Washington Metropolitan Area Transportation Authority
Board Action / Information Summary

☒ Action ☐ Information	MEAD Number:	Resolution: ☒ Yes ☐ No

PURPOSE

Request Board approval to update WMATA's Metrobus Fleet Management Plan, which was last updated in 2004. This Plan provides for bus and facilities to support future growth of the existing system.

DESCRIPTION

The Metrobus Revenue Vehicle Fleet Management Plan is a tool that provides proper planning for future Metrobus vehicle and facility needs, taking into consideration current and future ridership demand, proposed service expansion projects, scheduled and unscheduled maintenance, and Metrobus renovation program. The Federal Transit Administration (FTA) requires that WMATA adopt an updated Metrobus Fleet Management Plan.

The adoption of this Plan provides the justification for the future expansion of the Metobus fleet, and the need for additional storage spaces and maintenance bays for new vehicles. By adopting the Plan, the Board does not make any formal commitment of any project, or funding for any fleet expansion. The following is a summary of the improvements included in the Plan.

Bus Growth: This Plan describes the need for 167 additional buses to respond to projected ridership growth. The 167 buses for growth include 76 articulated buses that will be procured to reduce operating cost and increase seating capacity. This plan also maintains and expands the Authority's policy to replace overage buses and maintain an average fleet age of 7.5 years. The plan includes a modification to maintain overall capacity as older buses are replaced by newer buses with less seating capacity. This results in the replacement of 400 buses with 461 new buses to maintain capacity.

Current Fleet			1,481
Buses for growth		167	167
Articulated Buses	76		
40/42 Foot Buses	91		
Replacement Buses to maintain 7.5 avg. age			
One for one replacement	400		
To maintain capacity	61		
Procurement		461	61
Total Bus needs		628	
Projected Bus Fleet			1709

Metrobus Storage Needs: The network evaluation anticipates the need for an additional 228 buses. The fleet plan demonstrates that there are not sufficient storage spaces to accommodate system growth of 228 buses.

• Current number of bus storage spaces	1,645
Current Metrobus Operating Fleet	1,481
Excess storages spaces	+164
• Service Expansion 2011:	
Current Metrobus Operating Fleet	1,481
Total Additional buses	228
Total number of buses-with growth & seat loss	1,709
Current number of bus storage spaces	1,645
Subtotal storage spaces	(-64)
Articulated buses require 1.5 storage spaces, therefore an additional 38 storage spaces are required	(-38)
Storage spaces	(-102)
• System Growth of Storage Spaces	
Current number of bus storage spaces	1,645
New Southeast (121 existing, 129 new)	129
Bladensburg (257 existing, 43 new)	43
West Ox (Arlington/West Ox 100 spaces)	0
Additional storage spaces:	172
Total Additional buses	228
Articulated spaces	(-38)
Total storage spaces	1,817
Total buses	1,709
Subtotal storage spaces	108
Excess storage spaces	70

Bus Maintenance Facility Needs: The Plan includes two new garages to be constructed at West Ox and Southeast that will increase system capacity. The Fleet Plan also identifies the need for additional maintenance bays, to maintain articulated buses at Montgomery and Landover. In addition, modifications of existing capacity was identified at Bladensburg if the service vehicle maintenance shop is relocated. Funding to make these improvements has not been identified.

FUNDING IMPACT

The adoption of the Metrobus Fleet Plan is for planning purposes only and does not obligate the Authority or its Board of Directors to the Plan's projected requirements; therefore there is no funding impact.

RECOMMENDATION

Board approval of Metrobus Fleet Management Plan.

PRESENTED AND ADOPTED:

SUBJECT: BUS FLEET MANAGEMENT PLAN

PROPOSED
RESOLUTION
OF THE
BOARD OF DIRECTORS
OF THE
WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

WHEREAS, Submission of a comprehensive bus fleet management plan is required by the Federal Transit Administration (FTA) in support of WMATA's application for a federal capital grant to purchase new buses; and

WHEREAS, The WMATA staff has prepared the Metrobus Revenue Vehicle Fleet Management Plan dated April 2007, to satisfy the federal grant requirement; and

WHEREAS, The Metrobus Revenue Vehicle Fleet Management Plan documents the Authority's processes and procedures for operating and maintaining its fleet of buses through Fiscal Year 2011; and

WHEREAS, The Metrobus Revenue Vehicle Fleet Management Plan is a tool that provides proper planning for future Metrobus vehicle and facility needs, taking into consideration current and future ridership demand, scheduled and unscheduled maintenance, and the bus renovation program; and

WHEREAS, The Metrobus Revenue Vehicle Fleet Management Plan is for planning purposes only and does not obligate the Authority or its Board of Directors to the Plan's projected requirements; and

WHEREAS, It is intended that the Metrobus Revenue Vehicle Fleet Management Plan be updated prior to any future bus procurement; now, therefore be it

RESOLVED, That the Board of Directors adopts the updated Metrobus Revenue Vehicle Fleet Management Plan dated April 2007, and attached hereto, for planning purposes, without obligation to any of the plans' projected requirements and with the stipulation that the plan be updated prior to any bus procurements; facility project; and be it further

RESOLVED, That the Board of Directors concurs with forwarding the Metrobus Revenue Vehicle Fleet Management Plan to FTA in support of the Federal Capital Grant for the purchase of buses; and be it further

RESOLVED, That this Resolution shall be effective immediately.

Reviewed as to form and legal sufficiency,

Carol B. O'Keeffe
General Counsel

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY
600 FIFTH STREET, N.W. WASHINGTON, D.C. 20001

DRAFT

April 4, 2007 (4:10pm)

METROBUS REVENUE VEHICLE FLEET MANAGEMENT PLAN

APRIL 2007

This Metrobus Revenue Vehicle Fleet Management Plan was developed by:

Office of Operations Planning and Administrative Support
Washington Metropolitan Area Transit Authority
600 Fifth Street, N.W. ● Washington, D.C. 20001

Contributors

The following WMATA organizations contributed data and information to this Fleet Management Plan:

Department of Operations:	*Office of Bus Maintenance* *Office of Bus Transportation* *Office of the Chief Engineer*
Department of Planning and Strategic Programs:	*Office of Business Planning and Project Development*
Department of Communications:	*Replication and Digitizing Services (Graphic design and printing services)*

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WASHINGTON METROPOLITAN
AREA TRANSIT AUTHORITY

METROBUS REVENUE VEHICLE FLEET MANAGEMENT PLAN

APRIL 2007

This document is a statement of the processes and practices by which WMATA establishes its current and projected Metrobus revenue vehicle fleet size requirements and operating spare ratio. It includes a description of revenue service planned to accommodate growth in Metrobus ridership, as well as an assessment and projection of needs for bus vehicle maintenance. This plan is a living document which is based on current realities and assumptions, and is therefore subject to future revision. The intent is to update the plan on a regular basis and to have the plan become an input into the Authority's capital and operating budget preparation.

SECTION ONE

INTRODUCTION

Metrobus celebrated its 33rd anniversary in February 2006. Since the time Congress directed WMATA to takeover the region's four failing private bus companies in 1973 and create the Metrobus system, more than 1.0 billion miles of service have been operated and more than 3.9 billion passengers have used the system. Metrobus is not only the largest bus service in the metropolitan area, it is the fifth largest nationally based on fleet size.*

**Source: WMATA's FY 2006 National Transit Database Report*

The Authority takes pride in Metrobus's many accomplishments:

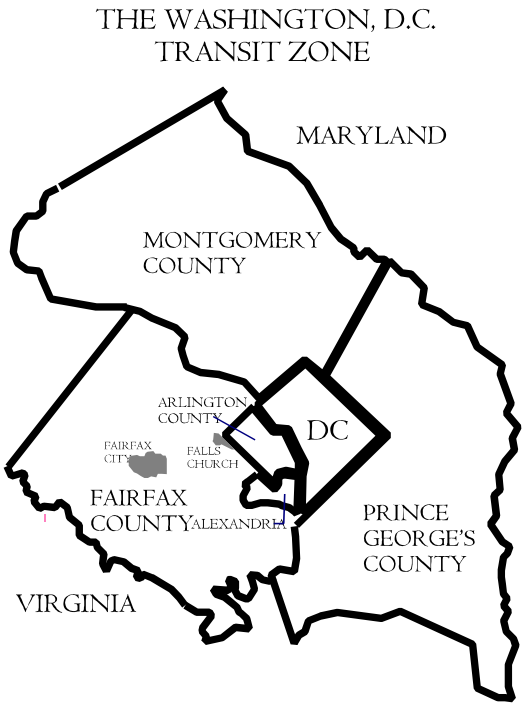
- Metrobus ridership is the sixth highest nationally.
- The Metrobus accident rate is one of the lowest of major metropolitan areas.
- Metrobus is in the top 25 percent for miles between service interruptions and has one of the lowest maintenance costs per mile.
- Metrobus exhibits very high rates of trips completed and on-time performance.
- Metrobus operators and mechanics receive high quality training and focus on serving the customer.
- Metrobus offers a stable and reliable workforce: operator and mechanic turnover rates are low.

**Source: WMATA's FY 2006 National Transit Database Report*

The Metrobus system carried about 441,000 unlinked passenger trips* on an average weekday in FY 2006, and recorded 131 million passenger trips*. The Metrobus fleet traveled 420 million passenger miles in FY 2006,* and this was accomplished with a mean distance between service delays of over 5,200 miles. The system operates 332 routes and 2,789 directional route miles in the Washington, D. C. transit zone.* Although bus service is light between the hours of midnight and 6:00 a.m., there are Metrobuses in operation somewhere in the system approximately 24 hours a day. Passenger fares pay more than one-third of Metrobus annual operating cost, the remainder being paid in the way of operating subsidy by the local governments in the transit zone.

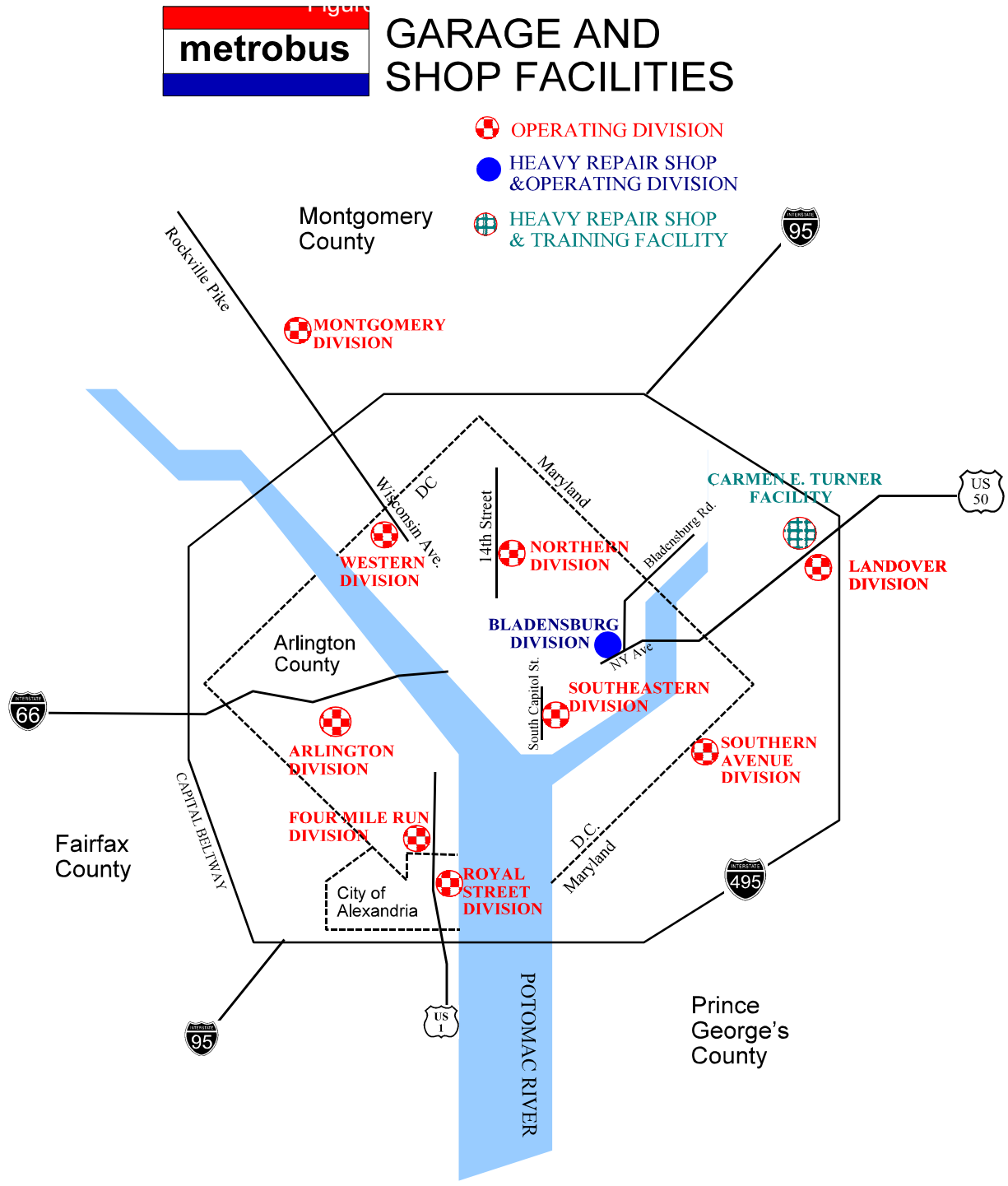
The WMATA Transit Zone, illustrated in Figure 1-1, is defined by the Authority's Interstate Compact, created by Congress in 1967.

Figure 1-1



Metrobus operates ten full service operating *divisions*, as shown in Figure 1-2. The Metrobus heavy repair shop is currently is located in the Carmen E. Turner facility at Pennsy Drive where major corrective maintenance is performed. In addition, the heavy repair shop at the Bladensburg Operating Division serves as the home of the WMATA Heavy Maintenance Overhaul Program. The Heavy Overhaul program has been so successful at extending the useful life of a transit bus, the WMATA Board of Directors raised the expected service life of a Metrobus from 12 years to 15 years and set the target average age of the Metrobus fleet at 7½ years. In the past the Authority has also contracted with other bus fleet operators such as the State of Maryland, Ride-On (Montgomery County, MD) and PRTC (Prince William County, VA) to provide heavy overhaul service.

Figure 1-2


metrobus
GARAGE AND SHOP FACILITIES
OPERATING DIVISION
HEAVY REPAIR SHOP &OPERATING DIVISION
HEAVY REPAIR SHOP & TRAINING FACILITY
Montgomery County
Rockville Pike
MONTGOMERY DIVISION
95
DC
Wisconsin Ave.
Maryland
14th Street
WESTERN DIVISION
NORTHERN DIVISION
Bladensburg Rd.
CARMEN E. TURNER FACILITY
US 50
LANDOVER DIVISION
BLADENSBURG DIVISION
NY Ave
Arlington County
South Capitol St.
SOUTHEASTERN DIVISION
66
ARLINGTON DIVISION
SOUTHERN AVENUE DIVISION
CAPITAL BELTWAY
FOUR MILE RUN DIVISION
D.C.
Maryland
Fairfax County
ROYAL STREET DIVISION
City of Alexandria
495
95
US 1
POTOMAC RIVER
Prince George's County

CURRENT METROBUS FLEET

As of December 2006 the Authority's Metrobus active revenue fleet consisted of 1,481 vehicles, as shown in Table 1.1. This table includes the vehicles necessary for revenue service, maintenance requirements, spares, and six training buses.

Table 1-1

Metrobus 2006 End-of-year Total Fleet and Division Assignment

DIVISION	Small Buses (26 Feet)	Standard Size Buses (30', 35', & 40 feet)	Articulated Buses	TOTAL
Bladensburg	5	213	21	239
Southern Avenue	0	103	0	103
Southeastern	0	113	0	113
Northern	0	148	27	175
Western	15	121	0	136
Four Mile	6	212	0	218
Arlington	0	88	0	88
Royal Street	0	71	0	71
Landover	0	173	0	173
Montgomery	0	151	14	165
TOTAL	**26**	**1,393**	**62**	**1,481**

ORGANIZATION OF THIS DOCUMENT

Demand Analysis: Section Two of this document summarizes the *demand* for revenue vehicles. Demand is analyzed in two components:

Passenger Demand, in which the process for developing peak vehicle requirements (PVR) is reviewed, including forecast peak period ridership, vehicle type requirements, strategic vehicles, and passenger load policy, and

Maintenance Requirements, including the process which defines vehicle requirements by size and type for both scheduled and unscheduled maintenance, and for mid-life vehicle renovation.

Network Evaluation: Section Three reviews and summarizes the comprehensive bus service Network Evaluation conducted to determine WMATA's fleet needs through fiscal year 2011.

Metrobus Fleet Needs: Section Four documents the impacts of the proposed service changes identified in the Network Evaluation on the existing fleet..

Maintenance Overview: Section Five focuses on Maintaining Service Reliability.

Demand/Supply Balance: In Section Six the balance of the demand for vehicles and the supply of vehicles is discussed. The plan is also summarized.

Supply of Revenue Vehicles/Garage Capacity: Section Seven addresses the *supply* of Metrobus revenue vehicles. It accounts for total buses owned by fiscal year, showing authorized and anticipated procurement, and vehicles available for service and garage capacity issues to store buses.

SECTION TWO

THE DEMAND FOR REVENUE VEHICLES

QUALITY OF SERVICE

Quality of service is what ultimately determines the success of any transit system. This is especially true for Metrobus, since strong commitments have been made in terms of the system's performance, and the public has come to expect a superior product in return for its investment.

Service quality is also important because the system is growing and the transit market continues to change. A large segment of WMATA's marketplace is discretionary. According to a recent WMATA survey, 78 percent of Metrobus users have access to a car and therefore are "choice" riders.* Quality of service is key to retaining and growing ridership in this market.

*"***WMATA Customer Satisfaction Measurement***", 2006*

According to the Metropolitan Washington Council of Governments (COG), more than 40 percent of commuter trips to the core area of Washington, D.C. are made using public transportation; second highest transit mode splits in the nation.

Favorable public opinion regarding the quality of service provided by WMATA has resulted in ridership growth.

Quality of service is considered to be a function of the following factors:

- Safety
- Speed
- Cleanliness
- Courtesy
- Frequency
- Comfort
- Service Reliability

Frequency, comfort, service reliability, and cleanliness are related to fleet size and vehicle type.

The process WMATA uses to develop bus fleet size requirements includes ongoing evaluations of ridership vs. route capacity, and new initiative procurement of new buses. Fleet size requirements are updated on a periodic basis prompted by events such as the initiation of new routes and services, increased demand for existing service, or the procurement of new buses.

METROBUS SERVICE PLANNING

The Metrobus network is comprised basically of two types of service. The first type, and the large majority of the service, is "demand driven". That is, the quantity of service, (i.e., the headway) is determined by the passenger loads on the respective trips, routes, and lines. The quantity of service is driven by ridership demand at the maximum load point on the line. The headways are adjusted to keep the service from becoming overcrowded. All service is monitored on a regular basis to balance supply and demand and to make adjustments for changing demographics and congestion. The latter effect can lead to an adjustment, usually an increase, in the running time of the service.* Consideration of vehicle size is also applied to demand driven service requirements. The Authority currently has articulated, standard size, and small buses to utilize in our vehicle supply mix. The vehicle size mix and availability are matched against the specific service needs. Once the headway, running time, vehicle size mix, etc., are established, the scheduling process is applied. The result of this process is scheduled vehicle requirements by size and by operating division. Service is scheduled to the most efficient division that has the necessary maintenance and storage capacity.

**The Washington region is the third most traffic-congested area in the country. Street congestion directly affects bus speed and passenger travel time. A continued decline in bus speed eventually will prompt an increase the number of vehicles necessary to operate the present level of service.*

EFFICIENCY AND PRODUCTIVITY GUIDELINES

On routes where level-of-service is driven by passenger demand, the efficiency of the route is defined as the degree to which the scheduled number of buses is able to satisfy the existing passenger demand. The primary objective of the scheduled headway is to provide enough service to permit every waiting passenger to board the first bus going in the passenger's desired direction of travel. Secondarily, whenever passenger volumes consistently exceed the prescribed guideline for each route classification in a one-half, or hour period, measures will be taken to adjust headways or add service.

Load Factor: The Authority uses load factor as the guideline to measure passenger demand. Peak hour maximum load factor measures the number of passengers on the bus at the maximum load point (the point that historically has the most passengers aboard the bus at any one time). It is calculated using point-checks to determine the number passengers at the maximum load point, divided by the number of seats that were available. The goal is to maintain an average number of passengers on each bus during the peak hour. Therefore, load factor is actually an average. Some trips will have more passengers and others less. A load factor of .90 means 90% of the available seats were occupied within the peak hour. The Authority uses load factor to determine when service should be increased and decreased.

To determine when a service increase is justified each line is classified as either being radial, crosstown, or express. Line classification is used because lines within certain classifications may have characteristics that lead to them performing at a different level than other classifications.

A service increase is warranted if the ratio of passengers to seats at the maximum load point during the peak half-hour or non-peak hour exceeds the load factor. The load factor is calculated by determining the number of passengers that pass the maximum load point, the number of trips made during the period, and the number of seats available on a bus (39). For example: 200 passengers divided by 5 trips, divided by 39 seats, yields a load factor of 1.0. This load factor differential by line type is as follows:

Line Classification Load Factors To Add Service

- **Radial** - operates over major arterials and corridors and is oriented toward major urban centers **1.2**
- **Crosstown** - provides service across corridors and generally does not serve urban centers **1.1**
- **Express** - operates over major travel corridors and includes significant non-stop segments oriented toward major activity centers **1.0**
- **Off-peak** (all service types) **1.0**

The second type of basic service is "policy driven". On a policy driven route the ridership generally is not high enough to produce an "adequate" headway if demand driven criteria were used. It is established by policy that the service will be provided, and that a specific or minimum level of service will be operated. Even though demand for a typical policy driven route may be low, it enhances the overall transit network by providing service to unserved markets which feed existing bus or rail lines or relieve congestion.

Examples of policy service include night and weekend service when ridership is typically light, and new routes or innovative types of services for which the demand is emerging/developing. For new and innovative services the objective is to provide an attractive level of service for the potential market and allow the ridership to grow. However, a minimum level of demand is required to implement new service. The vehicle requirements for policy driven routes are determined by taking into consideration the same parameters as described for demand driven service. Vehicle assignments are broken down by number, size, and operating division.

The scheduling process produces the maximum peak scheduled vehicle demand by operating division for both the AM and PM peak periods. It should be noted that some divisions may have a somewhat higher vehicle demand in one peak period or the other. The maximum scheduled peak period vehicle demand for that division is the higher of the two figures. The summation of the peak vehicle demands for all divisions equals the system-wide peak scheduled vehicle demand by vehicle size.

THE PLANNING PROCESS

The following paragraphs describe the tasks of the planning process that produce the Peak Vehicle Requirement and determine fleet size.

❶ **Estimate Passenger Demand:** The first step in the service planning process is to determine demand at the maximum load points of each bus route on which the level-of-service is demand driven. This is accomplished by actual counts of current ridership coupled with estimates of future demand. Future demand estimates are made by WMATA professional planning staff. For the purpose of this fleet management plan, passenger demand is projected five years into the future, and takes into account regional growth estimates from (COG).

❷ **Determine Policy Headways, Applicable Routes, and the Resulting Vehicles Required:** This is a simple vehicle count that derives from the policy headway and travel time.

❸ **Determine the In-Service Vehicle Requirement:** This is the sum of the vehicles required to maintain policy headways and those required to respond to observe and project passenger demand, categorized by vehicle type and operating division. It is a product of the scheduling process.

❹ **Determine the Strategic Bus Requirement:** Vehicle reliability history helps determine the number of buses needed as *"strategics"*. Strategic buses are manned spare vehicles held in reserve during peak periods at strategic locations for quick replacement of breakdowns or for response to unusual circumstances, accidents, weather, or unannounced major detours. They help ensure reliable service to the public.

❺ **Determine The Peak Vehicle Requirement:** The Peak Vehicle Requirement (PVR) is the sum of peak period in service bus requirements for the entire system plus *strategics*.

❻ **Determine the Operating Spares Required:** Bus reliability history and preventive maintenance practices determine the number of spare buses necessary to meet the total peak bus requirement. This number is usually expressed as a percentage of the scheduled fleet in excess of the daily in-service requirement. Current practice is to maintain a 15% spare ratio. It provides a sufficient number of buses to be available for routine maintenance, and also assumes that a certain number of buses will be unavailable for service each day because of mechanical problems. The operating spare ratio also contributes to fleet reliability.

❼ **Determine the Total Operating Fleet:** The total bus operating fleet is the sum of the Peak Vehicle Requirement and operating spares.

❽ **Determine the Heavy Overhaul Requirement:** This fleet management plan calls for 20 buses to be in the heavy overhaul process at any given time.

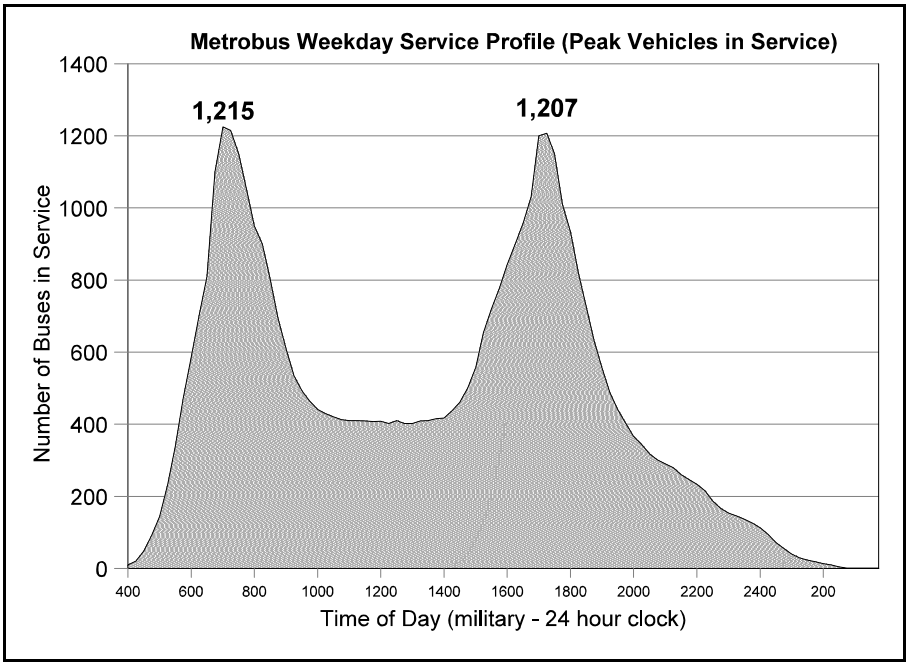
❾ **Determine the Total Active Fleet:** The total active fleet is the sum of the total operating fleet and the heavy overhaul requirement.

⑩ **Determine the Inactive Fleet:** The inactive fleet includes vehicles in acceptance testing, historic vehicles reserved for special use, buses pending disposal, and the contingency fleet. These vehicles are not included in the calculation of the spare ratios.

PEAK VEHICLE REQUIREMENT

The Peak Vehicle Requirement (PVR) is the total number of buses needed simultaneously in the peak periods to satisfy passenger demand while keeping per-bus passenger loads at or below a pre-determined level. As an illustration of this requirement, Figure 2-1 shows the total number of Metrobus vehicles in service by time of day.

Figure 2-1



FUTURE PASSENGER DEMAND AND FACTORS INFLUENCING PEAK PERIOD RIDERSHIP

General Ridership Growth: The Authority relies on the Council of Governments to project overall regional population, land use growth and transportation demand. Metrobus ridership increased approximately 12 percent from FY 2000 to FY 2006,* and the most recent COG study projects substantial growth between now and a horizon year of 2020. This fleet management plan needs to take that growth into account in projecting WMATA's future fleet size requirements. Hence the inclusion of two percent annual general ridership growth as a factor influencing fleet size requirements from FY 2007 to FY 2011.

*Wmata installed new fareboxes in FY05 that produce more accurate ridership numbers

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SECTION THREE

METROBUS NETWORK EVALUATION

PURPOSE OF EVALUATION

The purpose of this Metrobus Network Evaluation study was to perform a comprehensive bus service evaluation that determined the fleet needs for WMATA through fiscal year FY2011. This work built on the WMATA Regional Bus Study, a comprehensive bus plan for the region that addressed bus service needs to be provided by Metrobus, as well as, by local providers. The recommendations of this study support an update of the 5-year Metrobus Revenue Vehicle Fleet Management Plan.

The approach used to determine the fleet needs consists of several steps:

- Apply performance measures to existing Metrobus lines to determine which ones are performing poorly and thus could be candidates for service reduction or restructuring.
- Evaluate existing lines that may offer duplicative service as a means of reducing fleet needs.
- Identify existing lines that have crowding or running time (reliability) deficiencies that would require additional peak vehicles.
- Plan service improvements in selected corridors that have been identified as deficient based on the evaluation.
- Review recommendations of the Regional Bus Study to determine which ones have not yet been implemented, and whether they are still valid given current conditions.
- Consider any new requirements or service programs identified by the jurisdictions in preparing new service plans.

- Consider the potential for transferring operations between Metrobus and local jurisdictions to improve efficiency and level of service to the customer, a strategy that had not been discussed during the Regional Bus Study (per WMATA guidance).

- Achieve consensus with the jurisdictions on the service plans and fleet requirements.

- Determine garage requirements and implications

Evaluation of Existing Lines: Methodology

The following presents a description of the evaluation methodology used in the Metrobus Network Evaluation Study, including a review of available data sources and a list of recommended performance measures.

FOCUS ON FLEET RELATED CHARACTERISTICS

The first step was to focus the service evaluation on those measures that have a direct impact on the size of the fleet. The key question the Metrobus Network Evaluation Study addressed was how many of the buses projected to be procured actually need to be purchased given current and anticipated near term conditions. With this question in mind, the following performance and design characteristics are selected for this analysis:

Performance
Productivity/Efficiency of Service
Travel Time and Reliability
Crowding

Design
Duplication of Service
Service Frequency

Productivity measures how effectively the resources devoted to operation of a route are used, typically by calculating the number of boardings per hour, per mile, or per trip. Lines that have poor productivity (relatively few boardings per unit of service) are candidates for service cuts that could reduce the number of peak vehicles required (if the peak period service is reduced).[1]

[1]Note that while off peak service cuts will not reduce total fleet requirements, they do impact the operating budget and were included in the evaluation.

CHOICE OF PERFORMANCE AND DESIGN MEASURES

Reliability is a critical service quality feature for customers (based on research conducted in the Regional Bus Study and the recommendations of the APTA Peer Review), essential for attracting new riders and retaining all riders. Bus lines that have poor reliability, particularly ones whose travel times are longer than the scheduled times, may require additional vehicles in service to meet the schedule.

Finally, among the performance measures, crowding is another important service quality measure from the customer perspective. Lines that experience regular overcrowding require additional capacity, and thus more vehicles in service.[2]

Two characteristics of service design also have an impact on fleet size. If there are cases of service duplication (two lines serving the same streets for significant stretches), then some vehicles may be able to be saved by eliminating the duplication. Of course, if there is a case of duplication, and both routes have adequate productivity over that segment, then the duplication of the route alignment may not be considered for elimination.

Service frequency during peak periods also has a direct impact on vehicle requirements. For high ridership routes, frequency is determined by the number of vehicles required to accommodate the demand. For lower ridership routes, frequency is based on service policies.

The next step is to choose specific measures through which WMATA's 173 Metrobus lines are evaluated. The following measures were selected:

Productivity

Passengers per revenue-hour or revenue-trip

Travel Time and Reliability

Schedule adherence - % of trips "on-time" at key time points
Maintenance of headways for frequent routes
Match of scheduled and actual trip time

[2] The use of larger vehicles (articulated buses) was also considered and is discussed later in this document; it is worth noting here, however, that Metrobus garages currently pose constraints on increases in the use of articulated buses.

Duplication
Route overlap where no functional difference

Crowding
Load factor at peak load point

Frequency
Policy headways (intervals between buses)

ROUTE CLASSIFICATION AND INITIAL THRESHOLDS

A key feature of the Regional Bus Study's comprehensive operational analysis phase was the creation of a classification system for the various lines for the purposes of that study. WMATA also has a classification system in place that is somewhat different from that used in the Regional Bus Study. For the purpose of this analysis, a hybrid classification was developed that retained some of the key distinctions between lines established in the Regional Bus Study, but was more similar to the system routinely used by the planners in WMATA's OPAS division. This hybrid scheme includes five classes:

- Radial Line Haul
- Other Urban
- Other Suburban
- Express
- Small Bus (30 foot or less)

The study team also decided to divide service into peak and off-peak periods, using WMATA's standard definitions (peak periods being 5:30 a.m. to 9:29 a.m. and 3:00 p.m. to 6:59 p.m.) For each of the five classes, different standards were developed for peak and classes,

different standards were developed for peak and off-peak service. However, the analysis focused largely on peak period service.

The following presents a description of the performance of the current Metrobus route network and identifies where there are deficiencies in productivity, travel time, reliability, service convenience, and capacity, as well as, where the existing service network operates inefficiently due to duplication.

Productivity

In prior efforts (such as the Regional Bus Study), the productivity calculation for Passengers per Revenue-Hour (Pass/Rev-Hr) included the scheduled recovery time (consistent with the definition of revenue time in the National Transit Database), but for this analysis, recovery time is excluded. (As shown in table 3-1) This was done so that those services with apparent excess recovery time due to the scheduling arithmetic or other reasons are no longer penalized (i.e., no longer reported with lower productivity than other lines). The scheduled recovery time for WMATA lines averages approximately 20 percent of the run time with a standard deviation estimated at slightly greater than 8 percent. The recovery time for several routes is as great as 36 percent (twice the standard deviation) or more, thus it is more appropriate to measure WMATA routes with a Pass/Rev-Hr threshold that excludes recovery time.

Table 3-1

Productivity Thresholds						
Class	Peak Average	Peak Threshold (60% of Average)	Marginal Fail (-10% of Threshold)	Marginal Pass (+10% of Threshold)	Off-Peak Average	Off-Peak Threshold (60% of Average)
Express*	23	14	13	15	15	9
Radial **	55	33	30	36	38	23
Small Bus	35	21	19	23	23	14
Suburban	37	22	20	24	28	17
Urban	55	33	30	36	38	23

* Productivity of express lines is measured in boardings per peak direction trip, not boardings per revenue hour.
**Productivity of Articulated bus services (lines X2, Y5-9, & 70,71) not included in the average. Peak average would be 58 pass/rev-hr with these services.

The productivity threshold was set at 60 percent of the class average. In addition, for peak period services, those routes that were within 10% of the threshold (plus or minus) were identified as "marginal fail" (approximately between 54% and 60% of the class average) or "marginal pass" (approximately between 60% and 66% of the class average.) Ridership data from the three lines served with articulated buses were excluded from these revised calculations. These higher capacity buses would cause a significant increase in the peak average for the radial route class which would have an impact on the final identification of lines not meeting the productivity threshold.

In total, as detailed in Table 3-2, 11 lines were identified as failing to achieve the peak productivity threshold with 1 of these lines at a "marginal fail" level.[3] Eleven additional lines fall within the "marginal pass" level. For the off-peak services, 20 lines fail to meet the threshold measure for their respective classes.

[3]Four additional lines were identified, but they have been excluded from this analysis as they were slated for elimination in Fall 2006.

Table 3-2

Productivity Results						
Class	**Peak Threshold (pass/rev-hr)**	**Lines Failing Peak Threshold (incl. Marginal Fail)**	**Lines at Marginal Fail Level**	**Lines at Marginal Pass Level**	**Off-Peak Threshold (pass/rev-hr)**	**Lines Failing Off-Peak Threshold**
Radial	**33**	15K,L	none	none	**23**	15K,L
		66,68				66,68
		D5				N2-4,6
Urban	**33**	13A,B,F,G	none	V14,15	**23**	13A,B,F,G
		C12,14		J4		C12,14
				K1		H11-13
						22B
						25B
						G2
						25A,F,G,J,P,R
Suburban	**22**	C7,9	F13	12C,D	**17**	12A,E,F,G
		F13		28T		28T
				3T		
				24T		
				20F,W,X,Y		
Express	**14**	17A,B,F,M	none	29C,E,G,H,X	**9**	17A,B,F,M
		18P,R,S		Z11,13		18P,R,S
		B30				B30
						B29,31
Small Bus	**21**	N8	none	2T	**14**	E6
						N8
						N22
						26A-E

Travel Time

The most recent passenger-time survey reports (prepared by OPAS based on ridecheck data) were downloaded for each of the Metrobus lines, and these were manipulated to yield a count of the trips that were observed to be operating with travel times within 5 minutes of the scheduled travel time, 5 to 9 minutes greater than the scheduled time and 10 minutes or more greater than the scheduled time.

Lines for which 33% or more of peak-period trips took at least 5 minutes longer than scheduled, or lines for which 10% or more of peak-period trips took at least 10 minutes longer than scheduled, were deemed to have travel time "problems." Among the available ridecheck data (observations were not available for every single line), 43 lines fell into this category.

OPAS planners had already addressed some of these problem routes through their regular analysis of the ridecheck data. Schedules for over half of the problem lines (24) had already been adjusted.

(No data is available to determine whether these adjustments solved the observed running time problems.) The remaining 19 lines, which presumably are still experiencing travel time problems, are as shown below in Table 3-3.

Table 3-3

Lines with Travel Time Problems

Line	Line Name	Date of Check	Peak trips	Trips 5-9 min greater than sched	Trips 10+ min greater than sched	Pct>5 min	Pct>10
J7,9	I-270 Express	March-05	36	7	11	50%	31%
S1	16th St-Potomac Park	May-05	35	10	10	57%	29%
R12	Kenilworth Ave-New Carrollton	March-03	38	11	10	55%	26%
D1,3,6	Sibley Hospital-Stadium/Armory	February-04	113	19	23	37%	20%
3Y	Lee Highway-Farragut Square	November-04	10	2	2	40%	20%
16L	Annandale-Skyline City-Pentagon	September-04	6	3	1	67%	17%
Z6	Tanglewood-Westfarm	January-05	40	6	6	30%	15%
J1-3	Bethesda-Silver Spring	October-02	121	28	18	38%	15%
70,71	Georgia Ave-7th St	April-05	132	20	19	30%	14%
C2,4	Greenbelt-Twinbrook	November-02	114	23	16	34%	14%
30,32,34-36	Pennsylvania Ave	June-04	218	40	30	32%	14%
90,92,93	U St-Garfield	April-03	159	24	21	28%	13%
W4	Deanwood-Alabama Ave	June-03	72	12	9	29%	13%
V5	Fairfax Village-L'Enfant Plaza	June-03	25	3	3	24%	12%
N2-4,6	Massachusetts Ave	May-04	109	17	12	27%	11%
J5	Twinbrook-Silver Spring	August-02	20	3	2	25%	10%

Lines with Travel Time Problems							
Line	**Line Name**	**Date of Check**	**Peak trips**	**Trips 5-9 min greater than sched**	**Trips 10+ min greater than sched**	**Pct>5 min**	**Pct>10**
P1,2,6	Anacostia-Eckington	April-03	84	10	8	21%	10%
F12	Ardwick Industrial Park Shuttle	January-03	28	10	2	43%	7%
11Y	Mt Vernon Express	November-05	9	3	0	33%	0%

Without taking potential restructuring into account, the number of additional buses that would be necessary to solve these travel time problems was calculated. For several of the lines listed in Table 3-3 (those with light to moderate ridership), it seemed that the most practical solution would be to stretch the headways slightly rather than add vehicles. However, for the following lines, (table 3-4) additional vehicles are recommended.

Table 3-4

Additional Vehicles Needed To Address Travel Time Problems			
Line	**Line Name**	**Number of Additional Vehicles**	**AM or PM**
J7,9	I-270 Express	1	Both
S1	16th St-Potomac Park	1	Both
R12	Kenilworth Ave-New Carrollton	1	Both
J1-3	Bethesda-Silver Spring	1	PM
70,71	Georgia Ave-7th St	1	PM
C2,4	Greenbelt-Twinbrook	1	PM
30,32,34-36	Pennsylvania Ave	1	Both
90,92,93	U St-Garfield	1	Both
N2-4,6	Massachusetts Ave	2	AM

If all of these vehicles were added, the peak vehicle requirement would increase by 7 for the AM peak and by 8 for the PM peak.

Although travel time is the reliability factor most tied to potential fleet needs, the team also considered schedule adherence. Again, using ridecheck data, the number of trips on each line that departed the starting point more than five minutes late or that arrived at the ending point more than one minute early or more than five minutes late was calculated. Lines with service more frequent than every 10 minutes were excluded from this analysis, since the maintenance of headways is more important than schedule adherence for frequent routes (for which passengers typically do not consult printed schedules).

Some 97 lines had schedule adherence "problems" defined in this case as having less than two thirds of peak period trips departing and arriving "on time." Of these, 23 lines have had their schedules adjusted since the time of the data collection. These lines were listed in a project memorandum dated June 13, 2006.

The conundrum that arises with schedule adherence data is that despite clear indications of poor reliability, the data does not necessarily indicate any solution. For most of the lines that had schedule adherence problems, there is a roughly even split of early and late arrivals. That means that the current scheduled running time is not too short or too long; it is just that traffic conditions and ridership patterns are highly variable. If the running time is increased to try to avoid late arrivals, then more trips will arrive early. There are certain operational strategies that can be used to improve schedule adherence (such as increasing the running time but holding the bus at timepoints so that it does not run early), but these can make the service less convenient (slower) for passengers. The Automatic Vehicle Location system should help overall reliability by giving schedulers and operations staff better information about how the buses are actually running along the route.

Service Convenience

The primary measure of service convenience is the interval between buses on a line, in other words, the service frequency. The Regional Bus Study comprehensively evaluated all Metrobus lines versus recommended frequency thresholds, shown below.

Frequency (Minutes between buses)	Peak Period	Off-Peak/ Weekend
Urban/Radial	15	30
Suburban	30	60
Express	4 trips	none

Lines identified in the Comprehensive Operational Analysis of the Regional Bus Study as not meeting these thresholds were recommended for service increases. All of the five subregions other than Outer Virginia had a number of these lines.

There are 36 lines that do not currently meet the peak-period frequency thresholds shown above. Of these lines, most have light to moderate ridership, and thus would not be prime candidates for service increases. (Indeed, service increases could push some of them into the poor-performer category with respect to productivity.) There are two lines where current ridership is relatively heavy, P12 and T18, which could benefit from an increase in service from every 20 minutes to every 15 minutes in the peak periods. For the T18, this increase would require one additional peak bus in the morning and 2 in the afternoon. For the P12, the increase would require 2 additional peak buses in the morning and 3 in the afternoon.

Crowding

Passenger crowding is the component of service quality that receives the most attention from OPAS planners. They are continuously monitoring passenger complaints on this issue and regularly review stationary (point) check data to determine the degree of crowding throughout the system. When cutbacks are made to poorly performing routes, those resources are typically reallocated to lines that are experiencing crowded conditions.

WMATA began in calender year 2000 replacing the older buses slated for retirement with a new look low floor bus. Typically, the older buses were configured with more seats (43-48) and the low floor buses with fewer seats (39-41). As of December 2006 WMATA has purchased 681 low-floor buses that have an approximate net loss of five seats per vehicle.

Because of this high degree of attention to crowding on the part of internal staff, the consultant team did not perform an in-depth analysis of current crowding. However, an analysis was performed to project future crowding by inflating current ridership by 2% annually for five years (through 2010) and also taking into account the capacity effects of fleet replacement.

The lines shown in Table 3-5 would violate WMATA's guideline load factor of 1.2 in the peak period. The load factor is the number of people on the bus at the maximum load point divided by the number of seats. For a 38-seat bus, a 1.2 load factor would mean that 8 people would be standing.

Table 3-5

Lines with Crowding in Peak Periods			
Line	**2005-2006 Peak Hour Load Factor**	**2010 Projected Peak Hour Load Factor**	**Add'l Peak Vehicles Needed**
5A	1.10	1.43	1
42	1.00	1.30	2
52, 53, 54	1.03	1.34	2
S1	1.08	1.40	2
S2, S4	0.94	1.22	2
D2	1.50	1.72	3
84, 85	1.16	1.51	1
C2, C4	1.00	1.25	2
C28	0.94	1.22	1
F8	1.00	1.30	1
Q2	1.17	1.52	4
R1,2,5	1.00	1.25	1
T18	0.94	1.22	1
V11,12	1.04	1.35	1
12A,E,F,G	0.98	1.22	1

Note that the D2 was operated with small (26-foot) buses because of neighborhood and street constraints. WMATA has begun to replace its 26 foot buses with 30 foot buses on routes such as the D2. With 30 foot buses, the load factor on the D2 is now projected to be 1.1 in 2011 alleviating the load violation. Thus, no additional buses should be required.

A total of 22 full-size buses would be needed to alleviate crowded conditions on the lines indicated by 2011.

Service Duplication

Much of the Washington region has a dense network of bus service with many overlapping segments of bus lines. To some extent, this reflects the complex travel patterns of bus passengers who are traveling from many origins to many destinations.

In some cases, however, these overlapping segments may represent unnecessary duplication of service.

Using system maps, the consultant team identified the instances of apparent duplication shown in Table 3-6. The figure in the rightmost column represents a rough estimate of the percentage of the route mileage that is duplicated.

In some of these cases the duplication may be justified to avoid a situation where large numbers of passengers would have to transfer. In the first example shown, it is clear that the amount of bus service between Wheaton Station and Silver Spring Station provided by the Q2 and Y routes is more than is necessary. However, truncating the Y routes at Wheaton would reduce the convenience for those passengers that need to transfer to other bus routes at Silver Spring. According to the on-board survey conducted as part of the Regional Bus Study, there were approximately 200 passengers transferring between the Y routes and other bus routes at Silver Spring (mainly Ride On routes serving Takoma Park).

On the other hand, the two largest transfer moves from the Y routes to other lines occurred at Wheaton Station, specifically with the C2,4 and the Ride On 26. Of course, passengers heading to downtown Washington on the Red Line could transfer at either Wheaton or Silver Spring, but the peak fare from Wheaton is 65 cents more. The forthcoming construction project at Silver Spring will reduce bus berthing capacity there; this 2-year period may be an opportune time to test out the concept of truncation of the Y routes at Wheaton.

Table 3-6

Cases of Apparent Duplication			
Metro Line	**Other Metro Line**	**Other Local**	**Overlap**
Y5,7,8,9	Q2		25%
C8	Z2	Ride On 10	60%
Z routes		Ride On 22	75%
J4		Ride On 15	95%
89		CAR A-F	60%
T17		The Bus 15	75%
T16,17; R12; F4; C2		The Bus 16	75%
F4,6		The Bus 14	95%
R3; F8; 86; F12; A11		The Bus 18	75%
F6		The Bus 13	75%
F8/F2		The Bus 12	60%
T16,17; C2		The Bus 11	75%
F14		The Bus 23	50%
C21,22,29		The Bus 22, 26	50%
A11	J11-13		40%
X3	90-95		60%
V7-9	U2		50%
92	W4, W6,8		25%
M8,9	A routes		60%
29K,N		DASH AT8	25%
28B		DASH AT2	25%
28 Line	16 Line		10%

Summary

Table 3-7, provides a full summary of how each of the Metrobus lines fares with respect to the service evaluation measures. A "Yes" indicates that the line meets the threshold for service, and a "No" indicates that a line does not meet the threshold.

Table 3-7

Summary of Evaluation Measures

Line	Line Name	Class	Adequate Peak Produc-tivity	Adequate Travel Time	Meets Policy Freq.	No Crowding	No Duplic-ation	Curr. Peak Buses	Needed Buses
42	Mt Pleasant	Radial	Yes	Yes	Yes	No	Yes	17	2
80	North Capitol St	Radial	Yes	Yes	Yes	Yes	Yes	14	
15K,L	Chain Bridge Rd	Radial	No	Yes	No	Yes	Yes	5	
16A,B,D-F,J	Columbia Pike	Radial	Yes	Yes	Yes	Yes	Yes	14	
1B-F,Z	Wilson Blvd-Fairfax	Radial	Yes	Yes	Yes	Yes	Yes	10	
24P	Ballston-Pentagon	Radial	Yes	Yes	No	Yes	Yes	3	
30,32,34-36	Pennsylvania Ave	Radial	Yes	No	Yes	Yes	Yes	45	1
38B	Ballston-Farragut Square	Radial	Yes	Yes	No	Yes	Yes	6	
3A,B,E	Lee Hwy	Radial	Yes	Yes	Yes	Yes	Yes	9	
3Y	Lee Highway-Farragut Square	Radial	Yes	No	Yes	Yes	Yes	2	
4A,B,E,H,S	Pershing Dr-Arlington Blvd	Radial	Yes	Yes	Yes	Yes	Yes	7	
52-54	14th St	Radial	Yes	Yes	Yes	No	Yes	23	2
66,68	Petworth-11th St	Radial	No	Yes	Yes	Yes	Yes	6	
70,71	Georgia Ave-7th St	Radial	Yes	No	Yes	Yes	Yes	17	1
7A-F,H,P,W,X	Lincolnia-North Fairlington	Radial	Yes	Yes	Yes	Yes	Yes	24	
81,82,83,86	College Park	Radial	Yes	Yes	Yes	Yes	Yes	12	
96,97	East Capitol St-Cardozo	Radial	Yes	Yes	Yes	Yes	Yes	14	
9A,E	Huntington-Pentagon	Radial	Yes	Yes	No	Yes	Yes	7	
A9	South Capitol St	Radial	Yes	Yes	No	Yes	Yes	5	
D1,3,6	Sibley Hospital-Stadium/Armory	Radial	Yes	No	Yes	Yes	Yes	28	
D5	MacArthur Blvd-Georgetown	Radial	No	Yes	Yes	Yes	Yes	2	
G8	Rhode Island Ave	Radial	Yes	Yes	Yes	Yes	Yes	11	
H1	Brookland - Potomac Park	Radial	Yes	Yes	No	Yes	Yes	4	
K6	New Hampshire Ave-Maryland	Radial	Yes	Yes	Yes	Yes	Yes	7	
L1,2,4	Connecticut Ave	Radial	Yes	Yes	Yes	Yes	Yes	12	
L7,8	Connecticut Ave-Maryland	Radial	Yes	Yes	Yes	Yes	Yes	7	
N2-4,6	Massachusetts Ave	Radial	Yes	No	Yes	Yes	Yes	17	2
P1,2,6	Anacostia-Eckington	Radial	Yes	No	Yes	Yes	Yes	11	

Summary of Evaluation Measures									
Line	Line Name	Class	Adequate Peak Produc-tivity	Adequate Travel Time	Meets Policy Freq.	No Crowding	No Duplic-ation	Curr. Peak Buses	Needed Buses
Q2	Veirs Mill Rd	Radial	Yes	Yes	Yes	No	No	15	4
R1,2,5	Riggs Rd	Radial	Yes	Yes	Yes	No	Yes	8	1
R4	Queens Chapel Rd	Radial	Yes	Yes	No	Yes	Yes	3	
S1	16th St-Potomac Park	Radial	Yes	No	Yes	No	Yes	13	2
S2,4	16th St	Radial	Yes	Yes	Yes	No	Yes	26	2
V5	Fairfax Village-L'Enfant Plaza	Radial	Yes	No	No	Yes	Yes	7	
V7-9	Minnesota Ave-M St	Radial	Yes	Yes	Yes	Yes	No	14	
X1,3	Benning Rd	Radial	Yes	Yes	Yes	Yes	No	10	
X2	Benning Rd-H St	Radial	Yes	Yes	Yes	Yes	Yes	13	
X8	Maryland Ave	Radial	Yes	Yes	No	Yes	Yes	3	
Y5,7-9	Georgia Ave-Maryland	Radial	Yes	Yes	Yes	Yes	No	10	
Z8	Fairland	Radial	Yes	Yes	Yes	Yes	Yes	7	
62	Takoma-Petworth	Urban	Yes	Yes	Yes	Yes	Yes	9	
94	Stanton Rd	Urban	Yes	Yes	Yes	Yes	Yes	3	
10A,E	Hunting Towers-Pentagon	Urban	Yes	Yes	No	Yes	Yes	6	
10B	Hunting Towers-Ballston	Urban	Yes	Yes	No	Yes	Yes	4	
13A,B,F,G	Nat'l Airport-Pentagon-Washington	Urban	No	Yes	Yes	Yes	Yes	5	
16G,H,K,W	Columbia Hts West-Pentagon City	Urban	Yes	Yes	Yes	Yes	No	8	
16L	Annandale-Skyline City-Pentagon	Urban	Yes	No	Yes	Yes	Yes	2	
16Y	Columbia Pike-Farragut Square	Urban	Yes	Yes	Yes	Yes	Yes	5	
22A	Barcroft-South Fairlington	Urban	Yes	Yes	No	Yes	Yes	4	
22B	Pentagon-Army-Navy-Shirley Park	Urban	Yes	Yes	No	Yes	Yes	2	
23A,C	Mclean-Crystal City	Urban	Yes	Yes	Yes	Yes	Yes	10	
25A,F,G,J,P,R	Ballston-Bradlee-Pentagon	Urban	Yes	Yes	Yes	Yes	Yes	7	
25B	Landmark-Ballston	Urban	Yes	Yes	No	Yes	Yes	4	
60,64	Fort Totten-Petworth	Urban	Yes	Yes	Yes	Yes	Yes	5	
8S,W,X,Z	Foxchase-Seminary Valley	Urban	Yes	Yes	Yes	Yes	Yes	9	
90,92,93	U St-Garfield	Urban	Yes	No	Yes	Yes	No	25	1
A11,12	M L King Jr Hwy	Urban	Yes	Yes	No	Yes	No	6	
A2-48	Anacostia-Congress Heights	Urban	Yes	Yes	Yes	Yes	Yes	19	
A4,5	Anacostia-Fort Drum	Urban	Yes	Yes	Yes	Yes	Yes	6	
B2	Bladensburg Rd-Anacostia	Urban	Yes	Yes	Yes	Yes	Yes	15	
C12,14	Hillcrest Heights	Urban	No	Yes	No	Yes	Yes	3	
C2,4	Greenbelt-Twinbrook	Urban	Yes	No	Yes	No	Yes	19	3
D12-14	Oxon Hill-Suitland	Urban	Yes	Yes	Yes	Yes	Yes	12	
E2-4	Military Rd-Crosstown	Urban	Yes	Yes	Yes	Yes	Yes	12	

Summary of Evaluation Measures									
Line	Line Name	Class	Adequate Peak Produc-tivity	Adequate Travel Time	Meets Policy Freq.	No Crowding	No Duplic-ation	Curr. Peak Buses	Needed Buses
F14	Sheriff Rd-Capitol Heights	Urban	Yes	Yes	No	Yes	No	5	
F4,6	Prince George's-Silver Spring	Urban	Yes	Yes	Yes	Yes	No	16	
F8	Prince George's-Langley Park	Urban	Yes	Yes	No	No	No	4	1
G2	P St-Ledroit Park	Urban	Yes	Yes	Yes	Yes	Yes	8	
H11-13	Marlow Heights-Temple Hills	Urban	Yes	Yes	No	Yes	Yes	5	
H2-4	Crosstown	Urban	Yes	Yes	Yes	Yes	Yes	17	
J11-13	Marlboro Pike	Urban	Yes	Yes	No	Yes	Yes	3	
J1-3	Bethesda-Silver Spring	Urban	Yes	No	Yes	Yes	Yes	14	1
J4	College Park-Bethesda	Urban	Yes	Yes	No	Yes	No	5	
K1	Takoma-Walter Reed	Urban	Yes	Yes	No	Yes	Yes	2	
K2	Takoma-Fort Totten	Urban	Yes	Yes	No	Yes	Yes	2	
M6	Fairfax Village	Urban	Yes	Yes	Yes	Yes	Yes	3	
P12	Eastover-Addison Rd	Urban	Yes	Yes	No	Yes	Yes	9	3
T18	Annapolis Rd	Urban	Yes	Yes	No	No	Yes	7	2
U2	Minnesota Ave-Anacostia	Urban	Yes	Yes	No	Yes	No	3	
U5,6	Mayfair-Marshall Heights	Urban	Yes	Yes	Yes	Yes	Yes	4	
U8	Capitol Heights-Benning Heights	Urban	Yes	Yes	Yes	Yes	Yes	7	
V11,12	District Heights-Suitland	Urban	Yes	Yes	No	No	Yes	4	1
V14,15	District Heights-Seat Pleasant	Urban	Yes	Yes	No	Yes	Yes	5	
W4	Deanwood-Alabama Ave	Urban	Yes	No	Yes	Yes	No	14	
12A,E,F,G	Centreville South	Suburban	Yes	Yes	Yes	No	Yes	5	1
12C,D	Centreville North	Suburban	Yes	Yes	No	Yes	Yes	3	
12L,M	Little Rocky Run-Vienna	Suburban	Yes	Yes	Yes	Yes	Yes	3	
12R,S	Stringfellow Road-Vienna	Suburban	Yes	Yes	Yes	Yes	Yes	3	
20F,W,X,Y	Chantilly-Greenbriar	Suburban	Yes	Yes	Yes	Yes	Yes	4	
24T	Mclean Hamlet-East Falls Church	Suburban	Yes	Yes	No	Yes	Yes	2	
28A-B	Alexandria-Tyson's Corner	Suburban	Yes	Yes	Yes	Yes	No	8	
28T	Tyson's Corner-West Falls Church	Suburban	Yes	Yes	Yes	Yes	Yes	4	
29K,N	Alexandria-Fairfax	Suburban	Yes	Yes	No	Yes	No	5	
2W	Vienna-Oakton	Suburban	Yes	Yes	Yes	Yes	Yes	1	
3T	Pimmit Hills	Suburban	Yes	Yes	Yes	Yes	Yes	5	
89,89M	Laurel	Suburban	Yes	Yes	No	Yes	No	2	
B21,22	Bowie State University	Suburban	Yes	Yes	Yes	Yes	Yes	2	
B24,25	Bowie-Belair	Suburban	Yes	Yes	No	Yes	Yes	3	
B27	Bowie-New Carrollton	Suburban	Yes	Yes	Yes	Yes	Yes	2	
C11,13	Clinton	Suburban	Yes	Yes	Yes	Yes	Yes	3	
C21,22,26,29	Central Avenue	Suburban	Yes	Yes	Yes	Yes	No	6	
C7,9	Greenbelt-Glenmont	Suburban	No	Yes	No	Yes	Yes	4	

Summary of Evaluation Measures									
Line	Line Name	Class	Adequate Peak Produc-tivity	Adequate Travel Time	Meets Policy Freq.	No Crowding	No Duplic-ation	Curr. Peak Buses	Needed Buses
C8	College Park-White Flint	Suburban	Yes	Yes	No	Yes	No	4	
F12	Ardwick Industrial Park Shuttle	Suburban	Yes	No	No	Yes	Yes	5	
F13	Cheverly-Wash Business Park	Suburban	Yes	Yes	Yes	Yes	Yes	2	
K11-13	Forestville	Suburban	Yes	Yes	Yes	Yes	Yes	5	
R12	Kenilworth Ave-New Carrollton	Suburban	Yes	No	Yes	Yes	Yes	7	1
R3	Greenbelt-Fort Totten	Suburban	Yes	Yes	Yes	Yes	No	4	
T16,17	Greenbelt	Suburban	Yes	Yes	Yes	Yes	No	5	
T2	River Rd	Suburban	Yes	Yes	Yes	Yes	Yes	7	
W15	Camp Springs-Indian Head Hwy	Suburban	Yes	Yes	Yes	Yes	Yes	3	
Z2	Colesville-Ashton	Suburban	Yes	Yes	Yes	Yes	No	6	
Z6	Tanglewood-Westfarm	Suburban	Yes	No	Yes	Yes	Yes	7	
11Y	Mt Vernon Express	Express	Yes	No	Yes	Yes	Yes	5	
17A,B,F,M	Kings Park	Express	No	Yes	Yes	Yes	Yes	4	
17G,H,K,L	Kings Park Express	Express	Yes	Yes	Yes	Yes	Yes	15	
18E,F	Springfield	Express	Yes	Yes	Yes	Yes	Yes	3	
18G,H,J	Orange Hunt	Express	Yes	Yes	Yes	Yes	Yes	6	
18P,R,S	Burke Centre	Express	No	Yes	Yes	Yes	Yes	8	
21A-D,F	Landmark-Pentagon	Express	Yes	Yes	Yes	Yes	Yes	6	
28F,G	Skyline City	Express	Yes	Yes	Yes	Yes	Yes	2	
29C,E,G,H,X	Annandale	Express	Yes	Yes	Yes	Yes	Yes	13	
5A	DC-Dulles Airport	Express	Yes	Yes	Yes	No	Yes	2	1
5B	DC - Tyson's Corner	Express	Yes	Yes	Yes	Yes	Yes	2	
87,88	Laurel Express	Express	Yes	Yes	Yes	Yes	Yes	6	
B29,31	Crofton-New Carrollton	Express	Yes	Yes	Yes	Yes	Yes	2	
B30	Greenbelt-Bwi Express	Express	No	Yes	Yes	Yes	Yes	3	
C28	Pointer Ridge	Express	Yes	Yes	Yes	No	Yes	3	1
J5	Twinbrook-Silver Spring	Express	Yes	No	Yes	Yes	Yes	3	
J7,9	I-270 Express	Express	Yes	No	Yes	Yes	Yes	5	1
P17-19	Oxon Hill- Fort Washington	Express	Yes	Yes	Yes	Yes	Yes	12	
REX (R99)	Richmond Highway Express	Express	Yes	Yes	Yes	Yes	Yes	8	
W13,14	Bock Road	Express	Yes	Yes	Yes	Yes	Yes	9	
W19	Indian Head Express	Express	Yes	Yes	Yes	Yes	Yes	6	
Z11,13	Greencastle-Briggs Chaney Express	Express	Yes	Yes	Yes	Yes	Yes	10	
Z9,29	Burtonsville-Laurel Express	Express	Yes	Yes	Yes	Yes	Yes	8	
98	Woodley Park-Adams Morgan-U St Loop	Small Bus	NA	Yes	Yes	Yes	Yes	0	
10P	Mt. Vernon Ave-Potomac	Small Bus	Yes	Yes	Yes	Yes	Yes	2	

Summary of Evaluation Measures									
Line	Line Name	Class	Adequate Peak Produc-tivity	Adequate Travel Time	Meets Policy Freq.	No Crowding	No Duplic-ation	Curr. Peak Buses	Needed Buses
	Yard-Crystal City								
26A,E	East Falls Church Shuttle	Small Bus	Yes	Yes	Yes	Yes	Yes	1	
26W	West Falls Church Shuttle	Small Bus	Yes	Yes	Yes	Yes	Yes	1	
2A-C,G	Washington Blvd	Small Bus	Yes	Yes	Yes	Yes	Yes	9	
2T	Tyson's Corner-Dunn Loring	Small Bus	No	Yes	Yes	Yes	Yes	3	
84,85	RI Ave-New Carrollton	Small Bus	Yes	Yes	Yes	No	Yes	5	1
B8,9	Fort Lincoln Shuttle	Small Bus	Yes	Yes	Yes	Yes	Yes	4	
D2	Glover Park-Dupont Circle *Crowding alleviated by use of 30-foot buses.	Small Bus	Yes	Yes	Yes	Yes*	Yes	5	3
D4	Ivy City-Union Station	Small Bus	Yes	Yes	Yes	Yes	Yes	3	
D8	Hospital Center	Small Bus	Yes	Yes	Yes	Yes	Yes	8	
E6	Chevy Chase	Small Bus	Yes	Yes	Yes	Yes	Yes	2	
F1,2	Chillum Rd	Small Bus	Yes	Yes	Yes	Yes	Yes	5	
H5,7	Mt. Pleasant-Adams Morgan	Small Bus	Yes	Yes	Yes	Yes	Yes	3	
H6	Brookland-Fort Lincoln Loop	Small Bus	Yes	Yes	Yes	Yes	Yes	4	
H8,9	Park Rd-Brookland	Small Bus	Yes	Yes	Yes	Yes	Yes	7	
M2	Fairfax Village-Naylor Road	Small Bus	Yes	Yes	Yes	Yes	Yes	1	
M4	Nebraska Ave	Small Bus	Yes	Yes	Yes	Yes	Yes	5	
M8,9	Congress Heights Shuttle	Small Bus	Yes	Yes	Yes	Yes	No	3	
N22	Navy Yard Shuttle	Small Bus	Yes	Yes	Yes	Yes	Yes	6	
N8	Van Ness-Wesley Heights Loop	Small Bus	No	Yes	Yes	Yes	Yes	3	
TAGS (S80,S91)	Springfield Circulator	Small Bus	Yes	Yes	Yes	Yes	Yes	5	
U4	Sheriff Rd-River Terrace	Small Bus	Yes	Yes	Yes	Yes	Yes	3	
W2,3	S.E. Community Hospital-Anacostia	Small Bus	Yes	Yes	Yes	Yes	Yes	9	
W6,8	Garfield-Anacostia Loop	Small Bus	Yes	Yes	Yes	Yes	No	7	
W9	Defense Facilities Shuttle	Small Bus	Yes	Yes	Yes	Yes	Yes	2	

Needs for additional buses to address travel time, frequency, or crowding problems total 38 vehicles for the whole system. None of those "needed" vehicles is associated with a line that fails to meet the productivity threshold.

REGIONAL BUS STUDY RECOMMENDATIONS

Overall, relatively few of the recommendations for the District of Columbia have been implemented. Several of the suggestions for new services were reworked into new options. Some changes were projected to be implemented in 2006-7. It would require 60 additional peak vehicles for the service improvements listed above on which no action has been taken, the majority for RapidBus services.

Montgomery County has implemented many of the recommendations from the Regional Bus Study. The County developed a program called

"Go Montgomery!" in June 2002 to increase investment in transportation facilities and services. The Regional Bus Study recommendations were the basis for many of the transit investments that were subsequently implemented. The largest single restructuring recommendation involved Metrobus service in the US 29 corridor. This was implemented largely as recommended in the study. It would require 32 additional peak vehicles for the service improvements listed above that are not yet implemented. Up to 15 of these new vehicles would likely be operated by Ride On.

Relatively few of the recommendations for Prince George's County have been implemented. In addition to those shown in the table above, there were 65 recommendations for extensions to the span of service; only one of these-the institution of Sunday service on the C29-was implemented (with the opening of the Largo extension). The County is currently in the final stages of its 5-year transit plan; once this plan is completed, it is likely that more recommendations will move toward implementation.

It would require 36 additional peak vehicles for the service improvements listed above that are not yet implemented. Perhaps up to 8 of these vehicles would be operated by the County.

Several significant changes have been made to Metrobus service in Inner Virginia since the Regional Bus Study, but in several cases, the RBS recommendations were substantially revised prior to implementation. Some of the overlap with DASH service has been resolved through transferring responsibility for the service to DASH, and this trend appears likely to continue. The Metrobus 25 line is the prime candidate for further restructuring and analysis, in line with the conclusions of the evaluation. It would require 30 additional peak vehicles for the service improvements listed above that are not yet implemented. Up to 23 of these vehicles would likely be operated by DASH.

Several of the recommendations for Outer Virginia have been implemented, but more are planned to be instituted in the future. Seven routes associated with the Richmond Highway corridor, including a branded limited stop route (REX) and 6 circulators were implemented by Metrobus and Fairfax Connector respectively in 2004; these had been long-term recommendations of the Regional Bus Study. Several Metrobus routes are planned to be transferred to Fairfax Connector in 2008/2009, at which point they may be restructured. It would require 57 additional peak vehicles for the service improvements listed above that are not yet implemented. Of these, 29 were projected to be for Fairfax Connector routes, 9 for Loudoun County Transit, and 19 for Metrobus service. The 19 buses are net of vehicle savings due to restructuring recommendations.

SUMMARY

If all of the recommendations for new service from the Regional Bus Study that have not yet been acted upon (and are still deemed relevant) were implemented, a total of 137 additional peak vehicles would be required.[4] With the projected transfer of Metrobus services to Fairfax Connector, the vehicle requirement for Metrobus could drop to 119. With a spare ratio of 15%, the 119 peak vehicle requirement translates into a net additional fleet requirement of 137 buses.

Some of the above near-term recommendations were rated as high priority. A number of these have already been implemented. Among those not yet acted upon, a total of 90 peak vehicles (or 104 with spares) would be required to implement high priority recommendations, the majority of which are in Outer Virginia (57 vehicles).

The District of Columbia and Montgomery County would each require 9 more peak vehicles for their high priority items, while Prince George's County would require 21 peak vehicles for high priority recommendations.

[4] It is important to note that there is some overlap between the new buses required to address deficiencies identified in the present network evaluation and new buses needed to implement Regional Bus Study recommendations.

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SECTION FOUR

METROBUS FLEET NEEDS

The previous section presented the findings of the Network Evaluation for Metrobus services detailing recommended service modifications and enhancements for each of five subregions. This section presents the impacts of the proposed service changes on the 2011 fleet and garaging requirements. The need for the procurement of 167 buses over five years is confirmed.

The proposed Metro Matters acquisition schedule is as follows:

- FY07 25 buses
- FY08 25 buses
- FY09 30 buses
- FY10 37 buses
- FY11 50 buses

VEHICLE REQUIREMENTS BY TYPE

Baseline Conditions - December 2006

WMATA's active fleet at the end of FY2006 consisted of 1,481 vehicles distributed among bus types as summarized below. Table 4-1 shows the assignment of these vehicles by operating division.

Table 4-1

WMATA Metrobus Fleet by Type - 2006

Division	Local	Small CNG	Small Diesel	Standard CNG	Standard Hybrid	Standard Diesel	Artic	Total Assigned
Bladensburg	DC	24	5	178		11	21	239
Southeastern	DC		24			89		113
Northern	DC		9			139	27	175
Western	DC		21			115		136
Sub-Total	DC							663
Southern Avenue	MD					103		103
Landover	MD		12		25	136		173
Montgomery	MD				25	126	14	165
Sub Total	MD							441
Four Mile Run	VA	11	4	201				216
Royal Street	VA					73		73
Arlington	VA		4			84		88
Sub-Total	VA							377
System Total		35	79	379	50	876	62	1481

These 1,481 buses include a base fleet of 1,455 buses with 20 contingency buses designated for the heavy overhaul process and 6 reserved for training purposes. In addition, WMATA maintains 50 buses on 'Ready Reserve' status made up of older buses that exceed the 15-year life expectancy (See Section Six) at the Carmen E. Turner Maintenance and Training facility to augment the active fleet as required for special events or to support various maintenance program initiatives. These buses are not included in the active fleet.

The peak pullout required to meet the scheduled service for the December 2006 period is summarized in Table 4-2. WMATA reports Peak requirement required to meet the service schedule is currently 1,247 buses.

Table 4-2

WMATA Peak Bus Requirements (December 2006)									
Division	Local	Small Bus Peak	Note	Standard Peak	Note	Artic Peak	Note	Peak Required	Total Assigned
Bladensburg	DC	24	P	168	A	20	P	212	239
Southeastern	DC	21	B	58	P			79	113
Northern	DC	9	B	111	A	23	P	143	175
Western	DC	16	A	95	A			111	136
Sub-Total	DC							545	663
Southern Avenue	MD			91	A			91	103
Landover	MD	11	P	136	P			147	173
Montgomery	MD			125	B	14	B	139	165
Sub Total	MD							377	441
Four Mile Run	VA	10	B	176	P			186	216
Royal Street	VA			66	B			66	73
Arlington	VA	2	P	71	P			73	88
Sub-Total	VA							325	377
System Total		93		1097		57		1247	1481

Notes: P: Peak pullout in PM
A: Peak pullout in AM
B: Peak pullout in both AM and PM

Projected Requirements - FY2011

Table 4-3a provides a summary of the changes in bus requirements resulting from the findings of the bus service evaluation for Metrobus services for each of the five subregions. Including spares, it is anticipated that the requirement for small buses will decline by about 11 vehicles, the standard 40-foot bus fleet requirement would decrease by 27 buses, and articulated buses would increase by 76 buses for a net increase of 167 buses. Given that the current morning peak requirements are slightly greater than the afternoon peak requirements for the Virginia and District of Columbia subregions, it is assumed that the existing fleet can absorb the slightly greater increase in the afternoon requirements without additional purchases. The situation is just the opposite for the Maryland garages as the current afternoon peak requirement is larger than the morning peak requirement.

It is recommended to procure the 167 buses for the Metro Matters initiative, and they should be distributed to the subregions as presented as 'New Buses Required' in Table 4-3a. The fleet of 26-foot buses, will be eliminated and replaced by 30-foot buses as our standard small bus.

Table 4-3b shows the number of buses required by subregion and by reason.

Table 4-3a

WMATA Bus Requirements in 2011: Changes From Existing

Jurisdiction	Small Bus		Standard Bus		Articulated Bus		Total Peak Buses			New Buses Required**
	AM	PM	AM	PM	AM	PM	AM	PM		
District of Columbia	0	1	42	49	29	26	71	76	DC	95
Inner Virginia	(2)	(2)	46	47	0	0	44	45		
Outer Virginia	(3)	(3)	6	5	0	0	3	2	VA	53
Montgomery County	0	0	(26)	(27)	27	32	1	5		
Prince George's County	(5)	(5)	20	21	0	0	15	16	MD	37
Total	(10)	(9)	88	95	56	58	134	144		
Total with Spares	(12)	(11)	102	110	70	73	160	172		185

*Spare ratio assumed as 15% for small and standard buses and 25% for articulated buses
** 'New Buses Required' assumes the AM Peak for the District of Columbia and the PM Peak for Maryland and Virginia

Table 4-3b

Reasons for Additional Peak Vehicles by Sub-Region

	Restructuring and Modifying Existing Service	Crowding and Service Reliability	Conversion to Artic	Total	Spares	Total with Spares	Seat Loss	Grand Total
District of Columbia*	78	5	(12)	71	15	86		86
Inner Virginia	46	(1)	0	45	7	52		52
Outer Virginia	8	(6)	0	2	0	2		2
Total Virginia	54	(7)	0	47	7	54		54
Prince George's County	13	3	0	16	3	19		19
Montgomery County	10	6	(11)	5	3	8		8
Total Maryland	23	9	(11)	21	6	27		27
Total Region	155	7	(23)	139	28	167	76	243

Upon acceptance of the final delivery in FY 2011 of all 167 Metro Matters expansion buses, along with the planned bus renewal and replacement of 100 buses each year for the first four years of a five year program, the WMATA active fleet is projected to consist of the following 1,648 vehicles.

- Small 30 ‘ buses - 99
- Standard 40' buses - 1,411
- Articulated 60' buses - 138
- Total buses -- 1,648

FUTURE SEAT LOSS

With the replacement of 400 standard high floor buses having an average 45 seats with the low floor buses 39 seats, bus capacity will be reduced from 76 to 59 (includes standees). Actual seat loss will be approximately 6 seats per bus, for a total loss of 2,400 seats. To replace the lost seats an additional 61 buses would need to be procured. This would increase the number of 40' buses to 1,472 by 2011 and the total number of buses to be procured to 228 for a total active fleet of 1,709 buses.

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SECTION FIVE

MAINTENANCE OVERVIEW

MAINTAINING SERVICE RELIABILITY: ROAD CALLS, CHANGE-OFFS, AND STRATEGIC BUSES

The ripple effect of a peak period service delay can inconvenience hundreds of passengers on a line, whose trips are lengthened, who experience crush loads, and who may be unable to board overcrowded buses. Crush loaded buses make boarding and alighting difficult and thereby lengthen stop times, further exacerbating the delay in service. The feedback the Authority receives in the form of passenger complaints is immediate. Metrobus's riders do not hesitate to let us know when the quality of service does not meet their high expectations.

When an incident requires that a bus be removed from service, its removal leaves a gap equal to the scheduled headway plus the time required to get a replacement bus onto the route in its place. At times it may be difficult for the following buses to pick up all the waiting passengers.

**An incident could be vehicle or passenger generated.*

The Authority tracks incidents daily, weekly, and monthly.* They are categorized according to the following definitions :

Change-Off With Passenger Impact: Any bus replacement for an incident between layover points that causes passengers to transfer from the defective bus to a replacement bus with or without deviation from schedule.

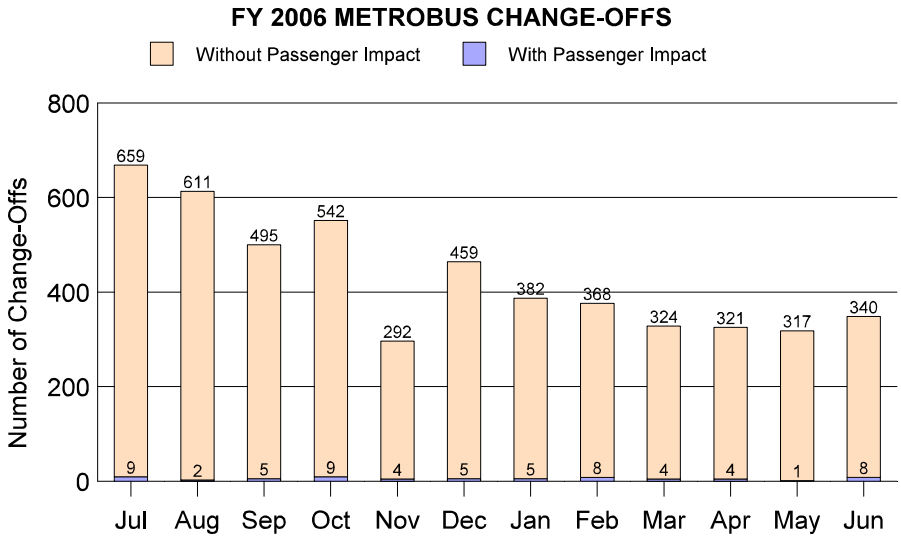
Change-Off Without Passenger Impact: Any bus replacement at layover points or while deadheading where there are no passenger transfers or delays.

Road-Call With Passenger Impact: Any incident while in revenue service that requires the bus to be removed from service or responded to by an emergency vehicle with deviation from schedule.

Road-Call Without Passenger Impact: Any breakdown during deadheading, or at layover points that requires the bus to be removed from service or responded to by a service truck with no deviation from schedule.

Figure 5-1 illustrates the number of Change-Offs per month in FY 2005, and Figure 5-2 illustrates the number of Road-Calls in the same period. The data for these graphs are tabulated in the Appendix.

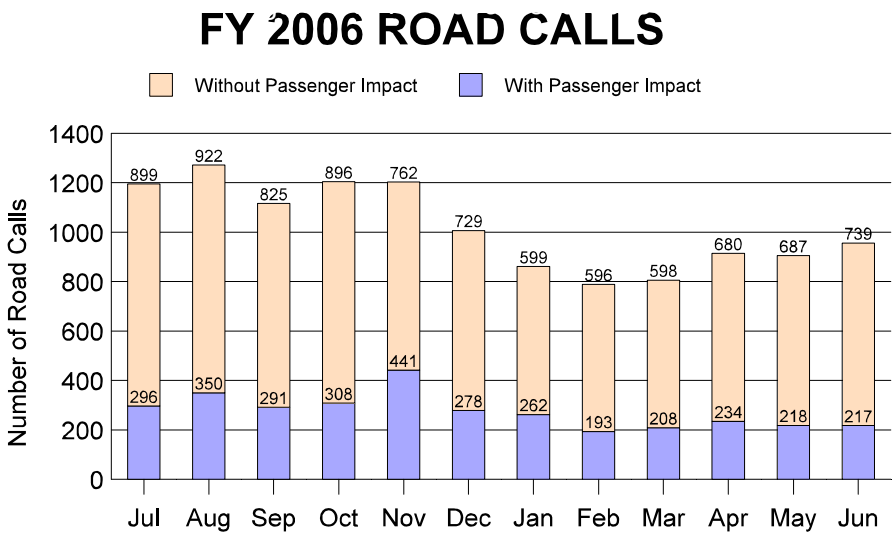
Figure 5-1



The average Metrobus change-off rate in FY 2006 was 431 incidents per month or about 14 per day. Over the course of the 12 months shown in Figure 5-1, only One percent of all Metrobus change-offs resulted in an inconvenience to passengers. The remaining 99 percent were accomplished at layover points and did not result in passenger inconvenience.

The average road-call rate in FY 2006 was 1,019 incidents per month or about 34 per day. Over the course of the 12 months shown in Figure 5-2, 73 percent of all Metrobus road-calls resulted in an inconvenience to passengers. The remaining 27 percent were accomplished at layover points or during deadheading, and did not result in passenger inconvenience.

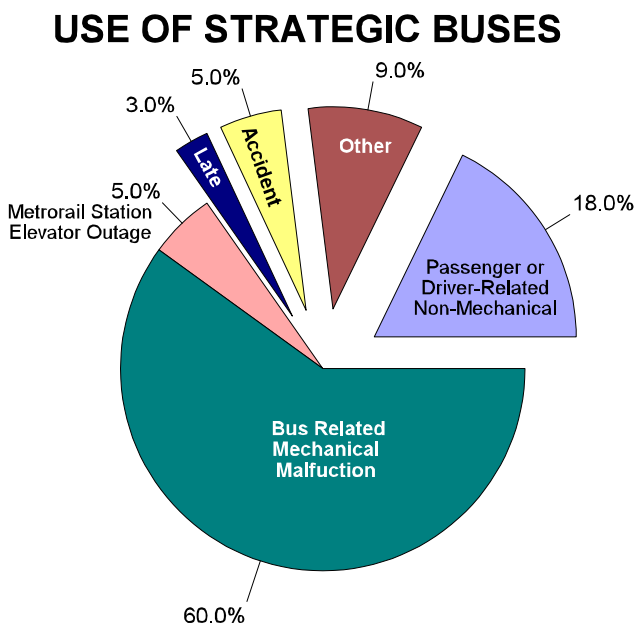
Figure 5-2



Note: Road-Calls and Change-Offs overlap somewhat. An incident may require a Road-Call and it may result in a Change-Off as well.

Service Trucks: The Authority stages tow trucks and service trucks throughout the system to respond quickly to vehicles that have failed while in passenger service. Service trucks are equipped with fluids, air compressors, tool kits, jump start equipment, and spare parts. If service truck personnel are unable to return a disabled bus to service, it is towed to its home division for more extensive repair, and a replacement bus is put into service.

Figure 5-3



**Note: The Department of Bus Service operates "emergency response vehicles" (ERV). These small vans are used, among other things, to provide bus-bridge service during Metrorail station elevator outages. However, they are sufficient to cover only a portion of the outages that occur. The percent figure shown for this category in Figure 5-3 represents use of scheduled strategics for this purpose in addition to the four ERVs.*

Use of Strategic Buses: Figure 5-3 shows strategic bus use by purpose category. The data (shown in detail in the Appendix) is offered here as being representative of the general pattern on any given day.

When a Metrorail station elevator is out of service, there is the possibility that an elevator-dependent disabled patron will be forced to exit the system at a station other than his primary destination. In such cases, WMATA provides courtesy Metrobus service back to the primary destination station. In Figure 5-3, the category labeled *Metrorail Station Elevator Outage* refers to a use of strategic buses to provide that supplemental service.*

Occasionally, when a bus is running particularly late, a strategic bus will be used to fill the gap in service. In Figure 5-3, the category labeled *Late* reflects such use of the strategic vehicles.

VEHICLE SIZE REQUIREMENTS

The assignment of standard size buses or large articulated buses to a given route is a function of passenger demand. Deployment of articulated buses helps to reduce fleet size and operating expense. Small buses are increasingly in demand on routes running through residential communities. Small vehicles may also be appropriate on short feeder routes where per-trip passenger volumes are expected to remain low. The requirement for articulated and small buses will be incorporated into future service plans. Actual procurement will be coordinated with WMATA's Office of Bus Transportation during the procurement cycle.

Metrobus currently operates 62 articulated buses, 86 thirty-foot buses, and 12 thirty-five foot buses. The 30 and 35-foot vehicles are smaller versions of the standard 40-foot transit bus. For the purpose of this fleet management plan, all of the Authority's 30-foot, 35-foot, and 40-foot buses are grouped together under the heading of "standard size" vehicles. They have similar operating and maintenance characteristics, failure rates, service frequencies, and resulting spare vehicle requirements. For service development, however, 30-foot buses are specified for low-ridership routes and neighborhoods.The Authority also operates 24 twenty-six foot small buses and 6 cut-away vans.

SUMMARY OF OPERATING PEAK VEHICLE REQUIREMENTS

The forecast PVR is shown in Table 5.5. It documents the number of vehicles required to serve passenger demand.The Authority is highly committed to carrying out a vehicle maintenance program that operates according to rigorous standards. The reason for adhering to an uncompromising maintenance standard is that it has a direct bearing on our ability to provide high quality, highly reliable passenger service and to minimize the number of maintenance spares required.

OVERVIEW OF THE METROBUS MAINTENANCE PROGRAM

The Authority dedicates itself to conducting a thorough program of fleet-wide preventive maintenance, including regular fluids analysis. The Preventive Maintenance Program has been in place for more than 33 years, and covers all revenue and non-revenue vehicles. Virtually all bus vehicle maintenance is performed in-house. The Authority's in-house maintenance capabilities include complete paint and body work and full component overhaul, as well as, the full scope of normal running maintenance.

Maintenance activity control and record-keeping is accomplished by means of an automated on-line Maximo System. Using Maximo, shop managers are able to track all preventive and corrective maintenance actions. The Maximo system provides a complete maintenance history on each vehicle, and makes it possible to perform a thorough and continuous equipment reliability analysis.

The Authority's extensive support infrastructure means maintenance managers are able to exercise more control over the maintenance process which translates into better body work, mechanical component overhaul, and bus rehabilitation. In addition, WMATA uses a highly developed system of manual record-keeping. The efficiency of the automated and manual systems working together assures the best possible vehicle maintenance at the lowest cost.

Two types of maintenance are performed on the Metrobus fleet:

- **Operating Maintenance**, including:
  Scheduled (preventive) maintenance
  Unscheduled (corrective) maintenance

- **Mid-life heavy maintenance overhaul**

Scheduled maintenance is done to keep equipment in good working order, to prevent in-service failures, and to meet certain vehicle regulatory requirements. Some bus components are overhauled on a schedule dictated by known failure rates and life cycle expectations. Scheduled preventive maintenance of buses is essential to providing safe, reliable, and attractive service. The transit bus is a major capital investment that must be well maintained to maximize its service life and to reduce capital and operating expenditures.To accomplish this task, a scheduled maintenance program has been implemented by the Office of Bus Maintenance.

No matter how carefully the preventive maintenance program is constructed and adhered to, however, and no matter how meticulously bus mechanics do their preventive maintenance tasks, the fact remains that buses will occasionally fail in service. Reality demands, therefore, that WMATA needs to plan for a certain portion of the fleet to be out of service because of unexpected failures. Preventive maintenance reduces the unexpected in-service failure rate.

**A consultant recommended that the Authority plan to overhaul buses at 7 years, in order to ensure that each vehicle is completed by the 7½ year mark.*

Service Life of a Transit Bus: Mid-life bus overhaul is essential in order to extend the life of the vehicle. Without it, the expected life of a transit bus is about 12 years. If a vehicle is overhauled at 7½ years*, its expected life will be extended to about 15 years. The WMATA Board of Directors has enough confidence in the Authority's heavy overhaul program that the Metrobus vehicle expected life has been officially extended to 15 years; one of the highest in the country.

THIS POLICY REDUCES THE REPLACEMENT CYCLE AND DECREASES WMATA'S CAPITAL REQUIREMENT FROM APPROXIMATELY 120 BUSES PER YEAR TO 100, THEREBY SAVING THE AUTHORITY $8.0 MILLION PER YEAR.

SCHEDULED PREVENTATIVE MAINTENANCE

The Metrobus scheduled maintenance program is designed to sustain bus reliability by detecting potential defects and allowing them to be corrected before they fail. It also permits servicing of equipment requiring lubrication, measurement, and adjustment. Buses are withdrawn from service at regular mileage-based intervals to permit the following preventive maintenance actions:

- Inspection of equipment to determine its condition compared with established standards.
- Routine service: lubricating, replacing filters, replenishing fluids, and making adjustments.
- Cleaning of exterior and interior surfaces and equipment.
- Scheduled replacement of electrical and mechanical equipment.

**Inspection frequency is dictated by manufacturer's recommended mileage-based intervals. For ease of scheduling, some of the mileage intervals are translated into time intervals based on known average daily miles operated by a WMATA Metrobus.*

The preventive maintenance program is a form of progressive inspection and servicing, the schedule for which is shown in Table 5-1 and is described in detail in the paragraphs that follow.

Table 5-1

PREVENTATIVE MAINTENANCE SCHEDULE			
Inspection Type	**Inspection Interval**	**Labor Hours**	**Number of Vehicles per Average Day**
A-Inspection	6,000 Miles	8	36
B-Inspection	Bi-Weekly	1	107
Bus Steam Cleaning	6,000 Miles	2.95	36
HVAC Inspection	90 Days	4.32	24
GFI Registering Farebox Maintenance	Varies	1.1	7
ADA Equipment Maintenance	42 Days & Annual	3.21	44
Bus Interior Cleaning	Daily / Weekly / Monthly	4	1501
Winter Preparation	Annual	2	Seasonal
Summer Preparation	Annual	2	Seasonal
Engine Tune-up	Annual	5.1	6
Coolant System Care	Bi-Annual	.32	12
Service Lane Activities	Daily	.32	1501
Heavy Maintenance Overhaul	7½ Years		20
Fluid Analysis	Various	.52	36

The preventive maintenance functions outlined in Table 5-1 are set forth in detailed step-by-step procedures found in bus manufacturer's maintenance manuals and Metrobus standard practice bulletins, standard operating procedures, and maintenance directives located at each Metrobus operating division and shop. Completed preventive and corrective maintenance activities are documented on the pertinent reporting forms, reviewed and certified by a supervisor, and entered into the specified reporting system. All corrective maintenance is required to be complete within 48 hours unless awaiting shop repair or deferred for parts.

There are four basic levels of maintenance:

1. **Warranty Maintenance:** service and repair of systems and equipment that are still under the manufacturer's warranty. This work is specified by the equipment manufacturer and is required to be accomplished in order to preserve the warranty on the product. On average 16 vehicles are undergoing warranty maintenance each day.

2. **Shop Maintenance:** Heavy repair shop work involving activities such as accident repair, scheduled equipment overhaul, and unscheduled corrective heavy maintenance (e.g. engine or transmission replacement). An average of 42 buses are undergoing heavy repair work in any given day.

3. **Garage Maintenance:** The bulk of Metrobus preventive and corrective maintenance is accomplished at the individual garage level. On average, 130 buses are undergoing this level of maintenance on any given day.

4. **Retrofit Maintenance:** This level involves about seven buses per day. Activities at this level include manufacturer's recall repairs, and special item retrofits such as Nabi frame repairs Orion V, VI frame retrofits, Niehoff alternator installations, sludge reducers, soot filters.

In the four levels together, Metrobus scheduled and unscheduled maintenance required 195 buses to be held out of service each service day in FY 2006. The following paragraphs summarize each of the scheduled maintenance activities.

A-Inspection: This is the primary Metrobus vehicle inspection and service activity. It covers the entire vehicle including driver's compartment equipment and controls, passenger interior, vehicle exterior, engine and engine compartment, transmission, battery,

chassis, lubrication, and articulation equipment (if pertinent).The A-Inspection culminates with a complete road test.

B-Inspection: A specific checklist of bus equipment is inspected for condition and operation. Defective equipment is repaired or replaced. The inspection includes safety and weather-related equipment, passenger seats, stop chimes, doors, floors, windows, wheelchair equipment, brakes, axles, tires, battery, fluid levels, wires, and hoses.

Bus Steam Cleaning: This service is performed at 6,000 mile intervals in conjunction with the A-Inspection. Specific areas of the vehicle that are steam cleaned are the engine and engine compartment, the transmission, the radiator, wheels and tires, the bulkhead area, front and rear exteriors, the A/C compartment and compressor, and the undercarriage.

HVAC Inspection: The HVAC system is inspected and serviced every 90 days. There are two procedures associated with this inspection: one for winter (cold weather) months when interior heating is necessary and the other for summer (warm weather) months when cooling is required.

GFI Registering Farebox Maintenance/SmartTrip Card:
This is a visual and audio inspection of the bill stuffer, bill transporter, coin mechanism, power supply, SmartTrip operation, and other electrical and mechanical components of the farebox. If a problem is found, the component is replaced.

ADA Equipment Maintenance: This inspection focuses primarily on the wheelchair lift, ramp, and kneel systems and associated interior ADA equipment and controls. The lift is inspected and lubricated, oil is changed, and the unit is checked for proper operation.

Bus Interior Cleaning: Three levels of cleaning are performed:

- *Daily:* Each bus is broom swept each day.
- *Weekly:* In addition to broom sweeping, the drivers console and interior ledges are hand washed, floors are mopped, and windows are cleaned.
- *Monthly:* Gum and graffiti are removed and the entire interior is hand washed and mopped.

Winter Preparation: Winterization of the fleet is a one time seasonal procedure, to be completed by October 1 each year. Inspection includes coolant condition and heater hoses, radiator, air dryer system, defroster, battery condition, ether injection system, and fast idle operation.

Summer Preparation: Summer preparation of the fleet is a one time seasonal procedure, to be completed by April 1 each year. Inspection includes coolant hoses and clamps, radiator steam cleaning, coolant condition, fan drive operation, A/C operation, engine and transmission fluid levels/condition/leaks, surge tank condition, engine shut-down system, and fast idle operation.

Coolant System Care: Coolant maintenance is performed at each A-Inspection. A refractometer is used to gauge the quality of the coolant, and based on test results, the fluid is replaced or replenished with coolant.

Engine Tune-up: All buses will be tuned up based on manufacturer recommendation. This includes spark plug and wire replacement, valve adjustment, fuel injector replacement or adjustment as necessary.

Service Lane Activities: This is a cursory inspection that takes place each day in connection with the routine refueling and service of the vehicle. Fluid levels are checked and replenished; lights, doors, and interlocks are checked for proper operation; the farebox is checked; the interior is swept and the exterior is washed.

Fluid Analysis: Engine and transmission fluid samples are drawn prior to fluid change in connection with each A-Inspection. Hydraulic and differential oils annually.

MONITORING AND SUPPORT OF THE PREVENTATIVE MAINTENANCE PROGRAM

The Bus Maintenance organization is responsible for the development of scheduled Metrobus maintenance programs. All programs are reviewed annually for adequacy, applicability and necessity. Manufacturer's recommendations, historical data on bus system performance obtained from the automated Maximo System and direct contact with bus maintenance employees performing the work provide the foundation for evaluating maintenance program effectiveness.

The Quality Assurance Branch monitors fleet performance to ensure that vehicle maintenance practices and procedures are effectively supporting the goal to provide the best in safe, reliable, cost effective and attractive bus transit services. Daily audits are performed within the various maintenance shops and on revenue lines to measure the quality of maintenance performed. The results of the audits are reported to the respective maintenance managers and the Chief Operating Officer for the Department of Bus Service. Considerable time is spent auditing preventive maintenance in progress and immediately after completion. Procedural problems and failure trends are reported to the Bus Maintenance Support Branch for further evaluation and corrective action.

The current Metrobus preventive maintenance program is the result of more than 33 years of maintenance and operating experience. Because vehicle system and component maintenance requirements change with age and usage, equipment condition and performance are monitored continuously in order to determine the maintenance actions necessary to meet service and budgetary goals.

UNSCHEDULED CORRECTIVE MAINTENANCE

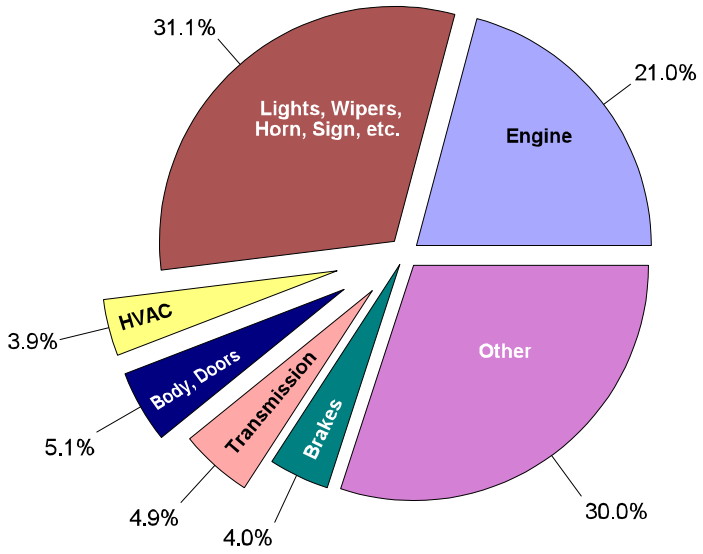
Equipment maintenance is accomplished essentially at a fixed rate. It is not a question of whether a component will need to be serviced, overhauled, or replaced, but when. When preventive maintenance is accomplished on a scheduled basis, plans can be made to schedule the maintenance task without affecting revenue service. When maintenance is accomplished as a result of an in-service failure, on the other hand, it is difficult (and more expensive) to compensate for its loss, and service quality suffers. Nonetheless, no matter how a maintenance organization tries to minimize in-service failure rates, the fact remains that unexpected failures will occur, even on new systems and components. The objective of a preventive maintenance program is to optimize the corrective maintenance requirement, and minimize the accompanying service quality degradation.

Figure 5-4 shows a sample of Metrobus system failures during a typical 12 month period. The "Other" category includes the following types of malfunctions:

Figure 5-4

METROBUS VEHICLE SYSTEM FAILURES

July 2005 through June 2006



- Mirror, window, seat, farebox
- Wheelchair lift
- Bellows
- Steering, acceleration
- Flat tire
- Leak, fumes, no fuel
- Miscellaneous

BUS FAILURE DEFINITIONS AND ACTIONS

Safety-Related Failures: Certain safety-related conditions require that a bus be removed from service. For example, the standard transit bus is designed with a brake/accelerator interlock. This system will not permit the bus to move if the back door is open. If this system fails, the bus operator must discontinue use of the back door. The newer buses, which are equipped with both front and rear door interlocks, are taken out of service if either interlock fails. The vehicle is removed from service as soon as possible. Loose wheel lugs, brake failures, and

engine overheat conditions are examples of safety-related failures that require a bus to be removed from service immediately.

Safety is first in all operational decisions. Whenever there is an indication of a problem with safety-related equipment, the bus is removed from service. This action eliminates all known risks to passengers, and is consistent with WMATA's System Safety Program Plan.

Other Types of Failures: In addition to safety-related conditions, WMATA removes buses from service as the result of a number of other situations. For example, if a bus is not producing sufficient cooling in summer weather, or sufficient heat when the outside air temperature is below 40°F, it will be removed from service as soon as possible during non-rush hours. If a bus is vandalized with significant graffiti or other major damage, it will be removed from service as soon as possible. If a bus is soiled by a sick passenger, it is removed from service immediately.

EXPECTED VEHICLE LIFE AND THE HEAVY MAINTENANCE OVERHAUL PROGRAM

Vehicle renovation is the third maintenance component of this fleet management plan. After 7½ years* of service life, a WMATA Metrobus will have traveled about 340,000 miles. Many critical parts will wear out and basic overhauls will not be enough to maintain the expected performance. For this reason, a bus will not be maintainable beyond 12 years without a mid-life overhaul.

The Heavy Maintenance Overhaul Program, initiated in 1994, provides for the rehabilitation of bus mechanical and electrical systems, including overhaul of the engine, transmission, differential, pneumatic equipment, doors, wheelchair lifts, destination signs, suspension, and other structural components. In addition, the interior and exterior of the bus are repainted and all upholstery and floor mats are replaced.

**The WMATA Board of Directors has approved a plan to overhaul buses at 7 years, in order to ensure that each vehicle is completed by the 7½ year mark.*

Heavy overhaul includes the incorporation of new technology and safety enhancements in older vehicles, it keeps the fleet in compliance with air quality requirements, and it permits standardization of configuration across bus fleets of varying ages.

THE METROBUS HEAVY MAINTENANCE OVERHAUL PROGRAM REDUCES THE CAPITAL OUTLAY FOR NEW BUSES. THE COST TO OVERHAUL A TRANSIT BUS IS $125,000 VS. $400,000 TO PURCHASE A NEW BUS.

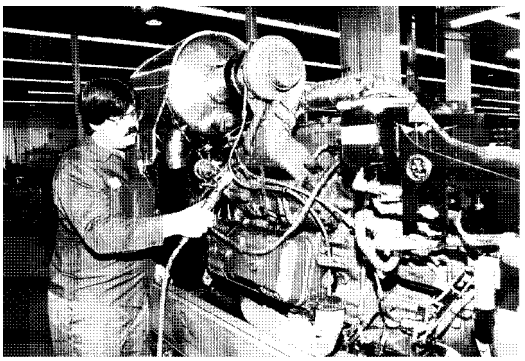
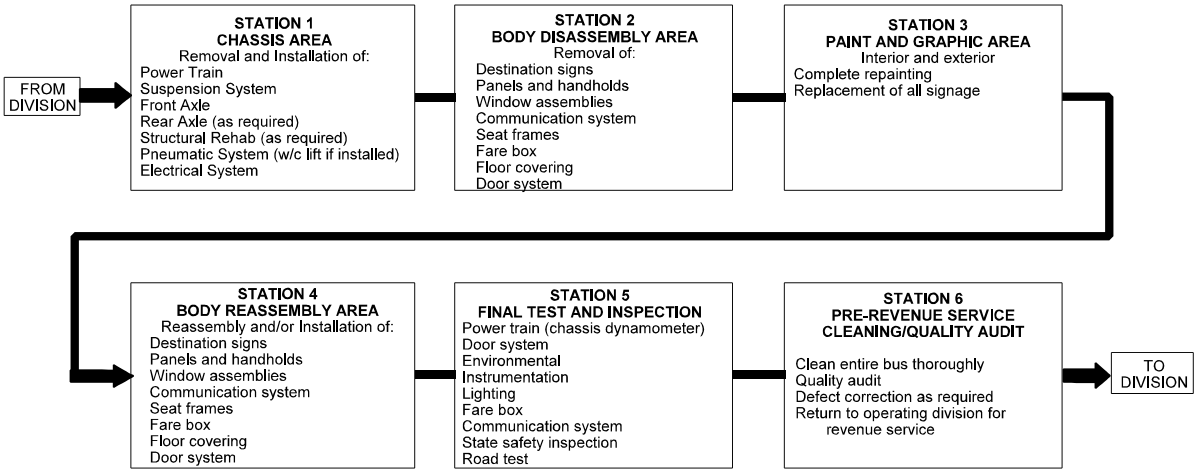


Figure 5-5 shows the heavy overhaul production flow and basic scope of work. Twenty buses are in process at any given time. Two buses enter the program each week and two are completed and returned to service.

Figure 5-5

METROBUS HEAVY MAINTENANCE OVERHAUL PROGRAM
PRODUCTION FLOW AND BASIC SCOPE OF WORK



THE OPERATING SPARE RATIO

For planning purposes, WMATA uses a Metrobus operating spare ratio calculated as follows:

Figure 5-6a

CALCULATION OF THE OPERATING SPARE RATIO (OSR)

$$\left(\begin{array}{c}\text{Buses required for scheduled}\\ \text{and unscheduled maintenance}\end{array}\right) \div \left(\begin{array}{c}\text{Peak Vehicle Requirement}\\ \text{including strategics}\end{array}\right) = \textbf{OSR}$$

On May 15, 1997 the WMATA Board of Directors approved a Metrobus fleet-wide average OSR of 15 percent. Actual spare ratios vary by vehicle type and by operating division. At city operating divisions vehicles are out of service more frequently for corrective maintenance. Urban operating conditions in Washington, D. C. are harsher than in suburban jurisdictions, and passenger volumes are much higher per vehicle mile and per operating hour, producing greater wear and tear on the buses.

THE FLEET SPARE RATIO

Figure 5-6b

CALCULATION OF THE FLEET SPARE RATIO (FSR)

$$\left(\begin{array}{c}\text{Buses required for scheduled}\\ \text{and unscheduled maintenance}\\ \text{including heavy overhaul}\end{array}\right) \div \left(\begin{array}{c}\text{Peak Vehicle Requirement}\\ \text{including strategics}\end{array}\right) = \textbf{FSR}$$

The *operating spare ratio* includes buses that are ready for service as well as those undergoing routine and corrective maintenance. Beginning in FY 2002, however, as many as 20 of the Authority's buses are undergoing mid-life heavy overhaul at any given time. Inasmuch as these vehicles are not available for service, they are excluded from the *operating spare ratio* calculation. The *fleet spare ratio*, on the other hand, includes those vehicles undergoing heavy overhaul, and is nominally about 15.6%.

ENVIRONMENTAL CONDITIONS AFFECTING THE OPERATING SPARE RATIO

As seen in Table 5-2, the number of buses required for maintenance fleet spares (including heavy overhaul) ranges from 195 in FY 2006 to 216 in FY 2011 if peak vehicle requirements increase as projected. This results in an actual OSR of about 15.6 percent and an FSR of 17.1 percent over the life of this fleet management plan.

The OSR is not adjusted to account for varying environmental conditions. While changing weather conditions and seasonal variations may affect operating reliability, the bus maintenance program attempts to compensate in ways other than by changing the spare ratio. Each fall all Metrobus vehicles undergo extensive winterization, and in the spring they are prepared for summer operation.

A SUMMARY OF MAINTENANCE REQUIREMENTS

In its 33 year history of operation, WMATA's Metrobus maintenance program has resulted in one of the best maintained fleets of transit buses in North America. An aggressive cleaning program keeps interiors and exteriors clean and graffiti free. No bus is released for service with graffiti, and none are allowed to remain in service once graffiti or vandalism are detected. The scheduled maintenance and overhaul program has resulted in a mean distance between failures of approximately 5,243 miles in FY2006.

Table 5-2

MAINTENANCE DEMAND FOR REVENUE VEHICLES

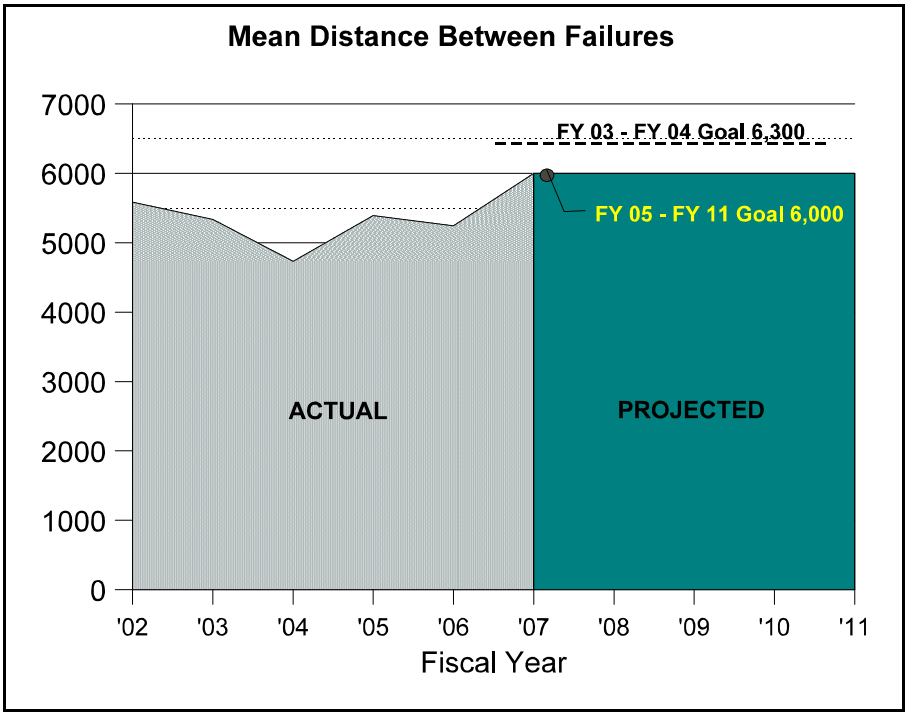
	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011
1. Peak Vehicle Requirement	1,247	1,268	1,289	1,314	1,345	1,386
MAINTENANCE REQUIREMENTS						
Operating Maintenance						
2. Scheduled Maintenance	153	154	157	160	164	169
3. Unscheduled Maintenance	42	44	44	45	46	47
4. Operating Maintenance Total	195	198	201	205	210	216
Bus Rehabilitation						
5. Heavy Overhaul	20	20	20	20	20	20
6. Maintenance Total	215	218	221	225	230	236
Vehicle Demand						
7. Total Operating Demand	1,442	1,466	1,490	1,519	1,555	1,602
8. Total Fleet Demand	1,462	1,486	1,510	1,539	1,575	1,622
Spare Ratios						
9. Planned Operating Ratio	15.6	15.6	15.6	15.6	15.6	15.6
10. Fleet Spare Ratio	17.2	17.2	17.1	17.1	17.0	17.0

Notes:
Line 7 = Line 1 + Line 4
Line 8 = Line 1 + Line 6
Line 9 = Line 4 ÷ Line 1
Line 10 = Line 6 ÷ Line 1

VEHICLE FLEET NEED AND MAINTENANCE CAPACITY

Mean Distance Between Failures: In keeping with the industry standard, Metrobus "Mean Distance Between Failures" is defined as the number of chargeable service interruptions during revenue service divided into scheduled miles. The Authority has been able to limit the number of Metrobus failures by use of the operating and maintenance strategies described in this fleet management plan.

Figure 5-7



Current Spare Vehicle Requirements: About three-fourths of WMATA's bus maintenance effort must be expended on scheduled maintenance and component overhaul in order to maintain expected performance. The remainder of the 260 maintenance spares are held out of service for unscheduled corrective maintenance.

To maintain this level of effort, the Metrobus maintenance program is planned over seven days each week on three shifts each day. There are ten garages strategically located to support the system. The Bladensburg bus facility contains the heavy repair shop. The Carmen E. Turner Maintenance and Training Facility contains the rebuild shops. Engine, transmission, axle, radiator, and small unit rebuilds are performed at this location.

BUS FLEET STORAGE AND REPAIR SHOP FACILITIES

Currently, there are 1,481 vehicles in the Metrobus operating fleet including 20 buses undergoing heavy overhaul. The ten Metrobus operating divisions have a combined shop and storage capacity for 1,645 buses or 164 more than in the current fleet. Even though there is sufficient capacity systemwide to house the entire fleet, that capacity is not distributed efficiently. Of the ten divisions shown in Table 5-3, four are located in the District of Columbia, and three each in Maryland and Virginia. (See location map in Section One)

Table 5-3

METROBUS GARAGES

Division	Location	Capacity	Functions Performed
Bladensburg	District of Columbia	257	Heavy Repair, Overhaul, Storage Service and Inspection, Running Repair
Northern	District of Columbia	175	Storage, Service and Inspection, Running Repair
Western	District of Columbia	138	Storage, Service and Inspection, Running Repair
Southeastern	District of Columbia	121	Storage, Service and Inspection, Running Repair
Montgomery	Montgomery County MD	240	Storage, Service and Inspection, Running Repair
Landover	Prince George's County MD	210	Storage, Service and Inspection, Running Repair
Southern Avenue	Prince George's County MD	103	Storage, Service and Inspection, Running Repair
Four Mile Run	Arlington County VA	218	Storage, Service and Inspection, Running Repair
Arlington	Arlington County VA	100	Storage, Service and Inspection, Running Repair
Royal Street	City of Alexandria VA	83	Storage, Service and Inspection, Running Repair
CTF	Heavy Overhaul Storage	50*	Ready Reserve fleet is not included in system or garage capacity
Total		**1,645**	

* Ready Reserve fleet is a compliment of buses that have exceeded the 15 year life expectency.

Table 5-4

VEHICLE FLEET AND GARAGE CAPACITY BY JURISDICTION

	Capacity	Maximum Scheduled	Strategics	Spares	Total Requirements	Net Capacity
DC Total	691	538	13	96	663	28
Maryland Total	553	367	7	61	441	112
Virginia Total	401	317	5	51	377	24
SYSTEM TOTAL	1,645	1,222	25	208	1,481	164

Garage Rehabilitation: A variety of Metrobus garage rehabilitation projects have been identified and funded as part of the Authority's Infrastructure Renewal Program (IRP). These projects are being undertaken in order to keep the garage facilities in good working order and repair.

Garage Relocation or Replacement: In addition to rehabilitation of present garage facilities, several garages have been earmarked for replacement or relocation as follows:

Division	Action
Royal Street	Relocation / Expansion
Southeastern	Relocation – anticipated completion in FY11 to DC Village site. Anticipated bus parking 250.
Arlington	Relocation of the garage, joint development project with Fairfax County at West Ox Rd. Anticipated bus parking for 100 buses

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SECTION SIX

THE SUPPLY OF REVENUE VEHICLES

As of December 2006 the active Metrobus fleet consisted of 1,481 vehicles as shown in Table 6-1. It is the goal of the Authority to have a "Class A" Metrobus fleet; defined as a fleet in which all vehicles have been procured or rehabilitated within the immediately preceding 7½ years. Achievement of this goal would produce a fleet with an approximate average age of 7½ years and no vehicle over 15 years of age.

Table 6-2 shows the projected supply of Metrobus revenue vehicles for the period of this fleet management plan.

PLANNED BUS PROCUREMENT AND VEHICLE REPLACEMENT

The Metrobus procurement cycle is designed to produce the Class A fleet mentioned above. 417 new buses have been purchased as of December 31, 2006. 250 CNG buses to enhance fleet in Virginia, 117 Clean Diesels divided among the three Maryland garages, and 50 Hybrid technology buses assigned to the Landover and Montgomery divisions. Four factors influence the Metrobus revenue vehicle procurement cycle:

1. **System Growth:** Changes in passenger demand, service area, and route coverage.

2. **Vehicle Sizes:** Changes in service from standard buses to small vans or articulated buses.

3. **Age Replacement:** Retirement of overage vehicles.

4. **Availability of Funds:** WMATA capital program has many competing requirements.

Table 6-1

CURRENT METROBUS FLEET as of DECEMBER 2006

				HB			HB				BWI	HB																
LENGTH	40'	35'	40'	40'	40'	40'	40'	40'	60'	40'	40'	40'	30'	26'	26'	40'	40'		40'	40'	60'	30'	40'	30'	40'	40'		
YEAR	1990	1990	1992	1992	1993	1994	1994	1994	1995	1997	1997	1997	1997	1999	2000	2000	2000	2001	2001	2002	2003	2003	2005	2005	2006	2006	ACTUAL	BUDGETED
MODEL	FLX	FLX	ORION	ORION	FLX	FLX	FLX	FLX	IKARUS	ORION	ORION	ORION	ORION	ORION	ORION	ORION	ORION	TAG	NEW	NEW	NEO	SLF	CNG	CNG	HYB	CD	TOTALS	+ CONT
	W/C	W/C	V	V		9800	9800	4000		V	V	V	V	II	II	V	VI		FLYER	FLYER			ORION VII	ORION VII				
LNMT			10		47						6	2	12				32								25	39	173	173
MOMT			10			25	6	10	14			4					32								25	39	165	165
SAMT								51				13														39	103	103
MD	0	0	20	0	47	25	6	61	14	0	6	19	12	0	0	0	64	0	0	0	0	0	0	0	50	117	441	441
BLMT	1				10				21					2	3				100	64			14	24			239	239
NOMT					28	4			6	63			9			44					21						175	175
WEMT	5									34			6	13	2	43	33										136	136
SEMT	6									39			24			44											113	113
DC	12	0	0	0	38	4	0	0	27	136			39	15	5	131	33	0	100	64	21	0	14	24	0	0	663	663
FMMT																		6					201	11			218	216
ARMT	1	12						41		30												4					88	88
ROMT	41		7	3						20																	71	71
VA	42	12	7	3	0	0	0	41	0	50			0	0	0	0	0	6	0	0	0	4	201	11	0	0	377	375
SYSTEM TOTAL	54	12	27	3	85	29	6	102	41	186	6	19	51	15	5	131	97	6	100	64	21	4	215	35	50	117	1481	1479

Table 6-2

SUPPLY OF REVENUE VEHICLES

	Fiscal Year					
	2006	**2007**	**2008**	**2009**	**2010**	**2011**
Peak Vehicle Requirement	1,247	1,268	1,289	1,314	1,345	1,386
			VEHICLE SUPPLY			
Vehicles Owned Start of Year	1,542	1,542	1,567	1,622	1,662	1,729
Procurement for Expansion	0	25	55	40	67	0
Procurement for Replacement	417	0	100	100	100	100
Retirement and Disposal	417	0	100	100	100	100
Vehicles Owned End of Year	**1,542**	**1,567**	**1,622**	**1,662**	**1,729**	**1,729**
Ready Reserve Fleet	50	50	50	50	50	50
Vehicles Available for Service	**1,492**	**1,517**	**1,572**	**1,612**	**1,679**	**1,679**

ADJUSTMENTS TO VEHICLE SUPPLY: INACTIVE FLEET

New Bus Acceptance: As new bus procurement programs move forward, a varying number of vehicles will be in the new bus acceptance process.

Special Use Fleet: Five buses are designated as historic vehicles. They have been restored to like-new condition and are not used in regular passenger service.

Ready Reserve Fleet: The Authority maintains a Ready Reserve fleet of overage buses. These vehicles are preserved in stored condition and are ready for service. If another bus in the active fleet is accident damaged, a bus can be pulled from the contingency fleet as its replacement. The contingency fleet is composed of older vehicles, past their useful service life (e.g. more than 15 years old), that nevertheless would be suitable for passenger service to support regular revenue operations or special events.

The Authority has been authorized to keep and maintain a Ready Reserve fleet of up to 50 vehicles. In that way there would be a sufficient number of uses to respond to unanticipated service requirements, such as:

- Unforseen increases in passenger demand.
- Replacement of a large number of active vehicles involved in a catastrophic event, such as a flood at an operating division, or recalled by a vehicle manufacturer.
- A major response if a Metrorail line is put out of service for an extended period.

ALTERNATIVE FUELS

The Authority bought 164 CNG buses in FY 2002. In 2003 the WMATA Board authorized the procurement of another 175 CNG buses to be received by the end of FY 2006, with four one-year options for an additional 75 buses. The Four Mile Run division has been refitted to service and maintain 218 of the new CNG buses. The remaining 38 buses are housed at the Bladensburg division. Currently, the Metrobus fleet is 28 percent CNG powered. When considering future CNG bus purchases, the Authority will need to consider the installation of CNG service and maintenance equipment at some or all of the remaining Metrobus divisions.

In order to make the Metrobus fleet environmentally friendly, the Authority has switched to the use of *ultra low sulfur (ULS)* diesel fuel. This fuel is used in all diesel powered buses in the fleet (1,035 vehicles). Of the remaining 464, 414 powered by compressed natural gas (CNG) engines, and 50 are powered by hybrid electric technology.

In the future, new diesel or other propulsion technologies may present themselves as alternatives to CNG and ULS diesel fuel that meet the Authority's emissions and environmental standards as well or better.

SECTION SEVEN

REVENUE VEHICLE DEMAND / SUPPLY BALANCE

Table 7-1 is a summary showing the balance of demand for Metrobus vehicles and the supply of buses for the period of this Metrobus Revenue Vehicle Fleet Management Plan. As discussed in the foregoing sections, this plan is a snapshot of an ongoing planning process. It takes into account the passenger demand for vehicles in revenue service and the demand that is placed on the fleet by scheduled and unscheduled maintenance requirements. The plan ties these operating and maintenance requirements to the supply of vehicles in both the present fleet and with the addition of anticipated new vehicle purchases.

The plan anticipates that fleet operating demand will rise from the current 1,247 buses at the end of FY 2006 to 1,386 buses by the end of FY 2011. It assumes that 25 buses will be needed each peak period as strategic spares. The plan assumes that the number of vehicles required for operating maintenance will rise from the present 215 to 236 buses by the end of FY 2011. It assumes the continuation of an aggressive mid-life bus renovation program.

The plan anticipates the purchase of 400 new buses during the five-year planning period, and it assumes an operating spare ratio of about 15 percent in each of the planning years. Receipt of those new replacement buses will serve to maintain the average age of the fleet at about 7½ years.

Table 7-1

VEHICLE DEMAND / SUPPLY BALANCE

	2006	2007	2008	2009	2010	2011
VEHICLE DEMAND						
Operating Requirements						
Peak Vehicle Requirement	**1,247**	**1,268**	**1,289**	**1,314**	**1,345**	**1,386**
Maintenance Requirements						
Operating Maintenance	195	198	201	205	210	216
Scheduled Maintenance	153	154	157	160	164	169
Unscheduled Maintenance	42	44	44	45	46	47
Total Operating Demand	**1,442**	**1,466**	**1,490**	**1,519**	**1,555**	**1,602**
Heavy Overhaul	20	20	20	20	20	20
Maintenance Total	215	218	221	225	230	236
Total Fleet Demand	**1,462**	**1,486**	**1,510**	**1,539**	**1,575**	**1,622**
VEHICLE SUPPLY						
Start of Fiscal Year	1,542	1,542	1,567	1,622		1,729
Projected Procurement for Growth	0	25	25	40	67	0
Projected Procurement for Replacement	417	0	100	100	100	100
Projected Retirement	417	0	100	100	100	100
End of Fiscal Year	**1,542**	**1,567**	**1,622**	**1,662**	**1,739**	**1,729**
Planned Operating Spare Ratio	15.6%	15.6%	15.6%	15.6%	15.6 %	15.6 %

GARAGE CAPACITY ISSUES

Most of WMATA's older garages are assigned buses in numbers at or near the practical storage capacity for these facilities. The major exceptions are the Landover and Montgomery garages both located in Maryland, central to the route networks operating in Prince Georges and Montgomery Counties, respectively. As shown in Table 7-2, about 69 percent of the available garage storage capacity, 112 spaces, is located at these two Maryland facilities while only 27 additional buses are required to service increasing needs on Maryland routes by 2011. Both of these two garages are located about six miles from Maryland's boundary with the District of Columbia, adding considerable non-revenue operating costs if DC routes were garaged at either facility.

The available capacity systemwide could service an estimated 162 buses which would be enough to support the Metro Matters expansion bus program of 167 buses if the current free capacity better matched the demand for expanded services. However, the existing District of Columbia and Virginia garages at current capacities can not adequately support the new buses expected to be assigned to the routes in these two jurisdictions between now and 2011. The storage deficit is currently estimated at 70 spaces just to meet the 2011 needs without consideration of longer term growth requirements. Second, most of the older garages are already assigned buses in numbers at or near the practical storage capacity for these facilities. WMATA as identified in the Regional Bus Study Garage Plan is fully cognizant of the critical constraints that its garages place not only on servicing newer buses but, providing sufficient capacity to house an expanded fleet.

NECESSARY GARAGE ACTIONS

A proposed plan for assignment of the expansion buses to WMATA garages along with the necessary actions required to expand garage capacity particularly to support growth in bus services for both Virginia and the District of Columbia was developed. The garages in Maryland are newer and have ample capacity to support larger fleets.

Given the garage capacity constraints, a proposed phasing plan for the acquisition of and for the implementation of the recommended service modifications and enhancements. This phasing plan takes into account the anticipated schedule to bring on line new garage facilities to replace aging, smaller garages as well as the timing of the anticipated service expansion needs.

Growth in the active bus fleet presents challenges to WMATA to increase its bus storage and maintenance capacity. First, Metrobus garages are largely old facilities that require considerable investment to be better able to service the newer bus types with advanced propulsion systems (e.g. CNG or hybrid/electric) and other advanced technologies. Further, WMATA policy requires that new buses be low-floor with ramp systems to improve accessibility for persons with disabilities.

Due to the low-floor design, newly manufactured buses specify the placement of several components on the roof, making buses taller and requiring changes in maintenance practices and equipment to reach these components. In fact, these modifications are not possible at several facilities due to height constraints.

As stated previously, the current capacity for each of WMATA's operating divisions, along with plans for new garages, WMATA is considering several relatively short-term actions to increase garage capacities including:

- Capacity at the Bladensburg (DC) garage can be increased to a total of 300 spaces (added increase of 37) with the relocation of the Service Vehicle Maintenance Shop (Car Shop) to the Carmen E. Turner facility.

- The Southern Avenue (MD) garage could support a total of 123 buses (increase of 20) with the development of off-site employee parking.

- Capacity for an additional 15 articulated buses at Montgomery and Landover could be realized with the addition of portable lifts and modifications of each facility to increase the number of bays by three.

WMATA's Arlington garage (currently assigned 90 buses) is due to close in early 2009 and will be replaced with a new West Ox facility in Fairfax County. The West Ox facility is a joint development project with Fairfax County with both Metrobus and Fairfax Connector buses to be serviced at this facility.

The current plan for the new West Ox facility will provide Metrobus with storage capacity for 100 buses replacing the lost Arlington garage capacity while Fairfax Connector operation would be allocated 75 spaces. The site plans for the new garage provides the possibility for future expansion to service as many as 300 buses.

The existing Southeastern garage located in the District of Columbia occupies a site designated for a new sports stadium and patron parking along with other associated development. Discussions with DC real estate and development officials have been initiated that would allow for construction of a replacement garage in the nearby Anacostia section of the city. This new Southeastern garage will be designed to support 250 buses.

Finally, while there has been a desire to develop the Royal Street garage site, any closure of Royal Street would require that this capacity be replaced at another nearby site.

In summary, an expanded West Ox garage and a new enlarged replacement Southeastern garage along with the available capacity at Landover and Montgomery, with facility modifications, would provide the necessary capacity to accommodate the recommended Metrobus systemwide service enhancements proposed for implementation over the next five years. In addition, the expansion of the Bladensburg facility should also be pursued to provide operating flexibility in the final assignment of routes to minimize non-revenue (i.e., deadhead) operations and to provide some excess capacity for growth beyond 2011. Further, the new Southeastern garage should be designed to support WMATA's abilities to service a proposed expansion of the articulated bus fleet.

PROPOSED GARAGE ASSIGNMENTS

The actions recommended increase total garage capacity by a total of 172 bus storage spaces, with the resulting systemwide bus capacity increasing from 1,645 to 1,817 as shown in Table 7-2. The changes in garage capacities and assignments are summarized as follows:

- District of Columbia - Net increase of 172 spaces
  - Capacity increases by 43 spaces at Bladensburg
  - Capacity increases by 129 spaces with new Southeastern

Table 7-2

Fleet Assignment– 2011

Jurisdiction	2011 Capacity	2011 Assigned	2011 Available
District (1)	863	749	114
Maryland	553	468	85
Virginia	401	431	- 30
System (seat loss)		61	108
System Total	1,817	1,709	70 (2)

Notes:

(1) Based on Service Vehicle Maintenance Shop relocating to CTF from Bladensburg and new Southeast garage.

(2) An additional 38 spaces needed for new articulated buses.

SECTION EIGHT

APPENDIX

Table A-1

METROBUS ROAD-CALLS AND CHANGE-OFFS IN FY 2006

	CHARGEABLE			NON-CHARGEABLE			COMBINED TOTALS	
FY 2006	Change -Offs	Road Calls	Total	Change -Offs	Road Calls	Total	Change -Offs	Road Calls
Jul	9	899	908	659	296	955	668	1,195
Aug	2	922	924	611	350	961	613	1,272
Sep	5	825	830	495	291	786	500	1,116
Oct	9	896	905	542	308	850	551	1,204
Nov	4	762	766	292	441	733	296	1,203
Dec	5	729	734	459	278	737	464	1,007
Jan	5	599	604	382	262	644	387	861
Feb	8	596	604	368	198	566	376	794
Mar	4	598	602	324	208	532	328	806
Apr	4	680	684	321	234	555	325	914
May	1	687	688	317	218	535	318	905
Jun	8	739	747	340	217	557	348	956
Total	64	8,932	8,996	5,110	3,301	8,411	5,174	12,233
Percent	1.2%	73.0%		98.8%	27.0%		100%	100%
Mth Avg	5	744	750	426	275	701	431	1,019
Daily Avg	0.2%	24.4%	24.6%	14.0%	9.0%	23.0%	14.1%	33.4%

Table A-2

USE OF STRATEGIC BUSES

STRATEGIC BUS UTILIZATION BY JURISDICTION APRIL 30, 2001

Jurisdiction & Division	MECH	LATE	OCC	ELEV	E&D	ACC	SPACE	Total Utilization	Trips Operated
PG - LNTR	2	1	1	0	0	1	0	5	0
MC - MOTR	2	0	1	0	0	0	1	4	2
VA - ARTR & FMTR	3	0	1	0	0	0	3	7	11
DC - NOTR, BLTR, WETR, SETR	6	0	1	0	1	1	1	10	11
							TOTAL SYSTEM UTILIZATION	26	24
							TOTAL BUSES SCHEDULED	50	
							TOTAL BUSES DISPATCHED	50	
							TOTAL BUSES NOT DISPATCHED	0	
							TOTAL TRIPS LOST	59	

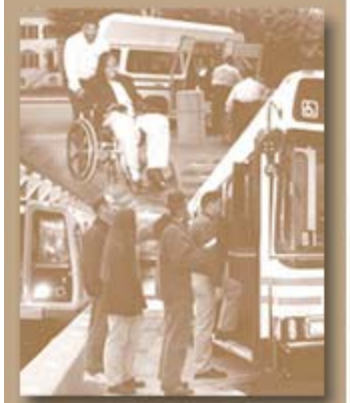
Washington Metropolitan Area Transit Authority

Metrobus Fleet Management Plan

Presented to the Board of Directors:

Customer Service, Operations and Safety Committee

April 12, 2007



Bus Fleet Management Plan

- Request Committee to adopt the update of 2004 Bus Fleet Management Plan
- The Plan is a planning tool that documents the projected growth in the Metrobus system, the required fleet and the improvements to maintenance facilities necessary to support the additional fleet
- The Plan does not obligate the Authority to the Plan's projected requirements
- The update of the Plan is required by the FTA to support future purchase of buses

Bus Fleet Management Plan
Plan Highlights

- Fleet Growth:
  - Ridership growth of approximately 2% a year and corresponding new service justifies the need for an additional 167 buses
    - To reduce operating cost and increase capacity an additional 76 articulated buses (included in the 167) will be procured to operate on high ridership routes in the District and Maryland
  - To maintain the system average age at 7.5 years:
    - 400 (100 per year) replacement buses will be procured
    - 61 additional buses will need to be procured to maintain the system seating capacity due to the loss of seats by procuring low floor buses
  - Total fleet – 628 buses (400/replacement + 228/growth)
    - Projected increase will increase the WMATA bus fleet from 1,481 to 1,709 buses

Bus Fleet Management Plan
Plan Highlights, Continued

- Maintenance Facilities:
  - The following maintenance facilities improvements are identified in the plan:
    - Complete West Ox garage – No additional storage spaces
    - New expanded Southeast garage
    - Expand storage and maintenance capacity at Bladensburg – an additional 43 storage spaces
    - Replacement of Royal Street garage
  - The system bus storage capacity will increase by 172 spaces