

## **Chapter 7: Fleet Program**

The San Francisco Municipal Railway (Muni) provides transit service to 686,000 riders each weekday, nearly the entire population of San Francisco. To meet this need, Muni operates 80 lines, providing transit service throughout San Francisco, 24 hours a day, 365 days a year. Muni's service design goal is to have all residential locations in San Francisco be within approximately one-quarter mile of a Muni route that operates at least 19 hours per day. This service is provided using four primary modes: motor coaches, trolley coaches, light rail vehicles, including historic streetcars, and cable cars. Within each of these modes there are a number of vehicle types utilized, making Muni one of the most diverse transit operators in the country. Muni also provides Paratransit services through a broker contract.

The Fleet Plan provides a systematic approach to the phased rehabilitation and replacement of Muni's vehicles. It takes into account the anticipated changes in service, vehicle demand, fleet composition, and ridership. These are some of the factors that determine the number and mix of vehicles Muni needs to meet its peak demand. This in turn drives the programming of funds for vehicle replacements and potential fleet expansions. The Fleet Plan demonstrates that Muni is able to maintain the vehicle fleet needed to provide for the level of service necessary to meet anticipated demand. It also demonstrates that sufficient resources are available to maintain and replace the vehicle fleet.

### **Background**

Muni is nearing the end of a process to replace the majority of the revenue vehicle fleet. Muni has procured 330 Neoplan motor coaches, 273 ETI trolley coaches, and 151 Breda LRVs. Also, Muni recently put a 10th Milan Historic Streetcar into service. This investment in new vehicles represents a significant improvement in the quality of service to Muni's 686,000 daily riders. It will also help improve the dependability of the fleet and in turn should raise the reliability of Muni service on the street. However, replacing such a large percentage of vehicles at one time has also come with a number of issues to be resolved. Of major concern at the present time are retrofits to several fleets to address fleet defects or to improve unforeseen aspects of the vehicles. There is also a large step up in technology compared to the vehicles these new fleets have replaced. For these reasons, a plan to stagger fleet procurements more evenly over time was considered. This could involve extending the useful life of a portion of the fleet to create smaller, regularly spaced procurements. This issue will need to be revisited as individual sub-fleets come due for replacement.

Muni is also looking to the future, with the impending start of Third Street light rail service. LRVs will replace motor coaches along Third Street, and a number of other changes to motor coach routes will also be implemented. Construction will soon start on new facilities. Muni Metro East will provide maintenance and storage space for the LRVs needed for Third Street and help to relieve overcrowding at the Green Division. Islais Creek will provide a modern motor coach maintenance facility to replace Kirkland Division. Muni is also building the historic streetcar fleet in anticipation of future E-line service along The Embarcadero. Finally, Muni is moving forward with a number of projects to carry out the Clean Air Plan.

With the passage of Proposition K in November 2003, Muni has a reliable source of matching funds to carry out vehicle replacement projects in the future. These matching funds help to leverage federal funds, typically on a four to one basis. Regularly replacing Muni's fleet of over one thousand vehicles is one of the most cost-effective ways to provide high quality service to its customers.

### Clean Air Plan

Muni is an acknowledged industry leader in terms of average vehicle emissions per-passenger, and is committed to increasing the number of clean fuel vehicles it operates. Through FY2003, over 52% of Muni's fleet was electrically powered, and nearly 60% of all unlinked passenger trips were taken on electric vehicles. Furthermore, almost 55% of all revenue service hours were operated by electrically powered vehicles. Muni continues to be in full compliance with all state and federal emissions requirements.

To ensure continued reductions in emissions output, Muni developed the Clean Air Plan entitled "Zero Emissions 2020". The primary goals of the Clean Air Plan are:

- To encourage ridership through reliable and efficient service
- To achieve a zero emission fleet by 2020
- To replace old buses with the most modern clean air technologies possible
- To minimize bus emissions fleet-wide

The Clean Air Plan sets out a course for Muni to achieve the lowest possible fleet emissions, with the goal of a 100% zero emission fleet by the year 2020. This strategy includes replacing diesel buses with electric drive vehicles, and retrofitting any remaining diesel buses with state-of-the-art low-emission diesel coaches. In the near term Muni will significantly reduce Particulate Matter (PM) and NO<sub>x</sub> (Oxides of Nitrogen) by installing new low-emission engines on older buses and adding PM/NO<sub>x</sub> reduction devices to all low-emission diesel buses.

#### **Proposition I**

In March 2004, San Francisco voters passed Proposition I, which directs Muni to replace all diesel buses purchased before 1991 with cleaner, low-emissions vehicles.

Muni has recently purchased 45 "clean diesel" Gillig buses from AC Transit. Purchase of these buses will allow Muni to remove from revenue service 45 1989 New Flyer 40-foot diesel buses once the Gillig buses arrive. By 2007, Muni plans to replace the remainder of the 40-foot and all the 30-foot pre-1991 diesel buses with hybrid electric buses (see Figure 51). Finally, Muni plans to rehabilitate 12 of 24 1991 diesel articulated coaches with clean diesel engines in 2006-07; the other 12 New Flyer articulated coaches have been retired.

#### **Action Plan**

Muni, the San Francisco Board of Supervisors, the Bay Area Air Quality Management District (BAAQMD), the California Air Resources Board (CARB), and local environmental groups have been cooperating to achieve the 85% reduction in PM emissions since 1997 and continue on an aggressive plan to reduce Muni's total fleet emissions even further by:

- Reducing emissions from new and existing diesels through advanced emissions reduction technologies, cleaner fuel, and revised service plans;
- Replacing the oldest diesels with alternative fuel buses and moving toward the fleet-wide use of electric drive vehicles; and
- Moving towards the goal of a 100% zero emission fleet by 2020.

The first step in this process was the evaluation of alternative fuel buses and emission reduction technologies. The information and experience gained from these evaluations helped Muni make informed decisions about using these technologies for future motor coach procurements and retrofits. Muni completed an Alternative Fuel Pilot Program (AFPP) made up of six 40-foot buses using alternative technologies: two powered by Compressed Natural Gas (CNG), two hybrid diesel-electrics, and two conventional diesels fitted with exhaust particulate matter (PM) filters. Over a period of two years, Muni evaluated the vehicles' performance on San Francisco's hilly terrain; their reliability rates; their operating, capital, and lifecycle costs; and vehicle safety issues. Further, in partnership with the University of

California at Davis, Muni performed pioneering research by being the first transit agency ever to test and evaluate heavy-duty vehicle emissions on hills.

Muni supplemented the original six alternative fuel prototypes by performing limited evaluations of newer hybrid-electric, battery-electric, and compression-ignition liquid natural gas (LNG) technologies. Based on conclusions gained from the AFPP, and new CARB regulations, Muni determined that hybrid-electric buses would best address Muni's short-term fleet goals. Purchase of hybrid-electric buses will enable Muni to retire the older, diesel buses, and will also lead Muni towards a fleet composed of all electric drive vehicles, the most effective and efficient drives for hilly terrain.

The next steps in the process include actions to replace the oldest diesels and address future bus procurements:

- Initiate the purchase of hybrid-electric buses: The MTA Board has authorized the award of a contract for 56 40-foot hybrid-electric buses to Orion Bus. Muni is also preparing a request for proposals to procure 30-foot hybrid-electric buses.
- Include safety provisions for lighter-than-air fuel in the new Islais Creek bus maintenance facility. Lighter-than-air fuels include natural gas and hydrogen. It is anticipated that lighter than air fuels will be used to power a portion of Muni's motor coach fleet during the next 20 years.

Actions to reduce emissions from existing diesels include:

- Complete the retrofit of diesel buses purchased since 1999 with PM (particulate matter) filters and NO<sub>x</sub> (oxides of nitrogen) reduction devices. These installations will reduce each vehicle's PM by 85% and NO<sub>x</sub> by 25%. To comply with state regulations, Muni is required to complete the PM filter retrofits no later than January 1, 2007. Muni has already converted the entire motor coach fleet over to ultra low sulfur diesel (ULSD) fuel, which is a prerequisite for the PM filter retrofits. ULSD has roughly one-tenth the sulfur content of conventional diesel fuel.
- Develop an electric trolley coach expansion plan, with support from the SFCTA (See Route Electrification Study).
- Deploy the least-polluting buses in neighborhoods most afflicted by multiple pollutant sources. All neighborhoods will eventually benefit from substantially cleaner bus technology.

Actions that will move Muni toward the eventual goal of a 100% zero emission fleet include:

- Build fleet-wide experience with the use of electric drive propulsion technologies.
- Participate in fuel cell bus demonstration programs, in cooperation with regional transit agencies.

## **Current Service Structure**

Muni's service structure is based on a number of specific service design standards. These standards guide decisions to determine the spacing of routes throughout the city, the frequency of buses and streetcars, the spacing of stops along a line, and the average loads experienced by passengers on vehicles. The standards also guide development of other programs that contribute to improved transit service.

- A. Facilitate multi-destination travel that allows most trips to be made with a maximum of one transfer by maintaining a modified grid route network with a radial grid of lines serving downtown, with circumferential cross-town and feeder lines on a general north/south and east/west orientation at approximately one-half mile spacing throughout the City, except where constrained by geography or the street grid;
- B. All residential locations in San Francisco should be within approximately one-quarter mile of a Muni route that operates at least 19 hours per day;

- C. Muni’s policy headways represent the maximum amount of time allowed between vehicle arrivals for the various line types as shown in Figure 38. When ridership warrants, more frequent service may be operated than provided by these standards;

**Figure 38: Policy Headways**

<b>Weekday</b>	<b>Peak</b>	<b>Base</b>	<b>Evening</b>	<b>Owl</b>
Radial	10	15	20	30
Express	10	--	--	--
Cross-town	15	15	20	30
Feeder	20	30	30	--
<b>Weekend</b>		<b>Base</b>	<b>Evening</b>	<b>Owl</b>
Radial		15	20	30
Cross-town		20	30	30
Feeder		30	30	--

- D. Operate service such that the peak period passenger load factor does not exceed the service standard goal of “no greater than 85% of combined seating and standing capacity,” as shown in Figure 39;

**Figure 39: Passenger Load Factor Standards**

<b>Fleet</b>	<b>Vehicle Capacity</b>	<b>85% Load Standard</b>
Motor Coach		
-Small (30')	45	38
-Standard (40')	63	54
-Articulated (60')	94	80
Trolley Coach		
-Standard (40')	63	54
-Articulated (60')	94	80
Light Rail Vehicle	119	101
Historic Streetcar	119	101
Cable Car	63	54

- E. Provide passenger stop spacing of approximately 800-1000 feet on motor coach and trolley coach lines except where there are steep grades (over 10%), and a stop spacing of 1000-1200 feet between stops on LRV surface lines;
- F. Construct appropriate transit guideways in major corridors to reduce transit travel time and increase capacity;
- G. Provide increased capacity at equal or lower cost by substituting articulated vehicles where loads and frequencies warrant; and
- H. Reduce service (without exceeding policy headways) on lines that continuously experience diminished ridership.

**Service Demand**

Revenue vehicle demand is based on running times, ridership levels, load factors, and the operating demands and constraints of the transportation system. The number of revenue vehicles needed to provide daily service is best expressed as the peak vehicle demand. Peak vehicle demand is defined as the number of vehicles operated in maximum service. Generally speaking this is the largest number of vehicles out

on the streets providing service at a single moment during a day. As of January 2005, Muni required 818 peak vehicles to provide daily service. These vehicles are used on the 80 lines Muni operates.

Service demand is guided by a number of factors. Trends and projections of demographic factors such as population and employment provide an indication of how much and where future growth may occur. Ridership trends and projections help predict future transit needs. Load factors help to identify the level of crowding and can indicate where service could be adjusted. Finally, planned service changes are developed with these other factors in mind.

**Demographic Trends**

San Francisco is a roughly 49-square mile city that is almost fully built out, at nearly 26 persons per gross acre. In 2000, San Francisco’s population was 776,733 according to the US Census. In terms of employment, 444,851 San Franciscans were employed in 2000. The city had a total of 634,430 jobs in 2000, or 16.9% of the region’s total.

In 2000, the city reached its highest population count since the 1950 Census, when there were 775,400 people living here. The 2000 count is a 7.3% increase from a population of 723,959 in 1990 and an increase of 8.5% since 1970, when 715,674 people lived in the city. San Francisco’s daytime population, including workers and visitors, is estimated at 1.1 million people.

In the next 30 years, according to the Association of Bay Area Governments (ABAG), the City is expected to grow by 20.4%, to a population of 935,100. This is much smaller growth than the 29.4% growth that ABAG projects for the nine-county Bay Area region as a whole.

In terms of employment, 444,851 San Franciscans were employed in 2000. The city had a total of 634,430 jobs in 2000, or 16.9% of the region’s total. The city is projected to have 815,680 jobs in 2030, a 28.6% increase, but less than the 39.2% increase in jobs in the Bay Area.

These trends are shown in Figure 40.

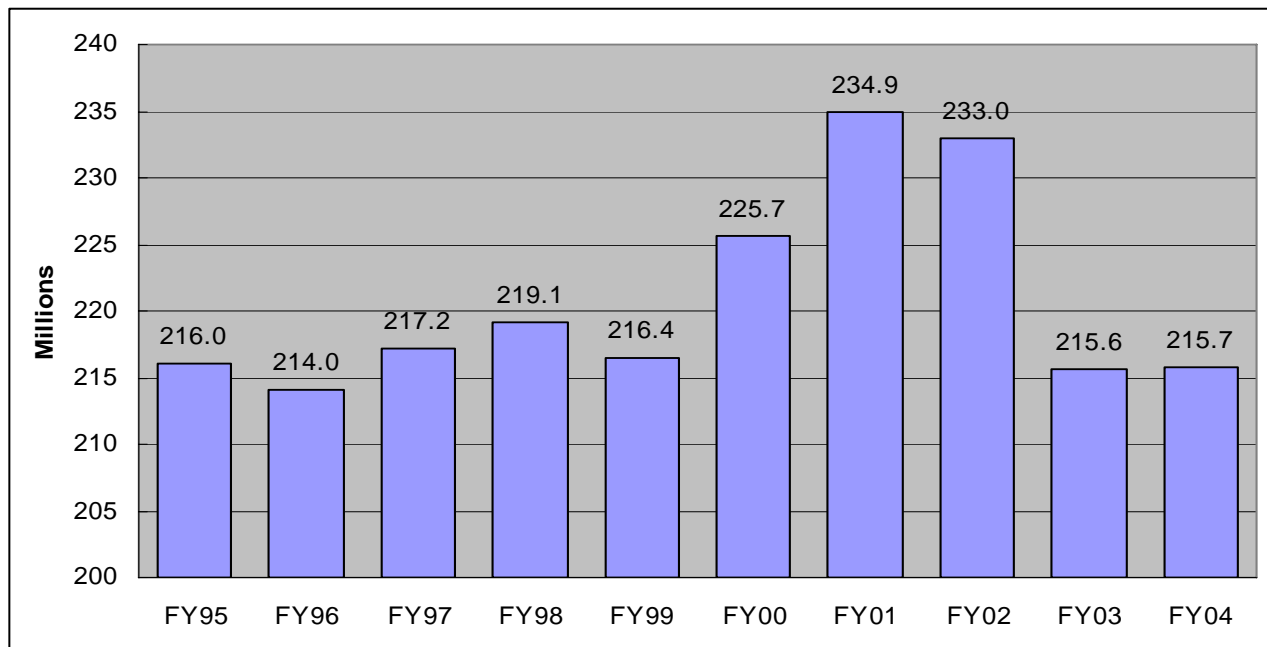
**Figure 40: San Francisco Job and Population Trends**

	2000	2005	2010	2015	2020	2025	2030
<b>Total Jobs</b>							
San Francisco	634,430	635,480	686,480	728,220	755,870	786,020	815,680
Change from 2000		0.2%	8.2%	14.8%	19.1%	23.9%	28.6%
SF Bay Region	3,753,670	3,848,870	4,199,670	4,509,840	4,751,990	4,982,800	5,226,400
Change from 2000		2.5%	11.9%	20.1%	26.6%	32.7%	39.2%
<b>Population</b>							
San Francisco	776,733	798,600	812,900	827,200	848,100	889,800	935,100
Change from 2000		2.8%	4.7%	6.5%	9.2%	14.6%	20.4%
SF Bay Region	6,783,762	7,193,900	7,527,500	7,840,200	8,168,300	8,457,800	8,780,300
Change from 2000		6.0%	11.0%	15.6%	20.4%	24.7%	29.4%

**Ridership**

Muni ridership fluctuated between 214 million and 219 million riders annually through FY1999. From FY2000 through FY2002, ridership increased substantially with the economic boom during those years. With the recent economic downturn, ridership has returned to pre-2000 levels. Future projections indicate that the system will experience only modest increases in ridership over the next 20 years. The most significant changes to ridership will come from the two-phase Third Street Light Rail project. In 2025, Phase 1, Initial Operating Segment, is projected to carry 40,518 daily riders. With Phase 2, Central Subway, ridership is anticipated to increase to 60,970 daily riders.

**Figure 41: Annual Ridership FY95-FY04**



**Figure 42: Historical Annual Ridership (millions)**

	Motor Coach	Trolley Coach	LRV	Cable Car	Total
FY95	90.6	79.3	37.2	8.8	216.0
FY96	89.9	77.8	36.7	9.6	214.0
FY97	89.8	80.8	36.7	9.8	217.2
FY98	92.8	77.5	38.9	9.9	219.1
FY99	93.0	78.3	35.7	9.5	216.4
FY00	96.4	78.5	41.6	9.2	225.7
FY01	96.0	80.9	49.7	8.3	234.9
FY02	98.6	78.8	47.9	7.7	233.0
FY03	90.9	74.4	42.9	7.4	215.6
FY04	87.5	75.2	45.2	7.9	215.7

**Load Factors**

Muni has a peak period passenger load factor service standard goal of “no greater than 85% of combined seating and standing capacity.” Each line is checked twice a year based on a random selection process.

**Figure 43: Load Factor Standards**

Fleet	Vehicle Capacity	85% Load Standard
Motor Coach		
-Small (30')	45	38
-Standard (40')	63	54
-Articulated (60')	94	80
Trolley Coach		
-Standard (40')	63	54
-Articulated (60')	94	80
Light Rail Vehicle	119	101
Historic Streetcar	119	101
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**Figure 44: Peak Period Load Factor Performance**

	FY2002	FY2003	FY2004	FY2005 Q2
# of Lines Checked	176	178	169	84
# of Lines Over 85%	23	10	14	9
% of Lines Over 85%	13.1%	5.6%	8.3%	10.7%

### **Service Plans**

Changes to service are made in response to ridership trends, demographic changes, and load factors. The need for service must be balanced with budget constraints. In FY06, Muni has proposed making a number of service adjustments to reduce operating expenses. Also in FY06, the Third Street Initial Operating Segment will open, providing additional passenger capacity in the Third Street corridor.

### **FY06 Service Adjustments**

The adopted FY06 Operating Budget is predicated on adjustments to Municipal Railway service that will achieve a net savings for the year of \$13 million. This will be accomplished through a combination of line restructuring, lengthened headways (beyond policy in some cases), and labor efficiencies. The changes were discussed with the public, scheduled for approval by the MTA board in May, and were implemented in September 2005.

These changes are intended to be temporary; that is, when operating revenues increase to a certain level, service will be restored, although not necessarily in the same places from which it was reduced. If these service adjustments become permanent, Muni will need to revisit the Fleet Plan, and make changes accordingly.

### **Third Street Light Rail Line**

The Third Street Light Rail Line Phase 1, Initial Operating Segment (IOS), will replace the current 15-Third motor coach line. At the same time a number of lines, most significantly the 9X series, will be adjusted to meet service needs previously covered by portions of the 15-Third line that will not be served by the IOS. The net result of these changes is an increase of 5 peak LRVs and a reduction of 15 peak motor coaches.

At this time the plan for Phase 2 of the Third Street Light Rail Line, the Central Subway, would increase LRV peak demand by 3 vehicles. At the same time, the 30-Stockton short line that operates between Columbus & Powell and the Caltrain Depot at Fourth & King streets will be eliminated. This change will reduce the peak demand for trolley coaches by 11 vehicles.

### Maintenance Demand

Maintenance demand can be broken down into four primary areas: 1) Running Repair, 2) Modification and/or Retrofit, 3) Overhauls or Major Repairs, and 4) Preventive Maintenance.

Running repair consists of vehicles that are not out of service for a scheduled maintenance activity such as a major repair or preventive maintenance. Running repair is comprised of defects identified by an in service breakdown, defects noted on an Operator Defect card, unscheduled cleaning of debris or bodily fluids and minor accident damage. Most of these tasks are completed and the coach is returned to revenue service within an hour or two, but frequently the workload can back up due to staffing or volume. This is an ongoing activity that remains fairly constant over time.

Modifications and retrofits require that coaches be kept out of revenue service to allow this work to be done. Retrofits can include technology upgrades such as video surveillance camera installation or environmental modifications like the installation of clean air traps on the diesel fleet.

Overhauls and major repairs are labor intensive and require considerable material resources. Heavy repair can include engine and transmission overhauls, vehicle body rehabilitation, and maintaining brake, cooling and other systems.

Preventive maintenance is a mainstay of Muni's maintenance efforts. In spite of the accumulation of the work backlog in other areas, Muni has seen its reliability improving steadily over the past three years. It is Muni's intention to constantly improve the PM program to enable us to move from a position of reactive maintenance to a better planned, more consistent and more proactive maintenance operation. With the implementation of new Maintenance Management software, we project an ability to plan our scheduled maintenance more accurately, plan better resource utilization and build a more cost effective maintenance program.

### Spare Ratio

The spare ratio is calculated by dividing the number of spare vehicles by the peak demand. The number of spare vehicles is the difference between the total fleet and the peak demand. The peak demand is the number of vehicles operated in maximum service. Vehicles operated in maximum service is defined as the revenue vehicle count during the peak season of the year, on the week and day that maximum service is provided. It excludes atypical days and one-time special events. FTA standard guidelines state that the spare ratio for motor coaches should not exceed 20 percent of the vehicles operated in maximum service. This restriction does not apply to other vehicles, such as trolley buses and rail vehicles. For those vehicles, FTA requires that Muni provide a reasonable justification for the spare ratio assigned to those modes. Current spare ratios are shown in Figure 45.

Muni is now working through a process to eliminate some of the oldest vehicles from the fleet. 12 New Flyer Articulated buses have been retired, and 10 Orion 30-foot buses will be retired and will not be replaced for at least one lifecycle, about 12 years. This reduction in vehicles will bring Muni's spare ratio within FTA's standard. The service changes that will be implemented at the start up of IOS will result in an increase of 5 peak LRVs and a reduction of 15 peak motor coaches. The procurement of 151 Bredas was sized to accommodate the additional LRV demand for Third Street, thus the current spare ratio is relatively high, but no additional vehicles are needed to operate the IOS. Also with the IOS, motor coach demand will decrease and 20 standard coaches will be moved to the reserve fleet, and 20 of the oldest coaches will be removed from the reserve fleet and retired. In the trolley coach fleet, future extensions to existing trolley coach lines, or conversions of motor coach to trolley coach lines could be accomplished without having to purchase additional vehicles, if the maintenance demand can be brought down.



**Figure 45: Spare Ratio Summary**

Fleet	Fleet Size	Peak Demand	Spares	Spare Ratio
Motor Coach	495	397	98	24.7%
Trolley Coach	333	264	69	26.1%
Light Rail Vehicle	151	110	41	37.3%

## Revenue Fleet

Muni's fleet consists of five modes, with 2-3 vehicle types in most modes, making the Muni fleet one of the most diverse in the country. Muni operates and maintains a fleet of revenue vehicles sized to meet its service schedule. The revenue fleet is composed of a variety of vehicle types each suited to address a different service need. The fleet size is a factor of peak vehicle demand and desired spare ratio. Peak vehicle demand is the maximum number of vehicles needed to meet scheduled service throughout the day. The spare ratio is the number of vehicles beyond the peak vehicle demand that are out of service for maintenance and repairs. The current fleet composition is shown in Figure 46.

**Figure 46: Summary of Revenue Vehicle Fleets**

Fleet	Vehicles
Motor Coach	495
Trolley Coach	333
Light Rail Vehicle	151
Historic Streetcar	26
Cable Car	40
Total Revenue Fleet	1,045
Motor Coach Reserve	45
Paratransit Accessible Vans	54

## Fleet Replacement

FTA establishes guidelines for the frequency with which revenue vehicles can be replaced using federal funds. These replacement cycles establish the useful life over which the vehicle must operate. If an operator chooses to remove vehicles from revenue service operation before their useful life has been reached, the operator must reimburse the FTA for the unused portion of the vehicle's life. In addition, MTC establishes policies at the regional level that govern fleet replacement cycles. Under the MTC Transit Capital Priorities guidelines, a transit operator is only eligible to program funds for vehicle replacement once the vehicle has reached the end of its useful life. Thus, due to the time needed to develop specifications, award the procurement, and to test and receive the vehicles, transit vehicles must effectively remain in revenue service for two years beyond their useful life. It is this combination of FTA and MTC requirements that establish the effective replacement cycles for Muni's revenue fleet as shown in the table below:

**Figure 47: Vehicle Life**

Fleet	FTA Useful Life	MTC Effective Life
Motor Coach	12	14
Trolley Coach	18	20
Light Rail Vehicle	25	27

## Fleet Mid-life Rehabilitation

To ensure that the revenue fleet can operate reliably and efficiently throughout its useful life, a regular program of vehicle mid-life rehabilitation should be scheduled. Each fleet has its own rehabilitation cycle based on its useful life and the industry standards for that fleet. These are shown in the table below.

**Figure 48: Fleet Rehabilitation**

Fleet	Rehabilitation
Motor Coach	At 7 years
Trolley Coach	Every 6 years
Light Rail Vehicle	Every 5 years

Due to funding constraints, Muni has not historically scheduled midlife rehabilitations through the capital program, but has instead relied on operating funds to rebuild vehicles and vehicle components as needed.

Muni also operates two fleets that are unique to the transit industry: Historic Streetcars and Cable Cars. Due to their unique nature, established replacement guidelines do not exist for these fleets. Instead of replacement cycles, Muni has developed rehabilitation cycles based on past experience as shown in the table below.

**Figure 49: Special Fleet Rehabilitation**

Fleet	Rehabilitation
Historic Streetcar	Every 10 years
Cable Car	Every 15 years

MTC's Transit Capital Priorities guidelines require that rail vehicles useful life be extended for 20 years to receive federal funds for these types of rehabilitation projects. The Operating Budget or some non-federal capital source will need to be used in combination with the infusion of federal funds every 20 years.

## Fleet Expansion

Several fleet expansion projects are currently planned. In the LRV fleet, four additional vehicles will be needed for Third Street Phase 2-Central Subway operation, 10 vehicles to provide supplemental service to Mission Bay on the Third Street line, and 10 vehicles to provide additional capacity on the existing Metro lines (J, K, L, M, and N). The revenue vehicle needs for the various phases of the Third Street project will be reassessed as part of the Supplemental Environmental document being prepared for the Central Subway project, expected to be completed in June 2006. In the Historic Streetcar fleet, a tenth Milan car has been rehabbed, bringing the revenue fleet to 27 streetcars. Up to 18 additional Historic Streetcars will be needed for E-line service and additional capacity on the F-line.

## Fleet Plan

Characteristics of the current and future revenue vehicle fleets are shown in Figure 50.

Figure 51 shows the 20-year fleet plan. It describes how various vehicle fleets move into and out of the revenue fleet. It graphically displays the replacement and retirement of individual vehicle fleets. It also provides a summary of many key statistics of the fleets, including overall size, peak vehicle demand, spare ratio, and average vehicle age. Each of the fleets is described in greater detail in the sections that follow.

Figure 50: Muni Revenue Vehicle Fleet Characteristics

FLEET CHARACTERISTICS								
Manufacturer	Vehicles	In Service	Retire	Mode of Power	Seating Capacity	Standing Capacity	Total Capacity	Wheelchair Positions
<b>MOTOR COACH</b>								
<b>Small MC (30ft/9.1m)</b>								
1990 - Orion (9001-9045)	45	1991	2005	Diesel	26	24	50	1
2007 - New (replaces 1991-Orion)	30	2007	2021	Hybrid	27	24	51	1
2019 - New (not replaced in 2007)	10	2019	2033	ZEV	27	24	51	1
2021 - New (replaces 2007-New)	25	2021	2035	ZEV	27	24	51	1
<b>Standard MC (40ft/12.2m)</b>								
1988 - New Flyer (8801-8850)	50	1988	2002	Diesel	40	37	77	1
1989 - New Flyer (8901-8956)	55	1989	2003	Diesel	40	37	77	2
1999 - NABI (8001-8045)	45	1999	2013	Diesel	38	36	74	2
1999 - Neoplan/Option (8101-8235; 8301-8304)	139	2002	2016	Diesel	43	37	80	2
1999 - Neoplan Option (8305-8371)	67	2003	2017	Diesel	43	37	80	2
1993 - AC Transit Gilligs	45	2005	2007	Diesel	44	48	92	2
2006 - New Hybrid (replaces 1989-New Flyer)	51	2006	2020	Hybrid	35	38	73	2
2006 - New Hybrid (replaces 1990-Orion)	20	2006	2020	Hybrid	35	38	73	2
2013 - New (replaces 1999-NABI)	45	2013	2027	Hybrid	35	38	73	2
2016 - New (replaces 1999-Neoplan/Option)	139	2016	2030	Hybrid	35	38	73	2
2017 - New (replaces 1999-Neoplan Option)	67	2017	2031	Hybrid	35	38	73	2
2020 - New (replaces 2006-New)	51	2020	2034	Hybrid	35	38	73	2
2020 - New (replaces 2006-New)	20	2020	2034	Hybrid	35	38	73	2
<b>Articulated MC (60ft/18.3m)</b>								
1991 - New Flyer Rehab (9101-9124)	12	2005	2012	Diesel	52	81	133	1
2001 - Neoplan (6200-6225)	26	2002	2016	Diesel	57	53	110	2
2001 - Neoplan (6226-6299)	74	2003	2017	Diesel	57	53	110	2
2002 - Neoplan Option (6401-6424)	24	2003	2017	Diesel	57	53	110	2
2012 - New (replaces 1991-New Flyer)	12	2012	2026	Hybrid	57	53	110	2
2016 - New (replaces 2000-Neoplan)	26	2016	2030	Hybrid	57	53	110	2
2017 - New (replaces 2000-Neoplan)	74	2017	2031	Hybrid	57	53	110	2
2017 - New (replaces 2002-Neoplan Option)	24	2017	2031	Hybrid	57	53	110	2
2019 - New (not replaced in 2007)	12	2019	2033	Hybrid	57	53	110	2
<b>TROLLEY COACH</b>								
<b>Standard TC (40ft/12.2m)</b>								
2000 - ETI (5401-5481)	81	2002	2022	Electric	50	54	104	2
2000 - ETI (5482-5640)	159	2003	2023	Electric	50	54	104	2
2022-New (replaces 2000-ETI)	81	2022	2042	Electric	50	54	104	2
2023-New (replaces 2000-ETI)	159	2023	2043	Electric	50	54	104	2
<b>Articulated TC (60ft/18.3m)</b>								
1992 - New Flyer (7000-7059)	60	1994	2014	Electric	53	81	134	2
2003 - ETI (7101-7133)	33	2003	2023	Electric	55	70	125	2
2014-New (replaces 1992-New Flyer)	60	2014	2034	Electric	55	70	125	2
2023-New (replaces 2003-ETI)	33	2023	2043	Electric	55	70	125	2
<b>RAIL</b>								
<b>Light Rail Vehicle</b>								
1995 - Breda (1400-1424)	25	1997	2024	Electric	60	160	220	4
1995 - Breda (1425-1451)	27	1998	2025	Electric	60	160	220	4
1995 - Breda (1452-1475)	24	1999	2026	Electric	60	160	220	4
1995 - Breda (1476-1481)	6	2000	2027	Electric	60	160	220	4
1995 - Breda (1482-1508)	27	2001	2028	Electric	60	160	220	4
1995 - Breda (1509-1534)	26	2002	2029	Electric	60	160	220	4
1995 - Breda (1535-1550)	16	2003	2030	Electric	60	160	220	4
2009 - New - Expansion (Mission Bay)	10	2011	2038	Electric	60	160	220	4
2009 - New - Expansion (NCS)	4	2011	2038	Electric	60	160	220	4
2013 - New - Expansion (JKLMN)	10	2015	2042	Electric	60	160	220	4
2022 - New - Replacement	25	2024	2051	Electric	60	160	220	4
2022 - New - Replacement	27	2025	2052	Electric	60	160	220	4
<b>Historic Streetcar</b>								
1928 - Milan Peter Witt	10	Varies	NA	Electric	29	68	97	2
1946 - SEPTA PCC (1050-1063)	17	Varies	NA	Electric	47	50	97	2
1948 - Muni Dbl End PCC	3	Varies	NA	Electric	46	40	86	2
2006 - NJT PCCs	11	2006	NA	Electric	42	46	88	2
2007 - New/Rehab (Seg. 4)	7	Varies	NA	Electric	50	34	84	2
2008 - New/Rehab (Seg. 3)	7	Varies	NA	Electric	50	34	84	2
2007 - New/Rehab (N.O. #952)	1	Varies	NA	Electric	50	34	84	2
<b>Cable Car</b>								
Powell Cars (1-28)	28	Varies	NA	Electric	30	20	50	0
California Cars (49-60)	12	Varies	NA	Electric	34	25	59	0

Note: seating capacity + standing capacity = maximum capacity; this does not equal the maximum load for planning purposes.

Figure 51: Fleet Plan

Fleet	In Service	Retire	2004	2005	2006	2007	2008	2009	2010	2011
<b>MOTOR COACH INVENTORY</b>										
<b>Small MC (30ft/9.1m)</b>										
1990 - Orion (9001-9045)	1990	2004	45	35	35	30	30	30	30	30
2007 - New (replaces 1990-Orion) [1]	2007	2021								
2019 - New (replaces 1990-Orion)	2019	2033								
2021 - New (replaces 2007-New)	2021	2035								
Revenue Fleet			45	35	35	30	30	30	30	30
New Vehicles			-	-	-	30	-	-	-	-
Retired Vehicles			-	10	-	35	-	-	-	-
Moved to Reserve Fleet			-	-	-	-	-	-	-	-
<b>Standard MC (40ft/12.2m)</b>										
1989 - New Flyer (8901-8956)	1989	2003	51	6	6	51	51	51	51	51
1999 - NABI (8001-8045)	1999	2013	45	45	45	25	25	25	25	25
1999 - Neoplan/Option (8101-8235; 8301-8304)	2002	2016	139	139	139	139	139	139	139	139
1999 - Neoplan Option (8305-8371)	2003	2017	67	67	67	67	67	67	67	67
1993 - AC Transit Gilligs	1993	2007		45	31					
2006 - New Alt. Fuel (replaces 1989-New Flyer)	2006	2020				51	51	51	51	51
2006 - New Alt. Fuel (replaces 1990-Orion)	2006	2020				5	5	5	5	5
2013 - New (replaces 1999-NABI)	2013	2027								
2016 - New (replaces 1999-Neoplan/Option)	2016	2030								
2017 - New (replaces 1999-Neoplan Option)	2017	2031								
2020 - New (replaces 2006-New)	2020	2034								
2020 - New (replaces 2006-New)	2020	2034								
Revenue Fleet			302	302	282	287	287	287	287	287
New Vehicles			-	45	-	56	-	-	-	-
Retired Vehicles			-	-	-	26	-	-	-	-
Moved to Reserve Fleet			-	45	20	25	-	-	-	-
<b>Articulated MC (60ft/18.3m)</b>										
1991 - New Flyer (9101-9124)	1991	2005	24							
1991 - New Flyer Rehab (9101-9124) [2]	2005	2012		12	12	12	12	12	12	12
2001 - Neoplan (6200-6225)	2002	2016	26	26	26	26	26	26	26	26
2001 - Neoplan (6226-6299)	2003	2017	74	74	74	74	74	74	74	74
2002 - Neoplan Option (6401-6424)	2003	2017	24	24	24	24	24	24	24	24
2012 - New (replaces 1991-New Flyer)	2012	2026								
2016 - New (replaces 2000-Neoplan)	2016	2030								
2017 - New (replaces 2000-Neoplan)	2017	2031								
2017 - New (replaces 2002-Neoplan Option)	2017	2031								
2019 - New (replaces 1991-New Flyer)	2019	2033								
Revenue Fleet			148	136	136	136	136	136	136	136
New Vehicles			-	-	-	-	-	-	-	-
Retired Vehicles			-	12	-	-	-	-	-	-
Moved to Reserve Fleet			-	-	-	-	-	-	-	-
<b>Motor Coach Summary</b>										
Revenue Fleet-Start of FY			495	495	473	453	453	453	453	453
New Vehicles			-	45	-	86	-	-	-	-
Retired Vehicles			-	22	-	61	-	-	-	-
Moved to Reserve Fleet			-	45	20	25	-	-	-	-
Revenue Fleet-End of FY			495	473	453	453	453	453	453	453
Peak Demand			397	397	397	382	382	382	382	382
Spare Ratio			24.7%	19.1%	14.1%	18.6%	18.6%	18.6%	18.6%	18.6%
Avg. Vehicle Age			4.9	4.8	5.4	3.9	4.9	5.9	6.9	7.9
SCE (Capacity)			569	541	521	521	521	521	521	521

**Notes:**

[1] 10 vehicles traded for preventive maintenance funds in FY06. Vehicles eligible to return to fleet in FY19.

[2] 12 vehicles traded for preventive maintenance funds in FY06. Vehicles eligible to return to fleet in FY12.

Figure 51: Fleet Plan CONTINUED

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
30	30	30	30	30	30	30	30	30	30	10	10	10	10
								10	10	10	10	10	10
										30	30	30	30
30	30	30	30	30	30	30	30	40	40	40	40	40	40
-	-	-	-	-	-	-	-	10	-	40	-	-	-
-	-	-	-	-	-	-	-	-	-	30	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
25													
139	139	139	139	139									
67	67	67	67	67	67								
51	51	51	51	51	51	51	51	51					
5	5	5	5	5	5	5	5	5					
	25	25	25	25	25	25	25	25	25	25	25	25	25
						139	139	139	139	139	139	139	139
						67	67	67	67	67	67	67	67
										51	51	51	51
										5	5	5	5
287	287	287	287	287	287	287	287	287	287	287	287	287	287
-	25	-	-	139	67	-	-	56	-	-	-	-	-
-	-	-	-	114	42	-	-	31	-	-	-	-	-
-	25	-	-	25	25	-	-	25	-	-	-	-	-
26	26	26	26	26									
74	74	74	74	74	74								
24	24	24	24	24	24								
12	12	12	12	12	12	12	12	12	12	12	12	12	12
						26	26	26	26	26	26	26	26
						74	74	74	74	74	74	74	74
						24	24	24	24	24	24	24	24
								12	12	12	12	12	12
136	136	136	136	136	136	136	148	148	148	148	148	148	148
12	-	-	-	26	98	-	12	-	-	-	-	-	-
12	-	-	-	6	78	-	-	-	-	-	-	-	-
-	-	-	-	20	20	-	-	-	-	-	-	-	-
453	453	453	453	453	453	453	453	475	475	485	485	485	485
12	25	-	-	165	165	-	22	56	40	-	-	-	-
12	-	-	-	120	120	-	-	31	30	-	-	-	-
-	25	-	-	45	45	-	-	25	-	-	-	-	-
453	453	453	453	453	453	453	475	475	485	485	485	485	485
382	382	382	382	382	382	382	382	382	382	382	382	382	382
18.6%	18.6%	18.6%	18.6%	18.6%	18.6%	18.6%	24.3%	24.3%	27.0%	27.0%	27.0%	27.0%	27.0%
8.7	8.9	9.9	10.9	6.8	2.7	3.7	4.5	3.9	3.9	4.9	5.9	6.8	7.8
521	521	521	521	521	521	521	549	549	549	549	549	549	549

Figure 51: Fleet Plan CONTINUED

Fleet	In Service	Retire	2004	2005	2006	2007	2008	2009	2010	2011
<b>TROLLEY COACH INVENTORY</b>										
<b>Standard TC (40ft/12.2m)</b>										
2000 - ETI (5401-5481)	2002	2022	81	81	81	81	81	81	81	81
2000 - ETI (5482-5640)	2003	2023	159	159	159	159	159	159	159	159
2022-New (replaces 2000-ETI)	2022	2042								
2023-New (replaces 2000-ETI)	2023	2043								
Revenue Fleet			240	240	240	240	240	240	240	240
New Vehicles			-	-	-	-	-	-	-	-
Retired Vehicles			-	-	-	-	-	-	-	-
<b>Articulated TC (60ft/18.3m)</b>										
1992 - New Flyer (7000-7059)	1994	2014	60	60	60	60	60	60	60	60
2003 - ETI (7101-7133)	2003	2023	33	33	33	33	33	33	33	33
2014-New (replaces 1992-New Flyer)	2014	2034								
2023-New (replaces 2003-ETI)	2023	2043								
Revenue Fleet			93	93	93	93	93	93	93	93
New Vehicles			-	-	-	-	-	-	-	-
Retired Vehicles			-	-	-	-	-	-	-	-
<b>Trolley Coach Summary</b>										
Revenue Fleet-Start of FY			333	333	333	333	333	333	333	333
New Vehicles			-	-	-	-	-	-	-	-
Retired Vehicles			-	-	-	-	-	-	-	-
Revenue Fleet-End of FY			333	333	333	333	333	333	333	333
Peak Demand			264	264	264	264	264	264	264	264
Spare Ratio			26.1%	26.1%	26.1%	26.1%	26.1%	26.1%	26.1%	26.1%
Avg. Vehicle Age			2.9	3.9	4.9	5.9	6.9	7.9	8.9	9.9
SCE (Capacity)			380	380	380	380	380	380	380	380
<b>LIGHT RAIL VEHICLE INVENTORY</b>										
1995 - Breda (1400-1424)	1997	2024	25	25	25	25	25	25	25	25
1995 - Breda (1425-1451)	1998	2025	27	27	27	27	27	27	27	27
1995 - Breda (1452-1475)	1999	2026	24	24	24	24	24	24	24	24
1995 - Breda (1476-1481)	2000	2027	6	6	6	6	6	6	6	6
1995 - Breda (1482-1508)	2001	2028	27	27	27	27	27	27	27	27
1995 - Breda (1509-1534)	2002	2029	26	26	26	26	26	26	26	26
1995 - Breda (1535-1550)	2003	2030	16	16	16	16	16	16	16	16
2013 - New - Expansion (Mission Bay)	2016	2043								
2013 - New - Expansion (CS)	2016	2043								
2013 - New - Expansion (JKLMN)	2015	2042								
2022 - New - Replacement	2024	2051								
2022 - New - Replacement	2025	2052								
Revenue Fleet-Start of FY			151	151	151	151	151	151	151	151
New Vehicles			-	-	-	-	-	-	-	-
Retired Vehicles			-	-	-	-	-	-	-	-
Revenue Fleet-End of FY			151	151	151	151	151	151	151	151
Peak Demand			110	110	110	115	115	115	115	115
Spare Ratio			37.3%	37.3%	37.3%	31.3%	31.3%	31.3%	31.3%	31.3%
Avg. Vehicle Age			4.2	5.2	6.2	7.2	8.2	9.2	10.2	11.2
SCE (Capacity)			151	151	151	151	151	151	151	151

Figure 51: Fleet Plan CONTINUED

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
81	81	81	81	81	81	81	81	81	81				
159	159	159	159	159	159	159	159	159	159	159			
										81	81	81	81
											159	159	159
240	240	240	240	240	240	240	240	240	240	240	240	240	240
-	-	-	-	-	-	-	-	-	-	81	159	-	-
-	-	-	-	-	-	-	-	-	-	81	159	-	-
60	60												
33	33	33	33	33	33	33	33	33	33	33			
		60	60	60	60	60	60	60	60	60	60	60	60
											33	33	33
93	93	93	93	93	93	93	93	93	93	93	93	93	93
-	-	60	-	-	-	-	-	-	-	-	33	-	-
-	-	60	-	-	-	-	-	-	-	-	33	-	-
333	333	333	333	333	333	333	333	333	333	333	333	333	333
-	-	60	-	-	-	-	-	-	-	81	192	-	-
-	-	60	-	-	-	-	-	-	-	81	192	-	-
333	333	333	333	333	333	333	333	333	333	333	333	333	333
270	270	270	270	259	259	259	259	259	259	259	259	259	259
23.3%	23.3%	23.3%	23.3%	28.6%	28.6%	28.6%	28.6%	28.6%	28.6%	28.6%	28.6%	28.6%	28.6%
10.9	11.9	9.3	10.3	11.3	12.3	13.3	14.3	15.3	16.3	12.4	1.9	2.9	3.9
380	380	380	380	380	380	380	380	380	380	380	380	380	380
25	25	25	25	25	25	25	25	25	25	25	25		
27	27	27	27	27	27	27	27	27	27	27	27	27	
24	24	24	24	24	24	24	24	24	24	24	24	24	24
6	6	6	6	6	6	6	6	6	6	6	6	6	6
27	27	27	27	27	27	27	27	27	27	27	27	27	27
26	26	26	26	26	26	26	26	26	26	26	26	26	26
16	16	16	16	16	16	16	16	16	16	16	16	16	16
				10	10	10	10	10	10	10	10	10	10
				4	4	4	4	4	4	4	4	4	4
			10	10	10	10	10	10	10	10	10	10	10
												25	25
													27
151	151	151	151	161	175	175	175	175	175	175	175	175	175
-	-	-	10	14	-	-	-	-	-	-	-	25	27
-	-	-	-	-	-	-	-	-	-	-	-	25	27
151	151	151	161	175	175	175	175	175	175	175	175	175	175
115	115	115	123	134	134	134	134	134	134	134	134	134	134
31.3%	31.3%	31.3%	30.9%	30.6%	30.6%	30.6%	30.6%	30.6%	30.6%	30.6%	30.6%	30.6%	30.6%
12.2	13.2	14.2	14.2	14.0	15.0	16.0	17.0	18.0	19.0	20.0	21.0	18.2	15.0
151	151	151	161	175	175	175	175	175	175	175	175	175	175

Figure 51: Fleet Plan CONTINUED

Fleet	In Service	Retire	2004	2005	2006	2007	2008	2009	2010	2011
<b>HISTORIC STREETCAR INVENTORY</b>										
1946 - PCC (1050-1063)			14	14	14	14	14	14	14	14
1948 - Muni Double-Ended PCC			3	3	3	3	3	3	3	3
1928 - Milan Peter Witt			10	10	10	10	10	10	10	10
2006 - NJT PCC			-	-	11	11	11	11	11	11
2007 - New/Rehab (Seg. 4)			-	-	-	7	7	7	7	7
2008 - New/Rehab (Seg. 3)			-	-	-	-	7	7	7	7
2007 - New/Rehab (N.O. #952)			-	-	-	1	1	1	1	1
Revenue Fleet-Start of FY			27	27	27	38	46	53	53	53
New Vehicles			-	-	11	8	7	-	-	-
Retired Vehicles			-	-	-	-	-	-	-	-
Revenue Fleet-End of FY			27	27	38	46	53	53	53	53
Peak Demand			19	20	20	23	24	27	27	27
Spare Ratio			42.1%	35.0%	90.0%	100.0%	120.8%	96.3%	96.3%	96.3%
Avg. Vehicle Age			NA	NA	NA	NA	NA	NA	NA	NA
SCE (Capacity)			27	27	38	46	53	53	53	53
<b>CABLE CAR INVENTORY</b>										
Powell Cars (1-28)			28	28	28	28	28	28	28	28
California Cars (49-60)			12	12	12	12	12	12	12	12
Revenue Fleet-Start of FY			40	40	40	40	40	40	40	40
New Vehicles			-	-	-	-	-	-	-	-
Retired Vehicles			-	-	-	-	-	-	-	-
Revenue Fleet-End of FY			40	40	40	40	40	40	40	40
Peak Demand			30	30	30	30	30	30	30	30
Spare Ratio			33.3%	33.3%	33.3%	33.3%	33.3%	33.3%	33.3%	33.3%
Avg. Vehicle Age			NA	NA	NA	NA	NA	NA	NA	NA
SCE (Capacity)			40	40	40	40	40	40	40	40
<b>MOTOR COACH RESERVE INVENTORY</b>										
<b>Reserve Standard Bus (40ft/12.2m)</b>										
1988 - New Flyer (8801-8850)	1988	2002	45							
1989 - New Flyer (8901-8956)	1989	2003		45	31					
1999 - NABI (8001-8045)	1999	2013				20	20	20	20	20
1999 - Neoplan/Option (8101-8235; 8301-8304)	2002	2016								
1999 - Neoplan Option (8305-8371)	2003	2017								
1993 - AC Transit Gilligs	1993	2007			14	25	25	25	25	25
2006 - New Alt. Fuel (replaces 1989-New Flyer)	2006	2020								
Reserve Fleet			-	45	45	45	45	45	45	45
New in Reserve Fleet			-	45	14	31	-	-	-	-
Retired from Reserve			-	45	14	31	-	-	-	-
<b>Reserve Articulated Bus (60ft/18.3m)</b>										
1991 - New Flyer (9101-9124)	1991	2005								
1991 - New Flyer Rehab (9101-9124)	2005	2012								
2001 - Neoplan (6200-6225)	2002	2016								
2001 - Neoplan (6226-6299)	2003	2017								
2002 - Neoplan Option (6401-6424)	2003	2017								
Reserve Fleet			-	-	-	-	-	-	-	-
New in Reserve Fleet			-	-	-	-	-	-	-	-
Retired from Reserve			-	-	-	-	-	-	-	-
<b>Reserve Summary</b>										
Reserve Fleet-Start of FY			45	45	45	45	45	45	45	45
New in Reserve Fleet			-	45	14	31	-	-	-	-
Retired from Reserve			-	45	14	31	-	-	-	-
Reserve Fleet-End of FY			45	45	45	45	45	45	45	45
SCE (Capacity)			-	45	45	45	45	45	45	45



Figure 51: Fleet Plan CONTINUED

2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
14	14	14	14	14	14	14	14	14	14	14	14	14	14
3	3	3	3	3	3	3	3	3	3	3	3	3	3
10	10	10	10	10	10	10	10	10	10	10	10	10	10
11	11	11	11	11	11	11	11	11	11	11	11	11	11
7	7	7	7	7	7	7	7	7	7	7	7	7	7
7	7	7	7	7	7	7	7	7	7	7	7	7	7
1	1	1	1	1	1	1	1	1	1	1	1	1	1
53	53	53	53	53	53	53	53	53	53	53	53	53	53
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
53	53	53	53	53	53	53	53	53	53	53	53	53	53
27	27	27	27	27	27	27	27	27	27	27	27	27	27
96.3%	96.3%	96.3%	96.3%	96.3%	96.3%	96.3%	96.3%	96.3%	96.3%	96.3%	96.3%	96.3%	96.3%
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
53	53	53	53	53	53	53	53	53	53	53	53	53	53
28	28	28	28	28	28	28	28	28	28	28	28	28	28
12	12	12	12	12	12	12	12	12	12	12	12	12	12
40	40	40	40	40	40	40	40	40	40	40	40	40	40
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
40	40	40	40	40	40	40	40	40	40	40	40	40	40
30	30	30	30	30	30	30	30	30	30	30	30	30	30
33.3%	33.3%	33.3%	33.3%	33.3%	33.3%	33.3%	33.3%	33.3%	33.3%	33.3%	33.3%	33.3%	33.3%
NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
40	40	40	40	40	40	40	40	40	40	40	40	40	40
20	45	45	45										
				25									
					25	25	25						
25													
								25	25	25	25	25	25
45	45	45	45	25	25	25	25	25	25	25	25	25	25
-	20	-	-	25	25	-	-	25	-	-	-	-	-
-	20	-	-	45	25	-	-	25	-	-	-	-	-
				20									
					20	20	20	20	20	20	20	20	20
-	-	-	-	20	20	20	20	20	20	20	20	20	20
-	-	-	-	20	20	-	-	-	-	-	-	-	-
-	-	-	-	-	20	-	-	-	-	-	-	-	-
45	45	45	45	45	45	45	45	45	45	45	45	45	45
-	20	-	-	45	45	-	-	25	-	-	-	-	-
-	20	-	-	45	45	-	-	25	-	-	-	-	-
45	45	45	45	45	45	45	45	45	45	45	45	45	45
45	45	45	45	55	55	55	55	55	55	55	55	55	55

## Motor Coaches

Muni operates a fleet of 495 motor coaches in revenue service, providing service on 54 lines, carrying nearly 282,000 riders each weekday. The motor coach fleet is a combination of 30-foot small, 40-foot standard, and 60-foot articulated vehicles, as shown in Figure 52.

**Figure 52: Motor Coach Fleet**

Motor Coach Fleet	Vehicles
Small (30ft)	45
Standard (40ft)	302
Articulated (60ft)	148
Total	495

### Current Activities

**Clean Air Devices:** Muni is currently retrofitting 375 diesel buses with PM (particulate matter) filters and NO<sub>x</sub> (oxides of nitrogen) reduction devices. These installations will reduce each vehicle's PM by 85% and NO<sub>x</sub> by 25%. By the end of July 2005, Muni expects that 257 devices will be installed. The remaining units should be installed by the end of October 2005. Clean air devices will also be installed on the 45 Gillig buses purchased from AC Transit and the 12 New Flyer articulated vehicles that will undergo an end-of-life rehabilitation.

**Hybrid procurements:** Muni is completing the replacement of its motor coach fleet with clean air technologies. The first step is to purchase 56 standard electric-diesel hybrids. The production contract award is anticipated to be finally approved by August 2005. Muni is currently preparing specifications for a negotiated procurement of 30 small electric-diesel hybrids. This latter procurement was originally for 40 vehicles, but the remaining 10 coaches have been traded for preventive maintenance funding. Through an arrangement with MTC, these 10 coaches must not be replaced before one useful life cycle has expired.

**AC Transit Gilligs:** To replace its oldest diesel engines with modern, ultra-low emission engines, Muni has purchased 45 1993 Gillig buses from AC Transit. The 1993 Gilligs have been repowered with modern diesel engines that are nearly identical to the engines in Muni's existing fleet of 375 Neoplan buses. These low emission engines will also be retrofitted with clean air devices, allowing them to reach 2007 regulatory requirements for new engine PM emissions. These vehicles will initially be used in revenue service allowing Muni to retire almost all of the 1988/1989 New Flyers out of the revenue fleet. After the hybrid procurements are complete, the Gilligs will be used in the reserve fleet.

**Rehabilitate 12 New Flyer Articulated Motor Coaches:** To increase the carrying capacity of the fleet, 12 New Flyer articulated coaches will be rehabilitated to extend their useful life by 7 years. This project was originally scoped to rehabilitate 24 coaches, but the remaining 12 coaches have been traded for preventive maintenance funding. Through an arrangement with MTC, these 12 coaches must not be replaced before one useful life cycle has expired.

**Vehicle Retirements:** In an effort to remove some of its oldest buses from the revenue fleet, Muni will be retiring a number of vehicles. The first group will be 12 New Flyer Articulated coaches that originally went into service in 1991. Another group of 10 Orion 30-foot buses will also be retired. Together, these retirements will reduce the motor coach fleet from 495 to 473.

**Service Reductions:** The FY2006 Operating Budget anticipated service reductions. When such reductions are implemented, they will be submitted as an update to the Fleet Plan. If the service reductions are anticipated to be permanent, the size of future vehicle procurements will be adjusted downward accordingly. If the service reductions are temporary, once revenues increase, service will be

reinstated. Specific service change proposals have not been approved and therefore are not included in this Fleet Plan.

**Preventive Maintenance Funds:** To help address the shortfall in the FY2006 Operating Budget, Muni will forego the replacement of two subfleets of motor coaches. As described previously, the 30-foot Hybrid procurement has been reduced from 40 vehicles to 30, with the funding for 10 vehicles being converted to preventive maintenance funds (PM). Also the 24 New Flyer Articulated Motor Coach Rehabilitation project has been reduced from 24 to 12 vehicles, with the 12 being converted to PM. Muni will be allowed to bring these vehicles back into the revenue fleet using regional federal funds once the vehicles have been out of the program for one useful life cycle. For the 12 articulated coaches this would be in 2019, and 2021 for the 10 30-foot vehicles. As these dates approach, the need for these vehicles will be reassessed based on ridership trends and vehicle demand.

### ***Motor Coach Replacement***

FTA requires that motor coaches purchased using federal funds operate in revenue service for a minimum of 10 years for small vehicles and 12 years for standard and articulated vehicles. At the regional level, MTC allows transit agencies to program federal funds for the replacement of motor coaches when they have reached their 12<sup>th</sup> year in revenue service, for all types of vehicles. Due to the time needed to develop and award the procurement, and to test and receive the vehicles, motor coaches must effectively remain in revenue service for 14 years. It is with these replacement cycles that motor coach procurements are scheduled in Muni's Fleet Plan (See Figure 51). As mentioned previously, Muni is nearing completion of replacement of a significant portion of the motor coach fleet. The remaining 96 coaches are anticipated to be replaced with alternative fuel vehicles, as discussed in greater detail below.

### ***Motor Coach Rehabilitation***

To ensure that the fleet of motor coaches is able to function in good working order throughout their service life, it is prudent to conduct a midlife rehabilitation of major vehicles systems. The fleet plan includes midlife rehabilitation projects scheduled at 7 years in revenue service, although the funding for these projects has not been identified in the Capital Plan.

At this time, fleet rehabilitation projects that only allow the vehicle to reach the end of its useful life are placed relatively low on the region's funding priorities. This means that these types of rehabilitation projects must be funded by non-federal sources. However, vehicle rehabilitation that extends the life of the vehicle by at least half of its useful life ranks high on the region's funding priorities, comparable to fleet replacement projects. Muni has funded midlife rehabilitations through the Operating Budget on an as needed basis.

### ***Motor Coach Expansion***

At this time there are no expansions anticipated for the motor coach fleet. However there are two efforts that Muni is exploring which may impact the number of vehicles in the motor coach fleet. The first is the Schedule and Headway Adherence Study, which recommends that Muni procure 17 additional motor coaches to increase the number of peak vehicles available. These vehicles will not provide additional service; rather they are required to maintain the existing service schedules. By updating the schedules and expanding the fleet, Muni could significantly improve service reliability. Before this type of expansion could be contemplated, Muni would need to identify operating resources needed to fund these additional operating costs. The second is the Route Electrification Study, which identifies a number of potential conversions of motor coach lines to electric trolley operation. It is anticipated that a conversion project of this type would allow for trolley coaches to replace motor coaches equal in number to those needed to operate the line. Thus, while the trolley coach fleet would increase, the motor coach fleet would decrease by a similar number of vehicles (also see Trolley Coach Expansion and Route Electrification Study). As these proposals develop they will be incorporated into future revisions to the Fleet Plan.

### **Bus Rapid Transit**

New, different types of vehicles may be added to Muni’s fleet as part of the Bus Rapid Transit program. Bus Rapid Transit (BRT) is a high quality, state-of-the-art bus service that reduces travel time, increases reliability and improves passenger comfort. BRT combines the flexibility of buses and the quality of light rail at a fraction of the cost. A key feature of BRT systems across the US and the world are high-capacity buses, designed to mimic light rail vehicles. BRT vehicles are designed with wider doors for faster boarding and exiting, low floors or special equipment for level boarding, and more comfortable interiors. BRT vehicles will use alternative fuels. The Geary Corridor BRT and Van Ness BRT studies will assess the benefits and costs of acquiring new vehicles, including the costs of related infrastructure and facilities upgrades. While new buses are desirable, it is possible to implement BRT with existing buses and transition to new vehicles at the end of the useful life of the current fleet.

### **Peak Demand**

Peak demand is the revenue vehicle count during the peak season of the year, on the weeks and days that maximum service is provided. It excludes atypical days and one-time special events. Current peak demand is 397. The only planned change at this time to motor coach demand comes with changes associated with the startup of Third Street Phase 1, the IOS. The current 15-Third motor coach line will be replaced with light rail service. At the same time a number of lines, most significantly the 9X series, will be adjusted to meet service needs previously covered by the 15-Third line that will not be served by the IOS. This results in a net reduction of 15 peak vehicles, for a peak demand of 382.

**Figure 53: Motor Coach Change in Peak Demand**

Service	MC Demand
Pre-IOS Start Up	397
IOS Change	-15
Post-IOS Start Up	382

### **Maintenance Demand**

#### **Current Maintenance Demand**

To determine the total vehicles required for the peak period for both the maintenance and service requirements, Muni tracked current maintenance demand between December 2004 and March 2005. The source of the data is Muni’s “Shop History and Online Parts System” (SHOPS). This software is transit specific for maintenance and inventory tracking and is an off the shelf product from Spear Technologies. Vehicle availability data is saved twice daily in SHOPS by each of the seven maintenance facilities. The status of each revenue vehicle is saved prior to 8 a.m. for the AM Availability and prior to 4 p.m. for the PM Availability, and then measured against peak demand requirements. Vehicle availability data used for calculating the averages was for weekdays only, excluding holidays and weekends. The data was extracted from the SHOPS Facility Control Module, which provides a breakdown by type of vehicle holds. The AM Availability data was used exclusively for this exercise.

Motor coach management falls into four areas:

- Running Repair
- Modification and/or Retrofit
- Overhauls or Major Repairs
- Preventive Maintenance

#### **Running Repair**

Running repair includes coaches that are not in the shop for a scheduled activity such as a major repair or preventive maintenance. Running repair is comprised of defects made known by an in-service breakdown, a defect noted on an Operator Defect Card, unscheduled cleaning of debris or bodily fluids

and minor accident damage. Most of these tasks are completed and the coach is returned to revenue service within an hour or so, but frequently the workload can back up due to staffing or volume. This is an ongoing activity that remains fairly constant over time.

### **Modification/Retrofit**

Modifications fall into two main categories and four subcategories of technology upgrades:

1. Neoplan retrofit program
2. Technology upgrade installations (avg. 4 coaches out of service)
  - a. Cleaire or equivalent Particulate trap
  - b. Video
  - c. NextBus® (future daily requirements unknown)
  - d. TransLink® (future daily requirements unknown)

These all presently or will soon require that coaches be kept in from revenue service to allow for this work to be done.

### **Overhauls/Major Repairs**

Heavy repairs fall into four categories:

1. Engines
2. Transmissions
3. Frame cracks
4. Brakes/Cooling/etc.

These repairs are labor intensive and require considerable material resources. A significant challenge in this area is eliminating the backlog of heavy repair needs. In addition to addressing the individual failure of an engine, Muni also addresses future transmission failures on the coach by assembling engine modules comprised of a rebuilt engine and transmission package.

There is currently a backlog of engine overhauls needed for 1988/1989 New Flyer motor coaches. These vehicles have operated beyond their useful life and are due for replacement. Two efforts are currently underway to remove the last of these vehicles from the revenue fleet. The first is the purchase of 45 1993 Gilligs from AC Transit. These vehicles recently underwent an engine overhaul and are in good working condition. The few remaining New Flyers will be replaced by the procurement of hybrid coaches scheduled for delivery starting in October 2006.

The Orion fleet has operated beyond its useful life and is due for replacement. While a replacement project is moving forward, retirement of the Orion fleet may not occur until 2007. In the meantime, the Orion frame has developed cracks, leading to a large number of these vehicles being held out of daily service.

Brakes, cooling, heaters, and other systems all require routine repairs that can at times put a strain on the maintenance capability of the system. These are often seasonal (heaters and defrosters in winter or cooling problems in the summer), and require intense efforts to keep maximum fleet availability.

### **Preventive Maintenance**

Preventive maintenance is a mainstay of Muni's maintenance efforts, with reliability improving steadily over the past three years in spite of the accumulation of the work backlog this Recovery Plan addresses.

Muni intends to constantly improve this PM program to move from a position of reactive maintenance to a better planned, more consistent and more proactive maintenance operation. With the implementation of the new Maintenance Management software, Muni projects an ability to schedule maintenance more accurately, plan better resource utilization, and build a more cost-effective maintenance program.

**Figure 54: Motor Coach Maintenance Average Daily Demand Summary**

Maintenance Demand	FY05	FY06	FY07	FY08	FY09
Running Repair	42	42	42	42	42
Mod/Retrofit	15	10	10	10	0
Overhauls/Major Repairs	64	27	25	25	25
Preventive Maintenance	7	7	7	7	7
Total	128	86	84	84	74

**Recovery Plan**

Daily motor coach availability has been negatively affected by four factors:

1. Neoplan retrofit program (10 coaches out of service)
2. Neoplan transmission problems (avg. 15 coaches out of service)
3. Orion frame and engine failures (avg. 15 coaches out of service)
4. Technology upgrade installations (avg. 4 coaches out of service)
  - Cleaire Particulate Matter/NO<sub>x</sub> Traps
  - Video Surveillance Systems
  - NextBus® (future)
  - TransLink® (future)

In the past Muni has maintained service levels by utilizing its reserve fleet to bridge the gap between available equipment and service demand. Muni recognizes the importance of discontinuing this practice. The following recovery measures outline Muni’s efforts that are now underway to restore fleet availability to acceptable levels.

**Establish In-House Transmission Repair Capability for the B-500 Allison**

Muni purchased Allison certified Transmission Diagnostic and Rebuild training for the B-400 and B-500 transmissions.

Transmissions that can be rebuilt by Muni are being installed at both the Woods Shop and at the Allison Distributor’s shop at the rate of two (2) per week. The present backlog of work will extend into early July of 2005. However, the present failure rate is about two (2) per week, so resolution of the transmission problem will not be realized until the whole fleet has had updated components installed, pushing final resolution out to approximately November 2008. As of April 2005 Muni has completed 114 unit transmission change-outs.

**Outsource Orion Frame Repairs**

Out of the fleet of 45 Orions, 11 have recently developed frame cracks. As described previously, the Orions are operating past their useful life and are due for replacement. A procurement project is moving forward, but vehicle delivery may be some time off. The Orion frame cracks are a short-term problem that will be resolved by the end of the FY05. Muni had six Orion coaches repaired by Complete Coach Works at a cost of \$25,000 each. Muni has five additional Orions needing frame repair, but these will be included in the 10 Orions slated for retirement. This will resolve the current backlog of vehicles, allowing Muni to identify and resolve possible future frame cracks in a timely basis.

**Increase Engine Repair Capacity**

Muni has arranged for the purchase of sound used engine blocks from Seattle and some miscellaneous 6V92 engines for the New Flyer fleet. New Flyer engine replacements have not been a priority because they will be replaced by the AC Transit coaches. However, Muni expects that by the end of 2005, the New Flyer hold count for engines will be abated, provided there are not heavy failures during the summer

months. The current failure rate is about one per month, with Shop production at two per month. There is also a current backlog that Maintenance will eliminate by January 2006. Once the backlog is eliminated, Maintenance will be able to address any failures on the few remaining New Flyer coaches without affecting the number of vehicles available to meet peak demand.

**Brakes/Cooling/Heaters**

The retrofit by Neoplan and the installation of the Young/Touchstone units should reduce future fleet defects. Nevertheless, these types of repairs are always in house and represent considerable allocation of the systems skilled resources and material expenditures.

**Figure 55: Motor Coach Maintenance Recovery Plan**

Year	FY05	FY06	FY07	FY08	FY09
Maintenance Demand	128	86	84	84	74
Peak Demand	397	382	382	382	382
Revenue Fleet	495	453	453	453	453
Vehicle Surplus/Deficit	-30	-15	-13	-13	-3

**Fleet Size**

A number of changes to the composition of the motor coach fleet are planned in the next few years. Muni started 2005 with 495 motor coaches. As the economy has cooled off, the pressure for Muni to provide additional service has subsided. Also, Muni is making a commitment to operate with a 20% spare ratio, which will require reducing the size of the fleet. The first step is to retire 10 Orion (30-ft) and 12 New Flyers (60-ft) in 2005. This will bring the spare ratio down to 20% for motor coaches. The change will also provide the operating budget with \$6M, as vehicle replacement funds are swapped for preventative maintenance dollars. When the IOS begins service, motor coach demand will further decrease. This will allow Muni to further reduce the motor coach fleet by 20 vehicles in 2006. Finally, the hybrid procurements will shift the fleet mix by reducing the small 30-foot fleet by 5 vehicles and increasing the standard 40-foot fleet by 5 vehicles. This will not change the overall fleet size, but will increase carrying capacity. These changes are summarized in Figure 56.

**Figure 56: Motor Coach Planned Changes in Fleet Size**

	As of Jan. 2005	Retire 22 vehicles	IOS Startup	Hybrid Procurement
Small	45	35	35	30
Standard	302	302	282	287
Articulate	148	136	136	136
Total	495	473	453	453

**Spare Ratio**

As of January 2005, Muni had 495 motor coaches with a peak demand of 397 vehicles. This resulted in a 24.7% spare ratio. To bring the spare ratio within the 20% FTA required level, Muni will retire 10 Orion (30-ft) and 12 New Flyers (60-ft). This will bring the spare ratio down to 20%. At IOS startup, peak demand will decrease by 15 vehicles, allowing 20 additional motor coaches to be retired from the revenue fleet and moved into the reserve fleet to remain at a 20% spare ratio. Finally the hybrid procurement will shift the fleet mix in favor of larger capacity vehicles, and will not change the spare ratio. These adjustments are summarized in Figure 57.

**Figure 57: Motor Coach Spare Ratio Changes**

	As of Jan. 2005	Retire 22 vehicles	IOS Startup	Hybrid Procurement
Fleet Size	495	473	453	453
Peak Demand	397	397	382	382
Spares/Float	98	76	71	71
Spare Ratio	24.7%	19.1%	18.6%	18.6%

**Trolley Coaches**

The trolley coach fleet carries over 236,000 riders each weekday. Trolley coaches are rubber-tired vehicles, powered electrically through overhead wires above the street right-of-way. Trolley coaches are zero-emission vehicles, operate with very little noise, and can perform effectively on grades far steeper than motor coaches or most rail vehicles. Currently, Muni operates the largest trolley coach fleet in the United States. The trolley coach fleet is a mix of 40-foot standard and 60-foot articulated coaches. With the completion of the ETI procurement, the trolley coach fleet mix is as shown in Figure 58.

**Figure 58: Trolley Coach Fleet**

Manufacturer	Year	Type	Vehicles
ETI	2000	Standard (40ft)	240
New Flyer	1992	Articulated (60ft)	60
ETI	2003	Articulated (60ft)	33
Total			333

**Trolley Coach Replacement**

Muni recently completed the replacement of 295 1976-Flyer coaches with 240 standard and 33 articulated ETI coaches. FTA requires that trolley coaches purchased using federal funds operate in revenue service for a minimum of 18 years. MTC requires that the vehicle be in service for 18 years before replacement funds can be programmed. As with the motor coach replacement projects, this generally adds two years to the effective life of the vehicle to allow for procurement and delivery. This sets the schedule for trolley coach replacement at 20 years as shown in Figure 51.

**Trolley Coach Rehabilitation**

To ensure that the fleet of trolley coaches is able to function in good working order throughout their 20-year service life, it is prudent to conduct a periodic rehabilitation of major vehicle systems. It is currently anticipated that rehabilitation campaigns should be conducted at 6 and 12 years in service. At this time, fleet rehabilitation projects that only allow the vehicle to reach the end of its useful life are placed relatively low on the region’s funding priorities. This means that these types of rehabilitation projects must be funded by non-federal sources. For these reasons the midlife rehabilitation program is currently not funded through the capital program. However, vehicle rehabilitation which extends the life of the vehicle by at least half of its useful life rank high on the region’s funding priorities, comparable to fleet replacement projects.

**Trolley Coach Expansion**

With the recent ETI trolley coach procurement completed, the total number of trolley coaches decreased from 355 to 333 vehicles, as a number of standard coaches were replaced with articulated vehicles. There are no expansions to the trolley coach fleet that are funded at this time. However there are two efforts that Muni is exploring which may impact the number of vehicles in the trolley coach fleet. The first is the Schedule and Headway Adherence Study, which recommends that Muni procure 21 additional trolley coaches to increase the number of peak vehicles available. These vehicles will not provide additional



service; rather, they are required to maintain the existing service schedules. By updating the schedules and expanding the fleet, Muni could significantly improve service reliability. However, before this type of expansion could be contemplated, Muni would need to identify operating resources needed to pay for this additional service.

The second effort is the Route Electrification Study, which identifies a number of potential trolley coach extensions and conversions of motor coach lines to electric trolley coach operation. The length of the trolley coach extension would determine the number of expansion coaches needed to maintain current service frequencies on the line. In the case of converting motor coach lines to electric trolley operation, it is anticipated that motor coaches could be replaced with a comparable number of trolley coaches. Thus, the trolley coach fleet would increase, while the motor coach fleet would decrease by a similar number of vehicles. The primary constraint on an expansion to the trolley coach fleet is the availability of storage and maintenance space. The two current trolley coach facilities, Presidio and Potrero, are at capacity. Muni would need to build a new trolley coach facility or convert a portion of a motor coach facility to accommodate additional trolley coaches in the fleet. As these proposals develop they will be incorporated into future revisions to the Fleet Plan.

### **Peak Demand**

As of January 2005, Muni had 333 trolley coaches with a peak demand of 264 vehicles. When ridership demand warrants, service on the 30-Stockton or 45-Presidio line will be extended into Mission Bay, increasing peak demand by 6 trolley coaches. With the opening of the Central Subway, the “short line” trips on the 30-Stockton line will be eliminated, decreasing peak vehicle demand by 11 vehicles. These changes are summarized in Figure 59.

**Figure 59: Trolley Coach Changes in Peak Demand**

Service Scenario	Change	Result
Jan. 2005		264
Mission Bay	+6	270
Central Subway	-11	259

### **Fleet Size**

There are currently no planned changes to the size of the trolley coach fleet. If future increases in trolley coach service are developed, one strategy would be to reduce the maintenance demand on the fleet. If the current spare ratio of about 26% could be brought down around 20%, then about 12 additional peak vehicles will be available. As future service proposals that increase peak demand are developed, the Fleet Plan will be updated accordingly.

### **Spare Ratio**

As of January 2005, Muni had 333 trolley coaches with a peak demand of 264 vehicles. This resulted in a 26.1% spare ratio. There are no planned changes to the number of vehicles in the trolley coach fleet at this time. When ridership demand warrants, service on the 30-Stockton or 45-Presidio line will be extended into Mission Bay, increasing peak demand by 6 trolley coaches, resulting in a 23.3% spare ratio. With the opening of the Central Subway, the “short line” trips on the 30-Stockton line will be eliminated, decreasing peak vehicle demand by 11 vehicles. This will result in a spare ratio of 28.6%. These changes are summarized in Figure 60.

**Figure 60: Trolley Coach Changes in Spare Ratio**

	As of Jan. 2005	Mission Bay	Central Subway
Fleet Size	333	333	333
Peak Demand	264	270	259
Spares/Float	69	63	74
Spare Ratio	26.1%	23.3%	28.6%

**Light Rail Vehicles**

Light rail vehicles are used in operation of the five Muni Metro Lines (J, K, L, M, and N), and the Castro Shuttle during peak periods only, carrying about 132,000 riders a day. These lines operate in conditions which range from exclusive right-of-way in the Muni Metro Subway, to mixed flow operation on city streets. LRVs provide an efficient, high capacity means of transporting large numbers of passengers.

**LRV Replacement**

In April 2003, Muni took delivery of the last of 151 new Breda LRVs. These vehicles replaced Muni’s old Boeing SLRVs, and provided additional vehicles for operation on the Muni Metro Turnback, Muni Metro Extension, and for the Third Street Light Rail Phase 1-Initial Operating Segment. FTA requires that light rail vehicles purchased using federal funds operate in revenue service for a minimum of 25 years. As with the other fleets, MTC allows transit agencies to program federal funds for replacement vehicles when they have reached the end of their useful life, in this case 25 years. Due to the time needed to develop and award the procurement, and to test and receive the vehicles, LRVs must effectively remain in revenue service for 27 years. This sets the schedule for LRV replacement at 27 years as shown in Figure 51.

**LRV Modification**

Work is underway under three modifications to the Breda Contract, Modifications Nos. 9, 11 and 12. The work under these modifications is currently being performed by Breda at its facility in Pittsburg, California.

**Modification No. 9: 3<sup>rd</sup> Brake control unit/Step extension/Video camera/Primary truck suspension:** There are 20 cars to be completed under the Mod. 9 retrofit. Muni anticipates that they will be completed in February 2006.

**Modification No. 11: Video camera installation on LRV fleet:** There are approximately 75 cars included in the Mod. 11 work. Muni anticipates that this work will be completed by December 2005.

**Modification No. 12:** Mod. 12 to the Breda Contract adds Brake Monitoring and Control Devices (EBALD) and brake overhaul and video surveillance equipment to the Breda fleet. This work is estimated to cost about \$14 million, with about \$10 million of this total to be funded using revenues from a Breda lease leaseback transaction. Funding is available to equip 151 cars with EBALD and perform a brake overhaul on 23 older LRVs. The Metro Support shop is engaged in a campaign to overhaul 23 air supply units with a new air dryer to support the brake overhaul. The brake overhaul is scheduled for completion by March 2006. Muni anticipates that the Mod. 12 EBALD element will be completed by November 2007, most of which will be performed by Breda at Green Division.

A number of other Breda safety modification projects have been grouped into the Breda Safety Modification program shown in the table below. At this time, funding for this program has not yet been identified.

**Figure 61: Breda Safety Modifications (\$2002)**

Phase	Cost Est.
Interlock Step Cutout/Door	\$1,350,000
Master Controller Mod	\$2,750,000
Sensitive Edge Body Seals	\$750,000
Emergency Door Release	\$750,000
Lighting Ballasts Replace	\$3,341,100
Auto Drop Pantograph	\$3,000,000
Crew Door Control Switch	\$55,000
Onboard Event Recorder	\$3,000,000
Total	\$14,996,100

### ***LRV Rehabilitation***

Based on industry standards, a regular program of rehabilitation projects should be scheduled for every five years the vehicle is in service. The rehabilitation of major components helps to ensure that the vehicles can operate with reliability and efficiency throughout their life. Each vehicle rehabilitation project would include rehabilitation or replacement of brakes, trucks, couplers, and HVAC system. However, as described earlier for the other modes, the region's federal program does not fund these types of midlife rehabilitation projects. Therefore, although these projects are included in the CIP, there are no available funds programmed in the capital program to perform the work.

### ***LRV Expansion***

There are currently three anticipated expansions to the LRV fleet. The first would require 10 additional vehicles to serve the developing Mission Bay Area as a short line operation on Third Street. Second, the Central Subway will require 4-5 additional vehicles. Finally, it is anticipated that an additional 10 vehicles will be needed to meet future service demand on existing Muni Metro lines (J, K, L, M, and N). These increases are included in the LRV Inventory in Figure 51.

In addition to these planned expansions to the LRV fleet, Muni has considered a number of light rail transit expansion projects, such as the Geary Corridor and Chinatown/North Beach. The additional LRVs required by these projects are not included in the LRV Inventory at this time. However, an estimate of the capital cost to procure the additional vehicles is included in the respective expansion project. As these expansion projects develop, their associated vehicle needs will be added to the LRV Inventory. Also, the expansion of the LRV fleet needed for a major corridor project such as Geary would require a new maintenance and storage facility.

### ***Peak Demand***

Current peak vehicle requirements on the J, K, L, M, N, and Castro Shuttle lines are 110 LRVs. When the Third Street IOS begins service in June 2006, peak demand will increase by 5 vehicles, as the K-line is extended along the Third Street line. When ridership demand warrants, a separate line will operate to the Mission Bay loop. Initially, this could be an extension of one of the existing Muni Metro lines, most likely the J-Church. Once the Central Subway is constructed, a separate Third Street "short line" would operate between Chinatown and the Mission Bay loop. Either of these options would require an additional 8 peak vehicles. When the Central Subway is operational, peak demand will increase by 3 vehicles. Finally, as passenger demand grows on the Muni Metro System, additional vehicles will be needed to expand capacity. This would add up to 8 peak vehicles to the system. These changes are summarized in Figure 62.

**Figure 62: LRV Planned Changes in Peak Demand**

Service Scenario	Change	Result
Jan. 2005		107
Third Street IOS	+8	115
Mission Bay	+8	123
Central Subway	+3	126
J,K,L,M,N Expansion	+8	134

**Maintenance Demand**

To determine the total vehicles required for the peak period for both the maintenance and service requirements, Muni tracked current maintenance demand between December 2004 and March 2005. The source of the data is Muni’s SHOPS software (see Maintenance Demand section under Motor Coach discussion). The AM Availability data was used exclusively for this exercise.

**Support Shop Services:** The Support Shop performs all major component replacements, and heavy repair work. The scope of work includes repairing or replacing trucks, HVAC, couplers, pantographs, pneumatic packages, brakes, and wheel profiling. In addition, the Support Shop is engaged in vehicle reliability campaigns. There are typically five cars on hold for Support Shops on a daily basis.

**Paint and Body Shop Services:** The Paint & Body Shops perform ongoing fleet appearance programs and repair accident damage. There are typically two cars in the paint shop and one car in body repair at all times.

**Preventive Maintenance:** Preventive Maintenance Inspections are scheduled based on vehicle mileage. Inspections ensure the LRV equipment remains in good working order and equipment is inspected, adjusted, serviced and/or repaired to prevent premature failure due to fatigue and aging. Minor defective equipment is replaced during the inspection. There are four cars on inspection hold on average per day.

**10-year Vehicle Overhaul:** A ten-year vehicle overhaul is planned to begin in FY 2007. A systematic overhaul of all light rail vehicles is required every five years for the life of the vehicle to maintain reliability. This is a systematic overhaul of vehicle equipment that includes HVAC, brakes, couplers, pantograph, propulsion equipment, doors, suspension, wiring, electrical system, car body, cab, seats, and other equipment.

**Figure 63: LRV Average Daily Maintenance Demand Summary**

Maintenance Demand	FY05	FY06	FY07	FY08	FY09
Retrofits & Modifications	7	7	5	0	0
Corrective Maintenance	20	17	16	18	13
Accident Repairs	4	3	2	2	2
Support Shop Services	5	5	5	5	5
Paint & Body Shop Services	3	3	3	3	3
Preventive Maintenance	4	4	4	4	4
10-year Overhaul	0	0	0	4	4
Total	43	39	35	36	31

### **Recovery Plan**

LRV availability has been negatively affected primarily by three factors:

- 1) Breda Retrofit and Modification Programs (7 LRVs out of service)
- 2) Corrective Maintenance (~30 LRVs out of service)
- 3) Accident Repairs (4 LRVs out of Service)

### **Retrofit and Modifications**

Upon the completion of the work under Modification No.11 to the Breda Contract, currently forecast for December 2005, Muni will reduce the cars out of service for modification at any one time from 7 to 6. Upon the completion of the work required under Modification No. 9 to the Breda Contract in February 2006, Muni will reduce the number of cars out of service from 6 to 5.

**Mod 9-3<sup>rd</sup> Brake control unit/Step extension/Video camera/Primary truck suspension:** There are 27 cars to be completed under the Mod 9 retrofit. It is anticipated the 27 cars will be completed in February 2006.

**Mod 11-Video camera installation on LRV2 & LRV3:** There are approximately 75 cars included in Mod 11. It is anticipated that this work will be completed by December 2005. It is important to point out that Mod 11 work runs concurrent with Mod 9 and Mod 12 work.

**Mod 12-EBALD / Brake Overhaul:** There are 151 LRVs included in the Mod 12 program. Funding is available for 151 EBALD cars and 23 LRV2 cars for the Brake Overhaul. The Metro Support shop is engaged in a campaign to overhaul 23 Air Supply units with a new air dryer to support the Brake Overhaul. The Brake Overhaul is scheduled for completion by March 2006. It is anticipated that the Mod 12 EBALD element will be completed by November 2007.

**Articulation Cracks:** Due to a fleet defect, there is an articulation yoke repair program currently underway affecting the entire LRV fleet. Of the 151 cars in the fleet, 30% have been completed. Anticipated completion of this repair program is April 2006.

### **Corrective Maintenance**

Muni is planning on a service demand of 112 vehicles when the Third Street IOS is opened for revenue service. In order to meet this demand, at a minimum the corrective maintenance hold must be reduced from 35 to 25 vehicles. In anticipation of the 2005 and 2006 baseball seasons and the Third Street IOS, Muni has several fleet reliability campaigns in progress. Unless otherwise indicated, these campaigns will continue for the life of the vehicle in five-year cycles, or until a vehicle overhaul program takes place.

**V-Tag transponders & Control units:** There is an ongoing fleet inspection to ensure V-tag functionality of the fleet. To date we have repaired/replaced 73 failed transponders/control units. This is an ongoing fleet campaign and will continue for the life of the vehicle in five-year cycles, or until a vehicle over haul program takes place.

**P1/P2 Train line connectors:** There is an ongoing fleet inspection to ensure electrical integrity of the P1/P2 train line connectors, which tend to fail primarily during winter months. To date, one car is on hold for train line connector related defects. The anticipated completion of repairs for these four cars is April 2005. This is an ongoing fleet campaign and will continue for the life of the vehicle in five-year cycles, or until a vehicle over haul program takes place.

**Couplers:** There is an ongoing coupler/draft gear overhaul and rebuild program in place at Muni to ensure a safe coupling operation, increase reliability and to extend service life of the unit. Support shop personnel remove, rebuild and replace couplers at the rate of four units per month. It is anticipated the fleet will be cycled out by April 2008. This is an ongoing fleet campaign and will continue for the life of the vehicle in five-year cycles, or until a vehicle over haul program takes place.

**Pantographs:** There is an ongoing weekly inspection and replacement program in place to ensure serviceability of pantograph rocker assembly carbons. Running repair replaces approximately 20 rocker assemblies per week. In addition, there is an ongoing pantograph assembly overhaul program in the Support Shop. Support Shop personnel replace worn or defective assemblies on the car at the rate of four pantograph assemblies per month. It is anticipated the pantograph assemblies on the fleet will be replaced by September 2008. This is an ongoing fleet campaign and will continue for the life of the vehicle in five-year cycles, or until a vehicle over haul program takes place.

**HVAC:** There is an ongoing HVAC unit repair and replacement program in the Metro Support Shop. The Support Shop repairs two defective units per month. In addition, Muni has a contract in place with Complete Coach Works to overhaul and upgrade 59 air conditioning units at the rate of four units per month. Upgrades include installing a scroll compressor, soldering all joints and installing a redesigned fresh air box. The upgrades will improve reliability, reduce maintenance and prolong service life. To date 24 units have been returned and installed on Muni LRVs. Muni is seeking additional funds to overhaul and upgrade the remaining units in the fleet. It is anticipated the fleet will be cycled out by September 2009. This is an ongoing fleet campaign and will continue for the life of the vehicle in five-year cycles, or until a vehicle overhaul program takes place.

**Articulation Wiring Harnesses:** There is an ongoing articulation harness repair/replacement program of the seven articulation cables on the roof of the LRV. The articulation harness failures are identified and we are installing an interim fix as prescribed by Fleet Engineering to return cars to revenue service. The scope of work for the interim fix requires 40 to 60 man-hours per car. To date the interim fix has been installed on 20 cars on an as failed basis. At the current rate of repair it is anticipated the fleet will be completed by December 2007. This is an ongoing fleet campaign and will continue until a vehicle over haul program takes place, at which time a permanent fix will be installed.

**Unscheduled/Running Repairs:** This is unscheduled or running maintenance for breakdowns and defects reported while the vehicle is in service. The Running Repair unit performs defect repairs that typically include propulsion, brakes, doors/steps, ATCS, train line issues, and couplers. In addition, Running Repair performs weekly inspections of specific car borne equipment, fleet preparation (includes functionality checks of safety critical elements), yard set-up for service pull-outs, train movements in the yard, vehicle modification installations, ongoing reliability campaigns and support to Fleet Engineering.

**Accident Repairs**

There are currently four vehicles on long-term hold due to accidents. Muni has received a quotation from Breda for the repair of one vehicle, Car #1541. It will be shipped to Breda for repair in April 2005. Anticipated return to Muni is September 2005. Muni intends to ship a second accident hold vehicle and anticipates that that vehicle will be returned to service June 2006. The remaining two accident vehicles have sustained extensive structural damage. The cost to repair these two vehicles may be fiscally prohibitive and it is recommended they be removed from the fleet and used for spare parts.

**Figure 64: LRV Maintenance Recovery Plan**

Year	FY05	FY06	FY07	FY08	FY09
Maintenance Demand	43	39	35	36	31
Peak Demand	107	115	115	115	115
Revenue Fleet	151	151	151	151	151
Vehicle Surplus/Deficit	1	-3	1	0	5

## Fleet Size

The current LRV fleet consists of 151 Bredas. This includes 136 vehicles for the existing Muni Metro lines (J, K, L, M, N, and Castro Shuttle) and 15 LRVs for the Third Street line. Procurement of 10 LRVs will be needed to operate the Mission Bay short line. Finally, the Central Subway project will purchase 4 LRVs. These changes are summarized in Figure 65.

**Figure 65: LRV Changes in Fleet Size**

	As of Jan. 2005	Third St IOS	Mission Bay	Central Subway	J,K,L,M,N Expansion
LRVs	151	151	161	165	175

## Spare Ratio

As of January 2005, Muni had 151 motor coaches with a peak demand of 110 vehicles. This resulted in a 37.3% spare ratio. This spare ratio is relatively high since the fleet includes vehicles that will soon be required for the Third Street IOS. When the IOS starts operation the spare ratio will drop under 31%. The spare ratio will remain at this level for the foreseeable future as future service expansions will include the procurement of the required fleet. As part of the 3<sup>rd</sup> Street Phase 2 Central Subway supplemental EIS now underway, Muni will examine if the need for additional cars should be reduced. The changes to spare ratio over time are summarized in Figure 66.

**Figure 66: LRV Changes in Spare Ratio**

	As of Jan. 2005	Third St IOS	Mission Bay	Central Subway	J,K,L,M,N Expansion
Fleet Size	151	151	161	165	175
Peak Demand	110	115	123	126	134
Spares/Float	41	36	38	39	41
Spare Ratio	37.3%	31.3%	30.9%	31.0%	30.6%

## Historic Light Rail Vehicles

The historic streetcar fleet is a collection of electric rail vehicles used on the F-Market & Wharves line, carrying nearly 14,000 trips per weekday. These include 17 Presidents' Conference Committee Cars (PCCs), 10 cars with a Peter Witt design from Milan, Italy, and other historic streetcars from the U.S. and around the world as shown in Figure 69. Muni currently runs 27 Historic Light Rail Vehicles (HLRVs) in regular revenue service. There are an additional 6 vehicles available for special service.

### Milan Enhancements

The 10 Milan streetcars will undergo a series of enhancements to be performed in house by Muni maintenance staff. The enhancements include: installing an electro-pneumatic valve to electrically apply brakes, a switch to act in a dead-man function, a treadle switch on center door outboard step, a sensitive edge switch to center door panels, a manual override switch, a circuit breaker panel, a multi-speed backup controller with an interface to the brakes, a new Operator's cab heater, an air horn, and an air bell. This work is scheduled to be complete in 2007.

### HLRV Rehabilitation

Due to their historic nature, the HLRV fleet is not replaced on a regular schedule. This makes a program of regular rehabilitation critical to the long-term operation of this fleet. Major overhauls are currently scheduled for every ten years a vehicle is in service. These overhauls extend the useful life of each vehicle, as well as ensuring ongoing reliable operation. The subfleet of 17 PCCs will begin the 10-year overhaul program in 2007.

***Fleet Size/HLRV Expansion***

The current historic streetcar fleet consists of 17 PCCs and 10 Milan cars. The popularity of the F-line and planned future expansion service requires Muni to add vehicles to the historic fleet. There are several procurement and rehabilitation projects moving forward to expand the size of the historic streetcar fleet.

In the next phase, Muni will rehabilitate 6 historic vehicles to meet CPUC and ADA requirements, and perform a major overhaul of one vehicle (#189). This project is fully funded and will bring the revenue fleet of HLRVs to 34 streetcars when complete in 2007.

In another phase, Muni will rehabilitate 6 PCCs to meet CPUC and ADA requirements, and perform a major overhaul of Historic Car #1. This project will bring the revenue fleet of HLRVs to 41 streetcars when complete in 2007.

Muni purchased 11 PCCs from New Jersey Transit. These vehicles are currently undergoing rehabilitation by Brookville Equipment Co. in Brookville, PA, and will be available for revenue service in 2006. Addition of the New Jersey Transit PCCs will bring the historic fleet up to 52 vehicles.

Finally, Muni has received funding through SFMRIC to purchase and rehabilitate a New Orleans streetcar. This will bring the total operational historic streetcar fleet to 53 vehicles.

This group of rehabilitation projects will provide additional vehicles so that Muni can expand F-line service, relieve pressure on some of the vintage vehicles now in daily use, and provide for future E-line service as described below.

These changes are summarized in Figure 67.

In addition to providing service to meet current F-line needs, there are plans to operate a separate historic streetcar line between Fisherman’s Wharf and the Caltrain terminal at Fourth & King streets. The E-line would require 12 additional vehicles, increasing peak demand by 9 streetcars with three maintenance spares. To allow for this new line, low-level boarding platforms have been added at the stations along the MMX. One issue that is still to be resolved is how the streetcars will turn around when they reach the terminal at Fourth & King. The options are to construct an MMX terminal loop or limit operation to the double-ended vehicles in the historic fleet. Since funding for a terminal loop has not been identified, at this time E-line service would be constrained by the number of double-ended vehicles in the fleet.

Currently Muni has nine double-ended HLRVs available for revenue service, although six of these require two operators, adding significantly to the cost of operations. It is anticipated that E-line service could be phased in beginning in 2006 if resources can be identified to cover the projected additional operating expenses.

Finally, an effort is currently underway to explore the possibility of extending the proposed historic streetcar extension from Fisherman's Wharf through National Park Service lands in Aquatic Park and Fort Mason. From Fort Mason, further extension of historic streetcar service to The Presidio is also under consideration. This effort is being lead by a partnership of non-profit agencies, the National Park Service and Muni. Additional vehicles required by this project will need to be identified as the study effort progresses. Also a funding strategy will need to be developed at that time.

**Figure 67: Historic Streetcar Changes in Fleet Size**

	<b>Subfleet</b>	<b>Total</b>
PCCs	17	17
Milan	10	27
NJT PCCs	11	38
6 ADA/CPUC + #189	7	45
6 ADA/CPUC + #1	7	52
New Orleans car	1	53



### **Peak Demand**

Current peak demand on the F-line is 21 vehicles. There are a range of potential E-line service schedules. A minimum demonstration weekend only service would operate 8 hours a day at 44 minute frequencies, requiring 2 streetcars. A more frequent demonstration line could operate on weekends only at 30 minute frequencies with 3 peak vehicles. The minimum E-line service would operate 20-hours per day, seven days a week, at roughly 22 minute headways, requiring 4 peak vehicles. Finally the optimum E-line service would operate 20 hours per day, seven days a week, at 15 minute peak headways, requiring 6 additional peak vehicles. These service scenarios are show in Figure 68.

**Figure 68: Historic Streetcar Peak Demand**

<b>Service Plan Alternatives</b>	<b>Peak Demand</b>	<b>Weekday Maintenance Demand</b>	<b>Total Fleet Requirement</b>
F-line (w/ Shuttle)	21	6	27
Weekend Demo 1	2	2	4
Weekend Demo 2	3	2	5
E-line 1	4	2	6
E-line 2	6	3	9

### **Maintenance Demand/Spare Ratio**

The current historic streetcar fleet consists of 27 vehicles. With a peak vehicle demand of 20, the historic streetcar fleet has a 35.0% spare ratio. The historic streetcar fleet has a relatively high spare ratio due to the historic nature of the fleet. These vehicles are largely “one-of-a-kind” and often require handcrafting replacement parts. For this reason it can take significantly longer to bring a historic streetcar back into service than a modern LRV. Also due to their historic nature a number of streetcars cannot run continuous 20-hour runs, seven days a week, though the demands of operating the F-line require vehicle assignments like any other trunk line in the system. Thus the fleet has been divided between workhorse streetcars that can run in daily service, and limited service vehicles which can only operate at about a third of a workhorse load.

### **Fleet Size**

The current historic streetcar fleet consists of 17 PCCs and 10 Milan cars. There are several procurement and rehabilitation projects moving forward to expand the size of the historic streetcar fleet.

Muni purchased 11 PCCs from New Jersey Transit. These vehicles are currently undergoing a rehabilitation program and will be available for revenue service in 2006. This will bring the fleet up to 38 vehicles.

The next phase to be undertaken will rehabilitate 6 historic vehicles to meet CPUC and ADA requirements, and perform a major overhaul of one vehicle (#189). This project is fully funded and will bring the revenue fleet of HLRVs to 45 streetcars when complete in 2007.

Another group of 6 PCCs will be rehabilitated to meet CPUC and ADA requirements, and perform a major overhaul of Historic Car #1. This project will bring the revenue fleet of HLRVs to 52 streetcars when complete in 2007.

Finally, Muni has received funding through SFMRIC to purchase and rehabilitate New Orleans streetcar #952. This will bring the total historic streetcar fleet to 53 vehicles.

These changes are summarized in Figure 69.

**Figure 69: Historic Streetcar Changes in Fleet Size**

	<b>Subfleet</b>	<b>Total</b>
PCCs	17	17
Milan	10	27
NJT PCCs	11	38
6 ADA/CPUC + #189	7	45
6 ADA/CPUC + #1	7	52
New Orleans #952	1	53

As previously described, the historic streetcar fleet has a relatively high spare ratio due to the historic nature of the fleet. These vehicles are largely “one-of-a-kind” and often require handcrafting replacement parts. For this reason it can take significantly longer to bring a historic streetcar back into service than a modern LRV. Also due to their historic nature a number of streetcars cannot run continuous 20-hour runs, seven days a week. Thus the fleet has been divided between workhorse streetcars that can run in daily service, and limited service vehicles which can only operate at about a third of a workhorse load.

Figure 70: Historic Vehicle Fleet Inventory

Car No.	Year	Manufacturer	Origin/Description	In Service	Notes
<b>Regular Service Vehicles = 27</b>					
<b>Single Ended (24 cars)</b>					
1050	1946	St. Louis Car	PCC, former SEPTA, Muni wings scheme	1994	
1051	1946	St. Louis Car	PCC, former SEPTA, Muni simplified	1994	
1052	1946	St. Louis Car	PCC, former SEPTA, LA Rwy scheme	1994	
1053	1946	St. Louis Car	PCC, former SEPTA, Brooklyn scheme	1994	
1054	1946	St. Louis Car	PCC, former SEPTA, PTC silver/cream	1994	
1055	1946	St. Louis Car	PCC, former SEPTA, PTC green/cream	1994	
1056	1946	St. Louis Car	PCC, former SEPTA, Kansas City scheme	1994	
1057	1946	St. Louis Car	PCC, former SEPTA, Cincinnati scheme	1994	
1058	1946	St. Louis Car	PCC, former SEPTA, CTA scheme	1994	
1059	1946	St. Louis Car	PCC, former SEPTA, Boston Elevated scheme	1994	
1060	1946	St. Louis Car	PCC, former SEPTA, Newark PSCT scheme	1994	
1061	1946	St. Louis Car	PCC, former SEPTA, PE Rwy scheme	1994	
1062	1946	St. Louis Car	PCC, former SEPTA, Louisville scheme	1994	
1063	1946	St. Louis Car	PCC, former SEPTA, Baltimore scheme	1994	
1807	1928	Accaio	Milan - purchased 1998 (formerly 1507)	2005	
1811	1928	Accaio	Milan - purchased 1998 (formerly 1911)	2000	
1814	1928	Accaio	Milan - purchased 1998	2000	
1815	1928	Accaio	Milan - purchased 1998 (formerly 1515)	2000	
1818	1928	Accaio	Milan - purchased 1998	2000	
1856	1928	Accaio	Milan - purchased 1998 (formerly 1556)	2000	
1859	1928	Accaio	Milan - purchased 1998	2000	
1888	1928	Accaio	Milan - purchased 1998 (formerly 1588)	2000	
1893	1928	Accaio	Milan - purchased 1998 (formerly 1793)	2000	
1895	1928	Accaio	Milan - purchased 1998 (formerly 1795)	2000	
<b>Double-Ended (3 cars)</b>					
1007	1948	St. Louis Car	PCC - double ended, Red Arrow scheme	1994	
1010	1948	St. Louis Car	PCC - double ended, Muni blue/yellow	1994	
1015	1948	St. Louis Car	PCC - double ended, Illinois Term scheme	1994	
<b>Special Service Vehicles = 6</b>					
<b>Double-Ended (6 cars)</b>					
1	1912	W.L. Holman	Muni's first car (2-person operation)		CPUC/ADA needed
130	1914	Jewett Car Co.	Muni (2-person operation)		CPUC/ADA needed
228	1934	English Electric	Blackpool "Boat" - open car (2-person operation)		CPUC/ADA needed
496	1930	Melbourne	Melbourne semi-convertible (2-person operation)		CPUC/ADA needed
578S	1895	John Hammond	Market St Rwy (2-person operation)		CPUC/ADA needed
952	1923	Perley A. Thomas	New Orleans (2-person operation)		CPUC/ADA needed
<b>Cars being Rehabilitated = 11</b>					
<b>New Jersey PCCs (11 cars)</b>					
			PCC, former New Jersey Transit	2006	
			PCC, former New Jersey Transit	2006	
			PCC, former New Jersey Transit	2006	
			PCC, former New Jersey Transit	2006	
			PCC, former New Jersey Transit	2006	
			PCC, former New Jersey Transit	2006	
			PCC, former New Jersey Transit	2006	
			PCC, former New Jersey Transit	2006	
			PCC, former New Jersey Transit	2006	
			PCC, former New Jersey Transit	2006	
			PCC, former New Jersey Transit	2006	

Figure 70: Historic Vehicle Fleet Inventory CONTINUED

<b>Non-active Vehicles = 41</b>				
<b>Single Ended (21 cars)</b>				
106	1922	Colanna	Moscow/Orel, Russia (2-person operation) (stored Du	
1023	1951	St. Louis Car	PCC (stored outside Pier 72)	
1025	1951	St. Louis Car	PCC (stored outside Pier 72)	
1031	1951	St. Louis Car	PCC (stored outside Pier 72)	
1038	1951	St. Louis Car	PCC (stored outside Pier 72)	
1040	1952	St. Louis Car	PCC, Muni (last PCC built in US) (stored inside Pier 80)	
1103			(stored inside Pier 80)	
1105	1946	St. Louis Car	PCC (stored inside Pier 80)	Sold????
1109	1946	St. Louis Car	PCC (stored inside Pier 80)	Sold????
1115	1946	St. Louis Car	PCC (stored inside Pier 80)	
1125			PCC (stored outside Pier 72)	
1139	1946	St. Louis Car	PCC (stored inside Pier 80)	
1155	1946	St. Louis Car	PCC (stored inside Pier 80)	Sold????
1158			PCC (stored inside Pier 80)	
1168	1946	St. Louis Car	PCC (stored inside Pier 80)	
1704	1946	St. Louis Car	PCC (formerly 1128) (stored at Geneva)	
1834	1928	Accaio	Milan - purchased 1984 (Parts Car)	
1979	1928	Accaio	Milan (stored inside Pier 72) (Parts Car)	Parts Car
2133	1946	St. Louis Car	PCC, SEPTA (stored outside Marin)	
2147	1946	St. Louis Car	PCC, SEPTA (stored inside Pier 80)	
3557	1951	LHB	Hamburg (stored outside Marin)	
<b>Double-Ended (10 cars)</b>				
96	1931	Milan	Milan Interurban (stored Pier 80)	Sold
151	1927	Kawasaki	Hankei/Osaka (2-person operation) (stored Pier 80)	
189	1912	J.G. Brill Co.	Oporto, Portugal open car (2-person operation) (store	
351	1926	St. Louis Car	Johnstown PA (2-person operation) (stored Pier 80)	
578J	1927	Fuginagata	Kobe/Hiroshima (2-person operation) (stored Duboce	
586	1930	Melbourne	Melbourne semi-convertible (2-person operation) (stor	
798	1924	Market St Rwy	Muni (2-person operation) (stored Pier 80)	
1006	1948	St. Louis Car	PCC - Muni - double ended (stored outside Marin)	
1009	1948	St. Louis Car	PCC - Muni - double ended (stored outside Pier 72)	
1011	1948	St. Louis Car	PCC - Muni - double ended (stored inside Pier 72)	Sold????
<b>New (8 cars)</b>				
162			From Orange Empire	Needs ADA/PUC
1026			From S. Lake Tahoe (stored outside Marin)	Needs ADA/PUC
1027			From S. Lake Tahoe (stored outside Marin)	Needs ADA/PUC
1028			From S. Lake Tahoe (stored outside Marin)	Needs ADA/PUC
1033			PCC from Orange Empire	Needs ADA/PUC
1039			PCC from Orange Empire	Needs ADA/PUC
4008			From Pittsburgh, PA	1990 Needs ADA/PUC
4009			From Pittsburgh, PA	1990 Needs ADA/PUC
<b>Status Unknown (2 cars)</b>				
1121				Sold????
1130			PCC (stored inside Pier 80)	
<b>TOTAL HISTORIC VEHICLE FLEET = 74</b>				

Figure 70: Historic Vehicle Fleet Inventory CONTINUED

<b>Other Vehicles = 12</b>					
<b>Work Cars (3 cars)</b>					
304	1907	United Railroads of SF	Line Car		Work Car
1008	1948	St. Louis Car	PCC - Muni - double ended		Work Car
C-1	1917	Municipal Railway	Flatbed Work Motor		Work Car
<b>Cars on Loan (9 cars)</b>					
109					Bay Area Electric Ry Museum
1014					Sydney Tramway Museum
1030					CTA
1129					Kansas City RR Museum
1146					Kansas City RR Museum
1150					Merced
1153					Bay Area Electric Ry Museum
1159					Oregon Electric Ry
1164					Transport Museum of St. Louis

### **Cable Cars**

Cable cars operate on three lines: Powell/Mason, Powell/Hyde, and California. Weekday ridership on the three cable car lines totals 21,600. The current fleet of cable cars includes 28 Powell type cars and 12 California type cars, for a total of 40 vehicles as shown in Figure 70. For additional information on the cable car system and its capital requirements, please see Muni's Cable Car System Capital Plan (Nov. 1998).

#### ***Cable Car Rehabilitation***

The Cable Car Vehicle Rehabilitation Program provides for the phased overhaul and reconstruction of the cable car fleet. The estimated service life of a cable car falls between 60 and 70 years, with a midlife major overhaul scheduled at 30 to 35 years in service. In addition, minor overhauls are scheduled for 15 years in service.

At any given time, up to four cable cars can undergo rehabilitation: two in reconstruction, one major overhaul, and one minor overhaul. The reconstruction process takes approximately 18 months and can include replacement or upgrades to all major vehicle components such as trucks, frame, woodwork, glass, roof, and floors. A major overhaul takes about 9 months, beginning with a full vehicle inspection to determine the work that needs to be accomplished. This can include upgrades to the frame and supports, woodwork replacement, glass replacement, metal parts refinishing, roof work, floors, electrical wiring, and painting. Finally, the minor overhauls take about 6 months to complete and include replacement of any rotted wood, electrical work, and painting.

Each cable car is unique so parts must often be fabricated for the individual vehicles. The Woods Carpentry Shop and the Special Machine Shop at 700 Pennsylvania carry out this work. While Muni has a goal of standardizing the cable cars across each fleet, currently the vehicle components that need replacement must be used to fabricate the replacement part. This leads to long down time when a car requires maintenance, which explains the relatively high float for this fleet.

#### ***Cable Car Expansion***

Over the years a number of extensions to the cable car system have been proposed. Currently, none of these proposals are being developed. Nor has Muni identified funding for the proposals. As these proposals are developed, the capital needs associated with their implementation will be added to the capital program.

**Cable Car Extension to Fisherman's Wharf.** This project would extend the Powell/Mason cable car line one block north to North Point. This project could improve service for the many riders who are heading to Fisherman's Wharf. It may also improve passenger safety and traffic circulation in the area.

**California Street Cable Car extension to Japantown.** The California line currently ends at Van Ness. This proposal would extend the line along California Street to a turnback somewhere in the vicinity of Fillmore Street.

Figure 71: Cable Car Fleet Inventory

Car No.	Year Built	Manufacturer	Last Rehab	Notes
<b>Powell Cars</b>				
1	1973	SF Muni	1997	
2	1894	Carter Bros.	1984	
3	1894	Carter Bros.	1999	Undergoing Minor Overhaul
4	1994	SF Muni	NA	
5	1894	Carter Bros.	1982	Undergoing Major Overhaul
6	1894	Carter Bros.	2000	Candidate for Reconstruction
7	1894	Carter Bros.	1999	Undergoing Minor Overhaul
8	1894	Carter Bros.	1958	Scheduled Overhaul 2002
9	1998	SF Muni	NA	
10	1894	Carter Bros.	2001	Undergoing Major Overhaul
11	1894	Carter Bros.	1983	
12	1894	Carter Bros.	1983	Undergoing Minor Overhaul
13	1992	SF Muni	2001	
14	1964	SF Muni	1984	
15	1894	Carter Bros.	1984	
16	1894	Carter Bros.	2000	Reconstructed by Muni in 1990
17	1887	Mahoney Bros.	1998	Undergoing Minor Overhaul
18	1962	SF Muni	1984	
19	1986	SF Muni	2000	
20	1894	Carter Bros.	1984	
21	1992	SF Muni	NA	
22	1887	Mahoney Bros.	1982	
23	1890	Ferries & Cliff	1983	
24	????	Mahoney Bros.	NA	Reconstructed by Muni in 1997
25	1890	Ferries & Cliff	1990	
26	1890	Ferries & Cliff	1975	Candidate for Reconstruction
27	1887	Mahoney Bros.	1983	Undergoing Reconstruction
28	1887	Mahoney Bros.	1984	
<b>Total</b>	<b>27</b>			
<b>California Cars</b>				
49	1992	SF Muni	NA	Scheduled Overhaul 2002
50	1910	CA St. Cable	1999	Major Overhaul Completed
51	1906	W.L. Holman	1982	Candidate for Reconstruction
52	1996	SF Muni	NA	Scheduled Overhaul 2002
53	1906	W.L. Holman	1982	
54	1906	John Hammond & Co.	1983	
55	1906	John Hammond & Co.	1983	Candidate for Reconstruction
56	1913	CA St. Cable	1984	
57	1914	CA St. Cable	1982	
58	1914	CA St. Cable	1983	
59	1998	SF Muni	NA	Scheduled Overhaul 2002
60	1906	John Hammond & Co.	2001	Reconstructed in 2003
<b>Total</b>	<b>12</b>			

### Reserve Fleet

In addition to the fleet of revenue vehicles, Muni maintains a 45-vehicle motor coach reserve fleet. Currently the reserve fleet is housed at the Woods facility. FTA has questioned the advisability of this arrangement as it is difficult to distinguish between revenue and reserve fleets, and it makes it fairly easy for a reserve fleet coach to be used in revenue service. In the long run, Muni would like to be able to better separate the reserve fleet from the revenue fleet, to alleviate these concerns. A leading candidate would be 1399 Marin Street, a leased facility that Muni may seek to purchase. This facility is just across the street from the future Islais Creek facility. Upgrades to the Marin Street facility would probably be needed, and funding has not yet been identified for this purpose. In addition to housing the reserve fleet, Marin may also include a training center, operator parking for Islais Creek, and storage.

The reserve fleet is an operations tool that allows Muni to accommodate service anomalies which may occur due to civil construction projects, emergency agency actions, natural disasters, sporting events, or fleet warranty retrofit campaigns. These vehicles are not part of the revenue fleet and should not be used in regular service. Their function is to have vehicles available to substitute for fixed guideway services (trolley coach, light rail vehicle, and cable car) in the event of service disruptions and for special services. These service disruptions could be planned, such as a track or overhead rehabilitation project, or unexpected, such as a power outage or track blockage. The vehicles in Muni's reserve fleet have been in revenue service for a minimum of 14 years before being transferred into the reserve fleet. As such, an end-of-life overhaul is necessary to ensure that the vehicles can operate when called upon. Since these vehicles will not operate in regular revenue service, this type of end of life overhaul is not eligible for federal formula funds from the region, and is not funded through the capital program, but has instead relied on operating fund to overhaul vehicles and vehicle components as needed.

FTA Circular 9030.1C mandates that a grantee with more than 50 or more fixed-route buses must have a contingency plan for its contingency (reserve fleet). FTA defines a contingency fleet as follows:

*Buses may be placed in an inactive contingency fleet --stockpiled -- in preparation for emergencies. No bus may be stockpiled before that vehicle has reached the end of its minimum normal service life. Buses held in a contingency fleet must be properly stored, maintained, and documented in a contingency plan, updated as necessary, to support the continuation of a contingency fleet. A contingency plan is not an application requirement, although FTA may request information about the contingency fleet during application review. Contingency plans are subject to review during triennial reviews required for the Urbanized Area Formula Program. Any rolling stock not supported by a contingency plan will be considered part of the active fleet. Since vehicles in the contingency fleet are not part of the active fleet, they do not count in the calculation of spare ratio.*

Basically, FTA permits a grantee to use its reserve fleet for local emergencies provided:

- The grantee has a plan for using its reserve fleet;
- The grantee stores and maintains its reserve fleet; and
- All of the vehicles in the contingency fleet have reached the end of their minimum useful life.

Generally, three major events trigger Muni's use of the reserve fleet.

1. Motor Coach substitution – Used for re-railing projects, subway projects, street construction, overhead lines maintenance and overhaul and power outages in order to prevent service interruption.
2. Short-Term Extra Service – If there is an extra demand for service for a short timeframe, the reserve fleet may be used to meet the increased demand. In any given week in San Francisco, special events such as sporting events, marathons, bike races, parades, marches, street festivals, fireworks displays, holiday celebrations, national and international conferences, etc., occur,



requiring extra service. One example of extra service is the annual the Bay-to-Breakers Run, in which thousands of participants are shuttled to and from the race.

3. Catastrophic fleet defect, fleet recall, or unanticipated warrantable fleet defect - In the event that a widespread fleet defect were to occur suddenly, the reserve fleet would be used to supplement service while the defect is repaired.

This plan supplements the reserve fleet Plan that was submitted in January 2002. This current plan is consistent with FTA's guidelines for acceptable use of a grantee's reserve fleet.

### ***Fixed Guideway Disruption***

Muni's operating model is more diverse than most agencies with a total of five different modes being employed to provide transportation daily. Of these, four modes depend upon fixed guideways (Trolley Coach, Light Rail Vehicle, Historic Streetcar, and Cable Car). When any of these four modes are disrupted by construction projects, fire or police activity or natural disaster, the normal transit service capacity must be made up by pressing motor coaches into service from the reserve fleet. Once the disrupting anomaly has been corrected, the reserve fleet vehicles are then placed back into ready status until such time as they might be required again. Muni fixed guideway construction projects can require the substitution of up to 33 motor coaches from the reserve fleet.

### ***49er Game Day Service***

The City of San Francisco is home to the 49ers NFL team which plays its home games at Monster Stadium (Candlestick Park). During any of the home games, both preseason and regular season, as many as 65 to 70 motor coaches are required to provide the necessary additional ridership capacity to transport the game-time crowd. These additional motor coaches are required in addition to the normal daily service demands, so the extra coaches are made available through a combination of reserve fleet coaches and coaches expedited through the normal preventive maintenance cycle by working overtime. These football service requirements are infrequent and usually predictable, but the reserve fleet of 45 motor coaches is critical to Muni's ability to provide the extra game day service in addition to normal daily service.

### ***Fleet Retrofit Campaign Support***

During the course of fleet replacement procurements it is not uncommon for Muni to declare fleet defects, which are governed by the warranty provisions of the contract with the vehicle manufacturer. The resulting campaign(s) necessary to correct fleet wide defects often result in such large numbers of vehicles out of service as to hinder Muni's ability to provide daily service. Muni has experienced this phenomenon during its diesel fleet replacement procurement on more than one occasion. During these retrofit campaigns the contractor has kept as many as 30 to 50 coaches out of service for weeks or even months at a time. During these extended periods of retrofit campaign work, Muni is only able to maintain its daily service obligations by utilizing the reserve fleet. Once these warranty issues have been corrected, the reserve fleet will be placed back into ready reserve status awaiting the next service call.

If Muni were to change the fleet mix substantially toward a higher percentage of fixed guideway vehicles, for example through route conversions to rail or trolley coach operation, the potential substitution needs would increase, while at the same time the pool of potential substitution vehicles would shrink. This might be an issue on only a few days a year; however it could limit Muni's ability to provide complete system service if a substantial substitution need occurs. Other concerns include the need to provide substitution service for construction activities for DPW, the Water Department, PG&E, and others; impacts on service in case of earthquakes, power outages, or other emergencies; and the impact on useful life of the reserve fleet if it is required to operate more than originally intended.

To address these issues, Muni will have to evaluate its demands upon the current reserve fleet and determine if increases are necessary as a result of increasing the number of fixed guideway vehicles it operates. Changes to the size of the reserve fleet will also need to consider capacity limitations at existing operating facilities and additional ongoing operating and maintenance costs of an expanded reserve fleet.

It is worth noting that the Emergency Power Units (EPUs) on the trolley coach fleet have the capability to address some of these situations by allowing the vehicles to operate for a limited time without electricity from overhead wires, potentially reducing the need for motor coach substitution.

### **New Vehicle Types**

Muni has been requested on numerous occasions to use small vans to replace standard buses in the evening on lightly traveled lines to reduce noise and operating costs. Muni has investigated the use of vans, and has identified the following issues with their use:

- Van capacity is insufficient to meet the ridership demands on most Muni lines, even into the evening hours.
- Providing a separate fleet of vans for evening service increases Muni's operating and maintenance costs, as the vans would not replace existing vehicles, but would be an additional fleet, requiring additional maintenance, parts and facility capacity.
- Positioning vans to replace buses for late-evening service would add deadheading and other operating costs.
- Operating costs for vans are equivalent to standard coaches, as the primary cost in providing van or bus service is the cost of the operator, which remains the same regardless of vehicle size.

Double-deck buses could be an alternative to articulated buses for high-capacity vehicles. Muni has tested double-deck buses in the past. Double-deck buses could solve many of Muni's street space issues, and would also make space available in facilities for parking additional vehicles, if the facilities could be modified to accommodate double-deckers. This type of vehicle has not traditionally been widely available in the North American market, though a few transit properties have recently acquired them for urban transit use.

### **Accessible Services Program**

The purpose of the Accessible Services Program is to ensure that appropriate, accessible, ADA-compliant transportation services are available to seniors and persons with disabilities. The main components of this program are:

- Assuring that fixed route bus and metro services are accessible to seniors and persons with disabilities;
- Managing the provision of door-to-door paratransit service for disabled persons unable to use Muni's fixed route service; and
- Providing identification cards to disabled persons to allow them to ride Muni's fixed route system at a discounted rate, as well as those of other Bay Area operators.

Muni staff works with two community advisory groups, the Muni Accessibility Advisory Committee (MAAC) and the San Francisco Paratransit Coordinating Council (PCC), on Muni accessibility and paratransit issues. Muni coordinates fixed route and paratransit services through the MAAC, the PCC, and the paratransit broker staff.

#### **ADA Paratransit Service**

Paratransit services are available for persons with disabilities who are unable to utilize bus and light rail service some or all of the time. Paratransit services are mandated under the Americans with Disabilities Act of 1990 (ADA). A paratransit broker under contract to the City administers the paratransit program. The paratransit broker manages subcontracts with paratransit service providers, monitors service quality, administers client eligibility, manages the sale of fare instruments, and acts on behalf of the Municipal Transportation Agency as the principal customer service representative for paratransit services. The San

Francisco Paratransit Program provides a range of services to persons certified eligible according to federal eligibility criteria established by the ADA. Currently, all modes of paratransit services contain elements that exceed the requirements of the ADA, and there are over 17,000 registered paratransit consumers. Paratransit services include:

- **On-call Taxi Services:** Curb-to-curb services provided by ten taxicab companies and two dispatch services to persons with ambulatory disabilities and wheelchair users. Service is available 24 hours a day, seven days a week. In addition, ramp taxi services are available to wheelchair users who are unable to independently transfer into a standard taxicab.
- **ADA Access and Lift Van Services:** Door-to-door van services requiring advance reservations. Service is available 24 hours a day, seven days a week for any trip purpose with no trip limits for fully eligible riders.
- **Group Van Services:** Group van services operated in coordination with social services agencies for ADA eligible clients going to a common destination such as a senior center, nutrition site, or Adult Day Health Center, on a routine, pre-scheduled basis Monday through Friday.

## **Fleet Accessibility**

### ***Paratransit Accessible Vans***

In the past, Muni purchased paratransit accessible minivans and leased them to the Paratransit Broker for use by San Francisco taxi companies. In return, Muni received a greater number of paratransit trips valued at approximately the value of the lease payments. There were a total of 54 paratransit accessible minivans in service. The first 30 of these vehicles were purchased in 1998 and are ready for replacement. The remaining 24 minivans will be replaced in 2006.

Accessible Services would like to move from purchasing minivans to van conversions. These larger vans have a greater capacity, carrying up to 12 passengers plus 2 patrons in wheelchairs, compared to a minivan, which can hold only 2 passengers and 2 patrons in wheelchairs. The ramped minivans, which were solely in taxi service, experienced numerous mechanical failures. The new vans will be used in Muni's paratransit group van service, which will operate fewer trips and thus reduce the wear on the vehicles.

In its Transit Capital Priorities guidelines, MTC allows paratransit vehicles to be “replaced with the next larger vehicle providing the existing vehicle is operated for the useful life period of the vehicle that is being upgraded to”. Under this rule, Muni is allowed to move from minivans to standard van conversions without the transaction being considered an expansion.

### ***Motor and Trolley Bus Service***

Accessible bus service is currently provided on 46 motor coach and trolley coach lines. Muni has completed the acquisition of new diesel buses and trolley coaches, all of which are lift-equipped and have space inside for two wheelchairs. The new vehicles also feature kneeling capability, extra poles and stanchions, and digital voice annunciation system (DVAS) signs. At the current time, a few non-accessible trolley coaches remain in service while defects in the new trolley coach fleet are addressed.

### ***Muni Metro Service***

The five-line Muni Metro system has become increasingly accessible in recent years, through the construction of accessible wayside platforms and lifts, and other ongoing accessibility projects. All Muni Metro subway stations have high-level platforms at car floor height, and are fully accessible by elevator. In order to make on-street stops accessible, either high level accessible wayside platforms or wayside lifts have been constructed, as part of the ADA-mandated Key Stops program.

The Muni Metro surface stations on the MMX incorporate full accessibility features, including wheelchair access, accessible signage, and tactile warning edges. Now that the Key Stops program has been

completed, Muni intends to pursue accessibility improvements at stops beyond those mandated by the ADA Key Station requirements.

The new Third Street light rail line, currently under construction, will add 18 fully accessible high-level platform stations to the Muni Metro system, and will connect the southeast portion of San Francisco to downtown with accessible light rail service.

The new Breda LRVs incorporate many accessibility improvements, including two wheelchair securement areas, widened aisles, extra stanchions, and a horizontal gap filler between the vehicle door and the platform edge.

### Non-revenue Vehicles

In addition to the revenue fleet, Muni also maintains a fleet of non-revenue vehicles (NRVs) that are used to support the revenue fleet and the system infrastructure and facilities. These include specific purpose maintenance vehicles, such as rail grinders, overhead platform trucks, and sanding machines, service vehicles and sedans. The latest count (April 2002) includes a total of 543 NRVs.

As a general rule NRVs should be replaced at 7 years or 70,000 miles. Under these guidelines, 392 NRVs are due for replacement, as they were acquired 7 or more years ago (see Figure 72). However, the NRV fleet is diverse and many vehicles must be evaluated for replacement on a case-by-case basis.

**Figure 72: Non-revenue Fleet**

Year	NRVs
Unknown	53
Through 1980	22
1981-1985	48
1986-1990	143
1991-1996	179
1997-2003	98
Total	543

### Fleet Capital Cost and Funds

The Fleet Plan establishes a program of capital needs related to fleet rehabilitation, replacement, enhancements, and expansions. There are a number of changes described in the Fleet Plan that will have a direct impact upon the Capital Improvement Program. This section provides a summary of these major changes.

**Replacement cycles.** As discussed previously, there have been clarifications made at the regional level as to the timeline in which fleet replacement projects become eligible for federal funds. The current policy is that fleet replacement projects can be programmed once the vehicles have reached the end of their useful life. For example, a standard motor coach has a useful life of 12 years, so after the 12th year in revenue service, the project to replace this vehicle can be included in the federal funding program through MTC. However, due to the time needed to develop specifications, award the procurement, and to test and accept the vehicles, the replacement cycle must be extended by about two years. This means that the standard motor coach used in our example has a useful life of 12 years, but must effectively remain in revenue service for 14 years, or two years beyond its useful life. The end result is that the replacement cycles, and thus the funding needs for vehicle replacement projects, are stretched out by two years.

**Fleet definition.** The Fleet Plan has been updated to conform to the MTC definition of a revenue fleet as “the same vehicle size, manufacturer, and year.” This clarification has the effect of breaking Muni’s vehicle fleets into a number of subfleets. This will allow Muni to program funds on a schedule that more

closely matches the project's needs. This is an important change as it relates to regional funding caps as discussed below.

**Alternative fuels.** Muni is at the initial stages of replacing its diesel coach fleet with alternative fuel vehicles. As a new technology, these vehicles cost considerably more than their diesel counterparts. Therefore the project costs for future procurements are significantly higher than past projects of a similar nature.

**Vehicle rehabilitation.** The prior CIP update included projects to perform midlife rehabilitations on all vehicle fleets. At that time only rough cost estimates were available. In the interim, a much closer look at the scope and potential cost for the rehabilitation of each fleet has been taken. Based on these estimates the CIP has been revised. However, these projects are largely unfunded at this time.

**Regional funding caps.** At this time, the region has established project caps for the formula funding programs (Federal Sections 5307 and 5309 funds). The current caps for vehicle replacement projects are as follows:

- Section 5307: \$20 million per project per year.
- Section 5309: \$30 million per project per year. If also using Section 5307 funds, the aggregate of 5307 and 5309 funds cannot exceed \$30 million per project per year.

Due to these fund caps, a number of the larger vehicle replacement projects must be spread out over a greater number of years than the project schedule would dictate. As discussed previously, Muni has revised the Fleet Plan to account for each subfleet as a separate replacement project. This will reduce the number of projects that are subject to these cap restrictions. The other change that Muni has proposed is for the regional caps to be updated on a periodic basis to account for inflation.

**Expansion/enhancement projects.** A number of expansion and enhancement projects, such as Bus Rapid Transit, Route Electrification, and corridor improvements, among others, have been proposed in the future service plan, with cost estimates included in the CIP. At the preliminary stage of project development the fleet costs associated with these expansion/enhancement proposals are included in the overall project cost. As project specific schedules and funding plans are developed, the fleet changes will be added to the Fleet Plan and vehicle costs can move into a separate but related fleet project.

### ***Fleet Capital Plan***

As previously described, the Fleet Capital Plan is composed of a series of replacement, rehabilitation and enhancement/expansion projects. Figure 72 shows the Fleet Capital Plan summarized in two ways. The first is by the mode the project serves and the second by the type of activity the project will undertake. Funds for each of the primary modes are fairly evenly split with motor coach receiving 35%, trolley coach 23%, and light rail vehicle 32%. The remaining 10% is shared by historic streetcars, cable cars, paratransit, and projects with system wide scope. When looking at the types of activities that Muni hopes to pursue over the next 20 years, over 87% of replacement needs have planned funds. About 44% of enhancement and expansion needs are planned to be funded. However, only about 1% of rehabilitation needs are planned to be funded by the capital program. In the past rehabilitation needs have been funded primarily through the Operating Budget. The larger recurring rehabilitation projects have been developed into capital projects as a way to capture their costs, although little capital funding is anticipated to cover these needs.

The Capital Improvement Program is described in detail in Chapter 9 of the Short Range Transit Plan.

Figure 73: Fleet Capital Plan Summary

FLEET CAPITAL PLAN SUMMARY										
All figures in 000s	Through FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011	FY2012	FY2013	FY2014
<b>SUMMARY BY MODE</b>										
<b>Motor Coach</b>										
Cost	266,327	20,781	10,676	-	42,340	82,992	52,277	7,216	42,327	205,059
Funds	253,944	13,238	-	-	-	27,366	37,782	23,351	-	52,344
+/-	(12,383)	(7,543)	(10,676)	-	(42,340)	(55,627)	(14,495)	16,135	(42,327)	(152,715)
<b>Trolley Coach</b>										
Cost	243,611	8,774	-	12,811	31,582	-	-	75,048	-	16,210
Funds	234,584	1,500	1,500	1,500	-	-	-	37,668	27,341	7,787
+/-	(9,027)	(7,274)	1,500	(11,311)	(31,582)	-	-	(37,380)	27,341	(8,423)
<b>Light Rail Vehicle</b>										
Cost	527,035	10,624	3,315	10,342	10,756	8,389	12,926	4,033	12,583	13,086
Funds	485,050	-	16,869	-	-	-	-	-	-	-
+/-	(41,985)	(10,624)	13,554	(10,342)	(10,756)	(8,389)	(12,926)	(4,033)	(12,583)	(13,086)
<b>Historic Streetcar</b>										
Cost	27,348	-	-	4,679	7,300	17,714	-	-	-	-
Funds	27,446	6,269	11,981	-	7,877	11,388	-	-	-	-
+/-	98	6,269	11,981	(4,679)	578	(6,327)	-	-	-	-
<b>Cable Car</b>										
Cost	9,833	1,678	1,008	1,048	1,090	1,134	1,179	1,226	1,275	1,326
Funds	9,259	1,912	1,008	1,048	1,090	1,134	1,179	1,226	1,275	1,326
+/-	(574)	234	-	-	-	-	-	-	(0)	-
<b>Paratransit</b>										
Cost	8,382	2,708	-	-	1,766	-	3,216	-	-	2,097
Funds	7,814	2,708	-	400	1,383	428	2,772	459	-	2,134
+/-	(569)	-	-	400	(383)	428	(445)	459	-	36
<b>Systemwide</b>										
Cost	44,228	2,007	2,088	2,171	2,258	2,348	2,812	34,810	2,642	2,747
Funds	1,570	-	-	-	-	-	100	32,270	-	-
+/-	(42,658)	(2,007)	(2,088)	(2,171)	(2,258)	(2,348)	(2,712)	(2,540)	(2,642)	(2,747)
<b>Fleet Total</b>										
Cost	1,126,765	46,573	17,087	31,052	97,092	112,578	72,411	122,334	58,827	240,527
Funds	1,019,667	25,627	31,358	2,948	10,351	40,316	41,833	94,975	28,617	63,592
+/-	(107,098)	(20,946)	14,271	(28,104)	(86,742)	(72,263)	(30,578)	(27,360)	(30,210)	(176,935)
<b>SUMMARY BY ACTIVITY</b>										
<b>Replacement</b>										
Cost	558,554	6,394	3,096	7,899	12,414	60,155	59,115	111,085	3,917	211,231
Funds	522,686	23,502	12,989	1,448	10,351	40,316	41,733	94,975	28,617	63,592
+/-	(35,868)	17,108	9,893	(6,451)	(2,064)	(19,840)	(17,382)	(16,111)	24,700	(147,639)
<b>Rehabilitation</b>										
Cost	37,459	39,929	13,991	23,153	84,678	52,423	12,926	11,249	54,910	29,296
Funds	4,146	1,500	1,500	1,500	-	-	-	-	-	-
+/-	(33,314)	(38,429)	(12,491)	(21,653)	(84,678)	(52,423)	(12,926)	(11,249)	(54,910)	(29,296)
<b>Enhancement/Expansion</b>										
Cost	530,751	250	-	-	-	-	370	-	-	-
Funds	492,836	625	16,869	-	-	-	100	-	-	-
+/-	(37,915)	375	16,869	-	-	-	(270)	-	-	-
<b>Fleet Total</b>										
Cost	1,126,765	46,573	17,087	31,052	97,092	112,578	72,411	122,334	58,827	240,527
Funds	1,019,667	25,627	31,358	2,948	10,351	40,316	41,833	94,975	28,617	63,592
+/-	(107,098)	(20,946)	14,271	(28,104)	(86,742)	(72,263)	(30,578)	(27,360)	(30,210)	(176,935)

Figure 73: Fleet Capital Plan Summary – CONTINUED

FY2015	FY2016	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	FY2023	FY2024	FY2025	Total
249,602	-	15,803	156,957	-	27,652	-	-	101,323	76,252	9,612	1,367,200
147,636	130,369	65,752	103,544	78,240	6,798	-	-	-	13,493	-	953,857
(101,967)	130,369	49,949	(53,414)	78,240	(20,854)	-	-	(101,323)	(62,759)	(9,612)	(413,343)
39,962	-	-	14,047	-	95,993	156,152	-	-	98,566	-	792,758
-	-	-	-	16,846	75,944	77,353	69,152	25,000	25,000	25,000	626,175
(39,962)	-	-	(14,047)	16,846	(20,050)	(78,799)	69,152	25,000	(73,566)	25,000	(166,583)
58,289	21,231	4,907	15,309	15,921	17,018	25,830	70,905	51,093	512,826	71,159	1,477,574
-	-	-	-	-	-	-	27,353	87,377	114,631	138,811	870,091
(58,289)	(21,231)	(4,907)	(15,309)	(15,921)	(17,018)	(25,830)	(43,552)	36,284	(398,194)	67,652	(607,483)
4,618	19,212	4,995	17,317	12,607	26,222	-	-	-	-	6,836	148,849
4,618	19,212	4,995	21,956	10,121	24,068	-	-	-	-	10,239	160,172
-	-	-	4,639	(2,485)	(2,154)	-	-	-	-	3,403	11,322
1,380	1,435	1,492	1,552	1,614	1,678	1,746	1,815	1,888	2,183	2,270	39,852
1,380	1,435	1,492	1,552	1,614	1,678	1,746	1,815	1,888	-	-	35,058
-	0	-	-	-	-	-	-	-	(2,183)	(2,270)	(4,793)
-	3,820	-	-	2,491	-	4,537	-	-	2,959	-	31,976
-	3,851	-	564	1,951	604	3,987	647	-	3,010	-	32,709
-	31	-	564	(540)	604	(550)	647	-	51	-	733
2,857	2,972	3,090	3,214	3,343	3,476	3,615	3,760	3,910	5,605	4,229	138,186
-	-	-	-	-	-	-	-	-	-	-	33,940
(2,857)	(2,972)	(3,090)	(3,214)	(3,343)	(3,476)	(3,615)	(3,760)	(3,910)	(5,605)	(4,229)	(104,245)
356,708	48,669	30,288	208,396	35,975	172,040	191,880	76,480	158,214	698,390	94,107	3,996,395
153,634	154,867	72,239	127,615	108,772	109,092	83,086	98,967	114,265	156,134	174,050	2,712,002
(203,075)	106,198	41,952	(80,781)	72,797	(62,948)	(108,794)	22,487	(43,949)	(542,256)	79,943	(1,284,392)
258,457	27,438	9,578	170,274	20,054	127,370	166,050	70,510	38,266	602,768	63,790	2,588,417
153,634	154,867	72,239	127,615	108,772	109,092	83,086	98,967	114,265	156,134	174,050	2,192,927
(104,824)	127,429	62,661	(42,659)	88,718	(18,278)	(82,964)	28,456	75,999	(446,634)	110,260	(395,490)
50,169	21,231	20,710	38,122	15,921	44,670	25,830	5,970	119,948	95,622	30,317	828,524
-	-	-	-	-	-	-	-	-	-	-	8,646
(50,169)	(21,231)	(20,710)	(38,122)	(15,921)	(44,670)	(25,830)	(5,970)	(119,948)	(95,622)	(30,317)	(819,879)
48,082	-	-	-	-	-	-	-	-	-	-	579,454
-	-	-	-	-	-	-	-	-	-	-	510,429
(48,082)	-	-	-	-	-	-	-	-	-	-	(69,024)
356,708	48,669	30,288	208,396	35,975	172,040	191,880	76,480	158,214	698,390	94,107	3,996,395
153,634	154,867	72,239	127,615	108,772	109,092	83,086	98,967	114,265	156,134	174,050	2,712,002
(203,075)	106,198	41,952	(80,781)	72,797	(62,948)	(108,794)	22,487	(43,949)	(542,256)	79,943	(1,284,392)

### Fleet Facilities

Muni has a total of 8 operating facilities as shown in Figure 74. In the near future, Muni will construct two new facilities: Islais Creek and Metro East.

Islais Creek is being built as a replacement for the Kirkland Motor Coach Division. Kirkland is being phased out of use because the maintenance buildings and driver facilities are inadequate to meet current needs. Changes in adjacent land uses have made the Kirkland Division incompatible with the surrounding hotel, retail, and residential uses. It is anticipated that once Islais Creek is operational, the Kirkland site would be available for redevelopment as described in greater detail in the Facilities chapter of the SRTP.

Metro East is a new light rail vehicle operating and maintenance facility being built as part of the Third Street Initial Operating Segment project. The facility will accommodate the addition vehicle demand needed to operate the two phases of the Third Street Light Rail Project, and will also help relieve crowding at the Green LRV Facility.

#### ***Impact of Fleet Expansion on Facilities***

The growth of Muni's fleet may be constrained by the limited space available at Muni's current maintenance facilities.

There are no plans to add to the number of revenue vehicles in the motor coach fleet. In fact, as previously described, Muni anticipates reducing the Motor Coach fleet over the next several years. To improve operating efficiency, Muni could replace some standard coaches with articulated coaches. This will allow overall passenger capacity to increase without adding to operating costs. In fact there may be opportunities to decrease operating costs. The primary constraint on pursuing these strategies is Muni's storage and maintenance capacity for articulated coaches. At present, only the Flynn facility is able to maintain articulated coaches. The Flynn facility was built with a capacity of 100 articulated coaches, although Maintenance has been able to handle 112 vehicles on a temporary basis. To increase the number of articulated coaches, Muni will have to identify another facility to handle vehicles beyond the current 100 vehicle capacity of Flynn. Islais Creek is being built to handle standard size coaches only. The facility is not being constructed to maintain articulated coaches. The Woods facility could accommodate articulated coaches if significant renovations are made. Funds for this project are not identified at this time. A potential option is to convert the Marin Street facility into an operating and maintenance division. Muni leases the facility at this time, so the types of major improvements necessary to function as an operating division are not being pursued at this time. Muni will need to develop service, facility and fleet plans that address these and other issues if a larger articulated fleet is desired.

The current trolley coach facilities are at or near capacity. Purchasing additional trolley coaches to operate on future electrification projects, such as trolley coach extensions or conversions from motor coaches, will be constrained by the limited space at the existing trolley coach facilities. It could be possible to add trolley coach service by reducing the relatively high spare ratio of this fleet. As the remaining administrative functions are moved from the Presidio Division, it is anticipated that the site will be redeveloped as part of a joint development type venture. The trolley storage and maintenance activities will likely remain below some type of development above. It may be possible to add capacity to the facility when it is redesigned to accommodate the joint development activities. The final option would be to convert an existing Muni facility from motor coach to trolley coach operation, or to construct a new facility. These final two options do not have any funding identified at this time.

Once Metro East opens, Muni will have the capacity to store and maintain 210 LRVs at Metro East and Green, and 50 Historic Streetcars at Geneva. This will allow for future expansion of the LRV fleet for additional Mission Bay service on the Third Street line (10 LRVs), vehicle requirements for the Central Subway (4 LRVs), and the possible acquisition of 10 LRVs to relieve future congestion on the current Muni Metro system (J, K, L, M, and N lines). Planned Historic Streetcar purchases and rehabilitation projects will expand the fleet from the current 27 streetcars, to a total of 53 vehicles. Vehicles that cannot



fit at Geneva could be housed at the Green Upper Yard or Metro East. The Metro East project included the purchase of 17 acres, although only 13 acres are needed for the initial construction. It had been envisioned that the additional 4 acres could be built out to store 20 more LRVs. To accommodate potential future expansion, the maintenance buildings at Metro East are designed to support 100 LRVs. However, a recent proposal from the Mayor’s Office would use the 4 acres for a cogeneration plant, making them unavailable for Metro East expansion. Given the current fleet plan, the loss of this additional land should not have an impact on Muni’s ability to store and maintain its LRVs. However, if a future expansion of the LRV system beyond the changes described previously, such as a new Geary LRT line or a North Beach extension to the Third Street/Central Subway line, is pursued, that project will need to reevaluate Muni LRV storage and maintenance capacity, and could result in the need for a third LRV maintenance facility.

**Figure 74: Fleet Facility Characteristics**

Facility	Mode	Major Functions	Year Built	Capacity	Current
<b>Current</b>					
Woods Division	MC	Operating division, maintenance, heavy repair, paint and body, cable car construction.	1975	233 (40')	231 (40')
Flynn Division	MC	Operating division, maintenance, heavy repair.	1989	100 (60')	136 (60')
Kirkland Division	MC	Operating division, running repair.	1950	140 (40')	132 (40')
Presidio Division	TC	Operating division, maintenance, heavy repair.	1912	171 (40')	165 (40')
Potrero Division	TC	Operating division, maintenance, heavy repair, paint shop.	1914	75 (40') 93 (60')	197
Green Division	LRV	Operating division, maintenance, heavy repair, electronic shop, paint shop.	1979	80	151
Geneva Division	HLRV	Operating division, maintenance.	1979	50	27
Cable Car Division	CC	Operating division, maintenance.	1984	40	40
<b>Future</b>					
Islais Creek	MC	Operating division, maintenance, fuel and wash.	Construction to begin 2005; Open 2009.	165 (40')	NA
Metro East	LRV/HLRV	Operating division, maintenance.	Construction to begin 2005; Open 2008..	80	NA

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