Std	5	5	5	5	6	6	6	6
2	M Std	M Std	M Std	M Std	7	7	7	7	8	8	8	8
3	T Std	T Std	T Std	T Std	5	5	5	5	6	6	6	6
5R	T Std, T Artic	T Artic	T Artic	T Artic	27	27	27	27	20	20	20	20
5S	M Std	M Std	M Std	M Std	10	10	10	10	10	10	10	10
6	T Std	T Std	T Std	T Std	12	12	12	12	13	13	13	13
7	M Std	M Artic	M Artic	M Artic	14	14	14	14	15	15	15	15
7X	M Std, M Artic	M Std	M Std	M Std	12	12	12	12	9	9	9	9
8	M Artic	M Artic	M Artic	M Artic	38	42	42	44	40	44	44	46
9	M Std	M Std	M Std	M Std	12	12	12	12	12	12	12	12
9R	M Std	M Artic	M Artic	M Artic	16	16	16	16	16	16	16	16
10	M Std	M Std	M Std	M Std	10	18	18	18	11	19	19	19
11	M Std	M Std	M Std	M Std	-	13	13	13	-	13	13	13
XX	-	M Std	M Std	M Std	-	7	7	7	-	7	7	7
12	M Std	M Std	M Std	M Std	9	6	6	6	10	7	7	7
14	T Artic	T Artic	T Artic	T Artic	18	18	18	18	20	20	20	20
14R	M Artic	M Artic	M Artic	M Artic	17	17	20	20	17	17	20	20
14X	M Artic	M Artic	M Artic	M Artic	10	10	10	10	10	10	10	10
18	M Std	M Std	M Std	M Std	4	4	4	4	4	4	4	4
19	M Std	M Std	M Std	M Std	10	12	16	16	10	12	16	16
21	T Std	T Std	T Std	T Std	12	15	15	15	12	12	12	12
22	T Std	T Std, T Artic	T Std, T Artic	T Std, T Artic	17	21	21	21	19	23	23	23
23	M Std	M Std	M Std	M Std	5	5	7	7	6	6	8	8
24	T Std	T Std	T Std	T Std	15	15	15	25	15	15	15	25
25	M Std	M Std	M Artic	M Artic	4	4	5	5	4	4	6	6
27	M Std	M Std	M Std	M Std	8	8	8	8	8	8	8	8
28	M Std	M Std	M Std	M Std	14	16	16	16	15	17	17	17
28R	M Std	M Std	M Std	M Artic	11	11	19	23	11	11	19	23
29	M Std	M Std	M Std	M Std	20	21	28	28	18	19	26	26
30	T Std, T Artic	T Std, T Artic	T Std, T Artic	T Std, T Artic	14	13	13	13	25	16	16	16
30X	M Artic	M Artic	M Artic	M Artic	11	11	11	11	7	7	7	7
31	T Std	T Std	T Std	T Std	11	11	11	11	12	12	12	12
31AX	M Std	M Std	M Std	M Std	6	6	6	6	5	5	5	5
31BX	M Std	M Std	M Std	M Std	6	6	6	6	5	5	5	5
33	T Std	T Std	T Std	T Std	9	9	9	9	9	9	9	9
35	M Short	M Short	M Short	M Short	2	2	2	2	3	3	3	3
36	M Short	M Short	M Short	M Short	3	3	3	3	3	3	3	3

Route	Vehicle Type				AM Peak Vehicles				PM Peak Vehicles			
	Existing (2017)	2020	2025	2030	Existing (2017)	2020	2025	2030	Existing (2017)	2020	2025	2030
37	M Short	M Short	M Short	M Short	4	4	4	4	5	5	5	5
38	M Artic	M Artic	M Artic	M Artic	15	15	19	19	16	16	21	21
38R	M Artic	M Artic	M Artic	M Artic	25	31	31	31	30	36	36	36
38AX	M Std	M Artic	M Artic	M Artic	6	6	15	15	6	6	15	15
38BX	M Std	M Std	-	-	6	6	-	-	6	6	-	-
39	M Short	M Short	M Short	M Short	2	2	2	2	2	2	2	2
41	T Std	T Std	T Std	T Std	15	15	15	15	11	11	11	11
43	M Std	M Std	M Std	M Std	22	22	22	22	19	19	19	19
44	M Std	M Std	M Std	M Artic	23	23	25	25	19	19	21	21
45	T Std	T Std	T Std	T Std	13	12	12	12	9	12	12	12
47	M Std	M Artic	M Artic	M Artic	15	15	15	15	17	17	17	17
48	M Std	M Std	M Std	M Std	13	13	13	13	12	12	12	12
49	M Artic	T Artic	T Artic	T Artic	18	18	18	18	21	21	21	21
52	M Short, M Std	M Short, M Std	M Short, M Std	M Short, M Std	4	4	4	4	4	4	4	4
54	M Std	M Std	M Std	M Std	8	8	8	8	8	8	8	8
55	M Std	-	-	-	3	-	-	-	3	-	-	-
56	M Short	M Short	M Short	M Short	1	3	1	1	1	3	1	1
57	M Std	M Short, M Std	M Short, M Std	M Short, M Std	5	5	5	5	5	5	5	5
66	M Std	M Std	M Std	M Std	2	2	2	2	2	2	2	2
67	M Short, M Std	M Short, M Std	M Short, M Std	M Short, M Std	2	2	2	2	2	2	2	2
81X/82X	M Std	M Std	M Std	M Std	3	3	3	3	2	2	2	2
83X	M Std	-	-	-	2	-	-	-	2	-	-	-
88	M Std	-	-	-	1	-	-	-	1	-	-	-
NX	M Std	M Std	M Std	M Std	9	9	9	9	8	8	8	8
CPX	M Std	M Std	M Artic	M Artic	-	8	8	8	-	8	8	8
HPX	-	-	M Std	M Std	-	-	10	14	-	-	10	14

Route	Vehicle Type				AM Peak Headway (min)				PM Peak Headway (min)			
	Existing (2017)	2020	2025	2030	Existing (2017)	2020	2025	2030	Existing (2017)	2020	2025	2030
1	T Std	T Std	T Std	T Std	6	6	6	6	6	6	6	6
1S	T Std	T Std	T Std	T Std	6	6	6	6	6	6	6	6
1AX	M Std	M Artic	M Artic	M Artic	10	10	10	10	15	15	15	15
1BX	M Std, M Artic	M Artic	M Artic	M Artic	7	7	7	7	15	15	15	15
2 short	T Std	T Std	T Std	T Std	15	15	15	15	15	15	15	15
2	M Std	M Std	M Std	M Std	15	15	15	15	15	15	15	15
3	T Std	T Std	T Std	T Std	15	15	15	15	15	15	15	15
5R	T Std, T Artic	T Artic	T Artic	T Artic	4	4	4	4	6	6	6	6
5S	M Std	M Std	M Std	M Std	9	9	9	9	9	9	9	9
6	T Std	T Std	T Std	T Std	10	10	10	10	10	10	10	10
7	M Std	M Artic	M Artic	M Artic	10	10	10	10	10	10	10	10
7X	M Std, M Artic	M Std	M Std	M Std	9	9	9	9	10	10	10	10
8	M Artic	M Artic	M Artic	M Artic	8	8	8	8	8	8	8	8
9	M Std	M Std	M Std	M Std	12	12	12	12	12	12	12	12
9R	M Std	M Artic	M Artic	M Artic	8	8	8	8	8	8	8	8
10	M Std	M Std	M Std	M Std	15	12	12	12	15	12	12	12
11	M Std	M Std	M Std	M Std	0	15	15	15	0	15	15	15
XX	-	M Std	M Std	M Std	0	12	12	12	0	12	12	12
12	M Std	M Std	M Std	M Std	15	15	15	15	15	15	15	15
14	T Artic	T Artic	T Artic	T Artic	15	15	15	15	15	15	15	15
14S	T Artic	T Artic	T Artic	T Artic	15	15	15	15	15	15	15	15
14R	M Artic	M Artic	M Artic	M Artic	8	8	8	8	8	8	8	8
14X	M Artic	M Artic	M Artic	M Artic	9	9	9	9	9	9	9	9
18	M Std	M Std	M Std	M Std	20	20	20	20	20	20	20	20
19	M Std	M Std	M Std	M Std	15	15	10	10	15	15	10	10
21	T Std	T Std	T Std	T Std	8	6	6	6	9	9	9	9
22	T Std	T Std, T Artic	T Std, T Artic	T Std, T Artic	8	8	10	10	9	9	10	10
22S	-	-	T Std, T Artic	T Std, T Artic	-	-	10	10	-	-	10	10
23	M Std	M Std	M Std	M Std	20	20	15	20	20	20	15	20
24	T Std	T Std	T Std	T Std	9	9	9	7.5	9	9	9	7.5
25	M Std	M Std	M Artic	M Artic	10	10	5	5	15	15	5	5
27	M Std	M Std	M Std	M Std	15	15	15	15	15	15	15	15
28	M Std	M Std	M Std	M Std	10	9	9	9	10	9	9	9
28R	M Std	M Std	M Std	M Artic	10	10	8	8	10	10	8	8
29	M Std	M Std	M Std	M Std	10	10	10	10	12	12	10	10
29S	-	-	M Std	M Std	-	-	10	10	-	-	10	10
30	T Std	T Std	T Std	T Std	8	8	8	8	12	8	8	8
30S	T Std, T Artic	-	-	-	-	-	-	-	6	-	-	-
30X	M Artic	M Artic	M Artic	M Artic	6	6	6	6	10	10	10	10
31	T Std	T Std	T Std	T Std	12	12	12	12	12	12	12	12

Route	Vehicle Type				AM Peak Headway (min)				PM Peak Headway (min)			
	Existing (2017)	2020	2025	2030	Existing (2017)	2020	2025	2030	Existing (2017)	2020	2025	2030
31AX	M Std	M Std	M Std	M Std	10	10	10	10	12	12	12	12
31BX	M Std	M Std	M Std	M Std	10	10	10	10	15	15	15	15
33	T Std	T Std	T Std	T Std	15	15	15	15	15	15	15	15
35	M Short	M Short	M Short	M Short	25	25	25	25	15	15	15	15
36	M Short	M Short	M Short	M Short	30	30	30	30	30	30	30	30
37	M Short	M Short	M Short	M Short	15	15	15	15	15	15	15	15
38	M Artic	M Artic	M Artic	M Artic	15	15	5.5	5.5	15	15	5.5	5.5
38S	M Artic	M Artic	-	-	15	15	-	-	15	15	-	-
38R-S	-	-	M-Artic	M-Artic	-	-	5.5	5.5	-	-	5.5	5.5
38R	M Artic	M Artic	M Artic	M Artic	4	4	5.5	5.5	4	4	5.5	5.5
38AX	M Std	M Artic	M Artic	M Artic	10	10	5.5	5.5	15	15	5.5	5.5
38BX	M Std	-	-	-	10	10	-	-	15	15	-	-
39	M Short	M Short	M Short	M Short	-	-	-	-	20	20	20	20
41	T Std	T Std	T Std	T Std	5	5	5	5	8	8	8	8
43	M Std	M Std	M Std	M Std	9	9	9	9	10	10	10	10
44	M Std	M Std	M Std	M Artic	10	10	10	10	8	8	8	8
45	T Std	T Std	T Std	T Std	8	8	8	8	12	8	8	8
47	M Std	M Artic	M Artic	M Artic	8	8	8	8	8	8	8	8
48	M Std	M Std	M Std	M Std	12	12	12	12	12	12	12	12
49	M Artic	T Artic	T Artic	T Artic	8	8	8	8	8	8	8	8
52	M Short, M Std	M Short, M Std	M Short, M Std	M Short, M Std	20	20	20	20	20	20	20	20
54	M Std	M Std	M Std	M Std	20	20	20	20	20	20	20	20
55	M Std				15	-	-	-	15	-	-	-
56	M Short	M Short	M Short	M Short	30	30	30	30	30	30	30	30
57	M Std	M Short, M Std	M Short, M Std	M Short, M Std	20	20	20	20	20	20	20	20
66	M Std	M Std	M Std	M Std	20	20	20	20	20	20	20	20
67	M Short, M Std	M Short, M Std	M Short, M Std	M Short, M Std	20	20	20	20	20	20	20	20
81X/82X	M Std	M Std	M Std	M Std	15	15	15	15	20	20	20	20
83X	M Std	-	-	-	20	-	-	-	15	-	-	-
88	M Std	-	-	-	20	-	-	-	20	-	-	-
NX	M Std	M Std	M Std	M Std	8	8	8	8	10	10	10	10
CPX	-	M Std	M Artic	M Artic	-	15	15	15	-	15	15	15
HPX	-	-	M Std	M Std	-	-	15	10	-	-	15	10