

Vehicle Maintenance

- Metro Transit should move forward with its plans to construct a new maintenance facility on site. The problem with the current complex has been noted in each of the past three performance audits.
- Metro Transit should address the problem of having a large number of ripped driver seats on its bus fleet. While not a major issue, ripped seats do hurt the overall appearance of the system.
- Metro Transit should investigate its performance in terms of the apparent large number of PM inspections that are performed early. While inspecting the bus before the inspection due mileage may be beneficial in that problems can be discovered more sooner, it can also increase costs unnecessarily.
- Metro Transit should attempt to meet its detailed interior bus cleaning goal of a detailed clean for each bus at least every six weeks. This would mean that two additional bus cleaners would need to be hired to increase the staff size of this group to four employees. With four employees doing two buses a day each, 40 buses can be cleaned in one week and 240 in six weeks.

Transit Operations

- Metro Transit should develop a specific program to monitor overall service quality. This program should establish target levels, data collection procedures, and analysis processes regarding the following:
 - On-Time Performance – Metro Transit does not have an adopted service performance guideline for on-time performance, and on-time performance information is not currently gathered, tracked, or analyzed.
 - Passenger Loads – Metro Transit does have adopted guidelines regarding overcrowding on its services, however, there are no procedures in place to systematically identify and respond to instances.
 - Schedule Adherence – This includes data regarding missed pull-outs and missed trips along with the reason for the miss (i.e., lack of equipment, insufficient staffing, accidents/incidents, operator error, etc.). Metro Transit also does not currently have adopted target levels for these measures.
 - Passenger Experience – Metro Transit should separately track complaints regarding the actual operation of service (i.e., on-time performance, missed trips, trips operated incorrectly).

Metro Transit staff expressed the need for significant post-processing of data collected by the APC and GPS/AVL equipment. This is not unique to Metro Transit. Many systems that have implemented this technology have found that they do not have the staff resources for effective post processing. Various systems have created positions in their IT or Planning departments specifically dedicated to post processing, manipulation, and reporting of this data. The APC and GPS/AVL systems are significant capital assets for Metro Transit which can have a significant benefit to operations management and planning. However, without proper staffing resources, Metro Transit cannot realize the full benefit of the tools.

- Based on the above recommendations, as well as recommendations included in the Transit Operations, and Planning and Scheduling reviews, it is recommended that Metro Transit pursue the completion of an Information Management Study that addresses the following issues:
 - Information technology staffing needs;
 - Actions necessary to improve reliability of mobile information technology to desired levels; and
 - Business processes designed to incorporate data collected through mobile information technology into planning and management decision making.

Parts

- Update the current computer system to addresses certain improvements such a establishing a formal cycle count program and bar coding.
- As part of the new facility construction project, emphasis should be placed on better security and access control to the parts room. Also, an effort should be made to centralize the bus parts now found in four or five different places into one or two.

Building and Grounds

- The computerized Buildings and Grounds (B&G) recordkeeping system should be used to track and analyze expenditures on outside contractors. This information should then be used for costing analysis and decision making regarding in-house B&G staffing and the use of outside contractors. For example, after reviewing the amount spent annually on outside electrical contractors, Metro Transit may find it more economical to hire an electrician as part of the in-house staff to perform this type of work. During down-time, this person could also perform other functions that are not related to electrician work.

FUNCTIONAL AREA REVIEW VEHICLE MAINTENANCE

This section provides a detailed review of the vehicle maintenance function at Metro Transit and includes analysis of staffing levels, facilities, fleet condition, preventive maintenance inspection program, running repair performance, vehicle servicing and other maintenance related work. A status of recommendations made in the prior audit as well as recommendations made in this audit is included.

Organization and Staffing

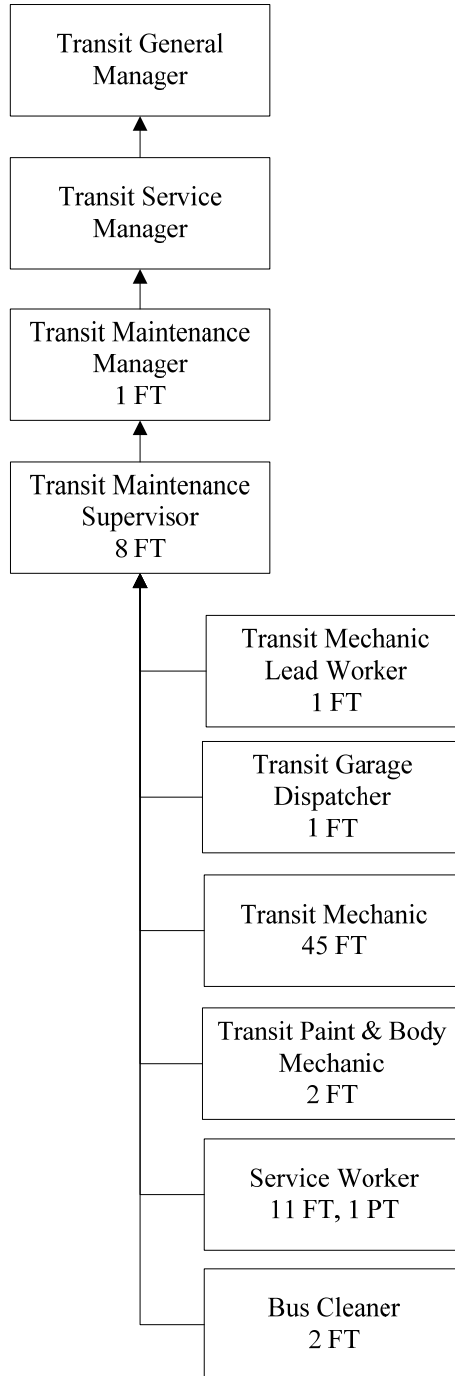
The mechanics employed by Metro Transit perform almost all of the transit system's vehicle maintenance activities at its bus garage located at 1101 East Washington Avenue, Madison, Wisconsin. The work includes routine vehicle maintenance activities including preventive maintenance inspections and diagnostic (running) repairs as well as major work including body repair, bus painting, removal of engines and transmissions, engine and transmission overhauls, component rebuilds, brake rebuilds, repairs to the fareboxes, two way radios and tire work. In addition, Metro Transit has a dedicated fleet of support (non-revenue) vehicles that it also maintains.

Work sent to outside vendors includes some communications equipment repair, electronic equipment repair such as bus head signs and rebuilds of certain components where it makes financial sense such as radiator cores. Further, some engine, transmission and component overhauls and rebuilds are also being performed by outside vendors.

As of November 1, 2008, the Metro Transit active fleet consists of 204 full size buses for fixed route service and 19 smaller vehicles for paratransit services. Of this number, approximately 164 buses are needed for peak period fixed route service. This results in a spare ratio of about 24 percent (40 spare vehicles divided by 164 vehicles needed for peak service). This is slightly above the FTA guideline of 20 percent. Typically, 15 of the 19 smaller vehicles are used in peak paratransit service, which results in a spare ratio of about 21 percent.

The current overall unit organization chart is illustrated in Figure 2.

Organizational Structure - Vehicle Maintenance Function



As of November 1, 2008, Metro Transit employed a staff of 71 full-time and one part-time person in its maintenance unit.

Excluding the Manager, Supervisors, Dispatcher, Service Workers and Cleaners, there are 47 employees that are considered mechanics to support the vehicle maintenance function of the Metro Transit fixed route and paratransit fleet (45 mechanics and two paint and body mechanics). Of this group, one mechanic is assigned the primary responsibility for the maintenance of the paratransit fleet.

Staff Size Ratios – There are 179 peak vehicles that are the responsibility of 71.5 maintenance employees. This is a ratio of 2.5 peak buses per maintenance employee. Typical staff size ratios at similarly sized systems are approximately 1.5 peak buses per maintenance employee. This indicates that Metro performs this function with a smaller staff when compared to similarly sized systems. On a per mechanic basis, Metro's fixed route service requires 164 vehicles. With 46 mechanics assigned to the fixed route fleet, this is a ratio of 3.6 peak buses per mechanic. Typical staff utilization averages about 2.5 peak buses per mechanic. This is another indicator that Metro's maintenance staff for this function is smaller than what would typically be expected.

Another way to review staff size is vehicle miles per mechanic. This measure is more accurate and accounts for actual vehicle utilization. Based on past experience, Metro Transit's fixed route fleet will accrue about 5.4 million miles annually. With 46 mechanics (one mechanic assigned to the paratransit fleet), the ratio of miles to mechanic is 117,400 miles. The average for this statistic at other systems is generally in the 100,000 to 125,000 miles range. Metro Transit's mechanic work force is within this range. Another indicator is that Metro Transit's vehicle miles per mechanic ratio was shown to be within 10 percent of the average for this measure among its peer group. This is favorable performance considering that some mechanics are often used to support the one mechanic assigned to the paratransit fleet, and the fact that Metro Transit still performs major overhauls to engines and transmissions, as well as paint and body work with in house staff. Many systems have changed and now only use outside vendors for this more major work.

Metro Transit has the equivalent of 13.5 full-time service workers and cleaners responsible for the entire vehicle servicing and cleaning function. Typically about nine workers are assigned to the service line each weekday evening including two "fuelers", two "vaulters", four "hostlers" and one "parker". With 179 vehicles requiring servicing each weekday evening, this represents a ratio of 20 buses per employee dedicated to this function. Typically, a ratio of at least 20 buses or more is acceptable.

The staff ratio for this group appears to be acceptable. In fact, at Metro, these employees perform additional activities such as farebox removal (vaulters) that typically is done within another staff function at other transit systems.

Facilities and Equipment

Metro Transit currently functions out of an operating base that houses vehicle maintenance, servicing and indoor storage functions. This base also includes the transportation function as well as parts storage. The administrative offices were recently moved to an adjacent building which has helped reduce some of the congestion. The operating base was converted from a Sears complex in 1980. It is designed to provide indoor storage for up to 190 buses. The facility must accommodate 204 buses and 19 paratransit vehicles. Metro Transit also stores five non-revenue parade type buses at this complex. With the current fleet size, the capacity of the facility has been exceeded. This does not include the potential for future growth in services.

There are a number of problems with the current facility including:

- Bus storage area is crowded and requires strict adherence to bus parking assignments to preclude the need for significant bus maneuvering. The limited indoor bus storage space is a major problem since buses cannot be stored outside in the winter months. Therefore, bus storage is accommodated in every possible space in the facility including travel aisles.
- Space devoted to vehicle maintenance is too small for the current fleet size. A general “rule of thumb” is for a facility to be furnished with one bus repair bay per 10 buses. With 204 buses, the Metro Transit facility should have approximately 20 repair bays. Metro Transit has 12 repair bays with 12 operable in-ground lifts. There are four additional bays in the body shop and one in the A/C shop. This limited space has mandated that a significant portion of the vehicle maintenance work be performed in travel aisles throughout the complex.
- Vehicle maintenance and transportation office space is also very limited with no room for supervisor’s desks or sufficient space for files. In fact, transportation supervisors must share limited desk space. This issue is in the process of being addressed as a result of the move of the administrative offices to an adjacent building. This move has freed up office space that can be used by the transportation staff;
- Other maintenance areas that are undersized include the component rebuild area and parts storage room;
- Other facility problems include:
 - The engine/transmission rebuild area is located in an open and unclean environment. The sensitivity of the rebuild functions requires a clean working space.
 - The body shop and paint booth are located in two separate parts of the facility when they should be located next to one another for efficiency.

- The tire shop and brake repair room are combined in one room when they should be separate.
- The A/C repair shop is located in a remote repair bay within the bus storage area.
- Mechanic tools are stored in unsecure locations along the walls throughout the facility when they should be stored in a locked or secured room.
- Bus parts are stored in a number of locations throughout the complex instead of one central location.

In summary, the maintenance facilities of Metro Transit are inadequate to support the vehicle maintenance requirements. The complex is generally old, overcrowded and not well laid out. The facility is, however, equipped with the necessary shop and garage equipment to support the vehicle maintenance function.

Revenue Fleet

As of November 1, 2008, the Metro Transit had an active fleet of 204 buses and 19 paratransit vehicles or a total fleet of 223 vehicles. All Metro Transit buses and paratransit vehicles are equipped with diesel engines. Full size buses are all equipped with bike racks. The entire fleet either has a wheelchair lift or a low floor ramp.

Federal Transit Administration guidelines suggest that the average age of the fleet should be no more than half of the average economic useful life of the fleet. For Metro, this would be a suggested average fleet age of 6.0 years. The average age of Metro's bus fleet is 8.4 years, which exceeds the suggested level. This high fleet age is due to 57 buses exceeding the 12 year replacement age: twenty-two 1992 Orion V's, twenty 1994 Orion V's, and fifteen 1995 Gillig Phantom's. It should be noted that during 2009, Metro Transit will be obtaining 33 replacement buses with 42 additional replacement buses being obtained by 2013. These 75 buses will replace the entire Orion V fleet (42 buses) as well as most of the Gillig Phantom fleet (36 buses).

The average age of the 19 paratransit vehicles is about 2.3 years. Since these vehicles have a useful life of seven years, this would suggest a target average age of 3.5 years. The Metro fleet is within that suggested guideline.

**Metro Transit Fleet
(as of November 1, 2008)**

Type of Bus	Year	Number of Seats	Number
Fixed Route Bus Fleet			
Orion V	1992	43	22
Orion V	1994	42	20
Gillig Phantom	1995	43	15
Gillig Phantom	1996	43	12
Gillig Phantom	1997	43	9
New Flyer	2000	39	30
New Flyer	2001	38	16
New Flyer	2002	38	14
New Flyer	2003	38	15
Gillig Low Floor	2004	38	15
Gillig Low Floor	2005	38	15
Gillig Low Floor	2006	38	16
Gillig Hybrid	2007	38	5
TOTAL			204
Paratransit Fleet			
ELF	2004	12	3
Starcraft	2006	12	16
TOTAL			19
Fleet Total			223

A visual inspection of 24 Metro Transit fixed route and paratransit vehicles (or about 11 percent of the fleet) indicated that the fleet was in relatively good condition. Buses were generally clean inside and outside along both sides. Seats were generally in very good condition and no broken or cracked windows were observed. However, there were a few problems found during the inspections that are worth noting, including:

- Nine of the buses that were inspected had ripped driver's seats.
- Minor body damage was observed on four of the buses. These buses were the older vehicles in the fleet and included a 1992 Orion V (#513), 1994 Orion V (#549), 1995 Gillig Phantom (#560) and 1995 Gillig Phantom (#568).
- Many of the windows on ten of the buses were dull and foggy. This condition is a result of the plastic insert material that is installed in many of the buses to protect the windows from vandalism damage.
- One issue with using automated bus washer equipment is that the rear exterior of buses can often be left dirty. This is due to the fact that staff drives the bus through the washer at too fast a pace, precluding the washer from adequately cleaning the exterior. As part of this inspection, it was found that only two of the 24 buses had dirty rear exteriors.

There were no problems with graffiti and ripped passenger seats. However, as noted above, the driver seats on nine buses were found to be ripped. Again, Metro Transit should be commended on the absence of any broken or cracked glass on the entire inspected fleet. Further, the three paratransit vehicles that were inspected were found to be in very good condition.

Road calls are recorded by Metro Transit by day, time, description of the problem, length of any delay, and whether a maintenance truck or another bus was sent to the problem bus. During September and October 2008, there were 126 mechanical road calls on the fixed route fleet. During this period, the fixed route fleet traveled about 970,000 miles. The overall road call rate for the two month sample for the fixed route fleet is about 7,700 miles between road calls. Road call performance is typically in the 4,000 to 6,000 mile range. The Metro Transit fixed route road call performance is very favorable. The road call performance for the paratransit fleet was found to be even better with a road call rate for the two month period of about 12,200 miles.

In summary, Metro Transit's bus fleet is relatively old with over one-quarter of the fleet having exceeded its economic useful life. Overall, the fleet was found to be in good condition with minor body damage on the oldest models, a few buses with dirty backs, some ripped driver's seats, and some foggy windows on a few buses. The fleet appears to be well maintained as exhibited by its very favorable road call performance.

Preventive Maintenance (PM) Program

Metro Transit has in place a very extensive PM program for all revenue vehicles. A detailed form with clear and concise instructions is used by all mechanics when performing

preventive maintenance inspections. Different forms are used depending on the bus type as well as the inspection interval. Separate forms are also used for wheelchair lift, A/C, and farebox PM inspections.

Metro's PM program includes four inspection categories that are performed on a 6,000 mile interval. The "A" inspection is the basic inspection and involves changing of engine oil and filters. The "B" level inspection is the next interval and involves the same activities as the "A" inspection plus additional tasks. The "C" inspection is performed at the sixth interval and includes all "A" and "B" activities plus additional tasks. The "D" level inspection is the final category and includes all inspection activities from the "A", "B" and "C" inspection plus a road test, as well as changing differential fluid change. The "D" inspection is performed on an annual basis in place of one of the other inspections. It should be noted that Metro Transit uses a 3,000 mile interval for the paratransit fleet.

PM inspections are completed by either a Class "B" or Class "C" mechanic. The mechanic is responsible for the inspection plus completion of any needed repairs. However, if repairs are major, the problem will be noted on the inspection sheet for future work.

The PM schedule for the Metro Transit fleet is based primarily on the mileage of each vehicle as well as time for those vehicles that accrue little mileage. The mileage is determined during the fueling process. The process is computerized to keep accurate records of fuel levels, PM intervals, and mileage. Metro Transit utilizes the upgraded Fleet Mate computer system known as Transit Fleet for all vehicle maintenance record keeping and reporting. This computer system identifies those vehicles that are due for a PM inspection.

The computer also generates a daily output itemizing the type of PM inspection scheduled to be performed. In addition to basic PM inspection work, periodic PM inspections are performed on the wheelchair lift, A/C system, and fareboxes.

It should be noted that during PM inspections, engine oil and transmission fluid is sampled and an analysis is performed. This analysis not only determines whether impurities exist in the sample, but also addresses whether the lubricating properties of the fluids have deteriorated. This analysis can help in making engine and transmission replacement decisions as well as in determining which of the 44 Orion V buses will be replaced by the new 33 Gillig low floor buses being obtained in 2009.

Overall, Metro Transit's PM program is extensive and thorough. Adherence to the schedule for all PM inspection categories was analyzed based on data for a sample period of September 18, 2008 to November 18, 2008. During the sample period, 221 separate inspections were conducted. There were no inspections performed more than 10 percent later than the prescribed interval of 3,000 miles for paratransit vehicles, and 6,000 miles for buses. In fact, there were only four cases where the actual inspection was conducted more that 500 miles above the planned 6,000 mile interval. The performance was not as favorable in terms of early

inspections. There were 21 inspections that were performed more than 10 percent (i.e., 600 miles) earlier than the planned 6,000 mile interval. Overall, more than 90 percent of the inspections were performed within 10 percent of the planned interval. This is excellent performance considering that no inspections were performed later than 10 percent of the planned interval.

Running Repair

Repair work on Metro Transit vehicles occurs when a problem is discovered through one of several ways including information from drivers, due to a road call, from the service workers while the bus is being serviced, or during the PM inspection. The driver's Defect Card allows space for operators to comment on their vehicle's condition. As previously mentioned, almost all of Metro Transit's repair work is performed by in-house staff mechanics.

One way to analyze the performance of a vehicle maintenance program is to review how often vehicles are brought into the shop for repair work. For a good program, the frequency of repair work should be no less than one half the PM interval. Therefore, with a planned PM interval at Metro Transit of 6,000 miles, vehicles should need repair no less than every 3,000 miles. For the paratransit fleet with the planned interval of 3,000 miles, vehicles should need repair no less than every 1,500 miles.

The performance of Metro Transit was reviewed for a sample of 17 buses and three paratransit vehicles for a six month review period spanning May 18, 2008 to November 18, 2008. Repair records for the 20 vehicles were reviewed with defects noted where the repair work was major and required more than two hours of mechanics time to complete. Results indicated that Metro Transit has an average interval of about 2,100 miles for the fixed route bus sample where buses were at the shops for major repair work (more than two hours) and about 3,000 for the paratransit sample. The sample of paratransit vehicle performance is above the goal of 1,500 miles but the performance of the 17 bus sample is below the 3,000 mile goal. A more detailed review of the bus performance indicates that eight buses in the sample were from the older fleet of 1992/1994 Orion V's and 1995 Gillig Phantom's. These older buses required much more repair work. In fact, the major repair on these vehicles occurred on average every 1,100 miles. The performance on the newer buses was much better and exceeded 2,700 miles between major repairs.

Overall, this result indicates that the Orions and 1995 Gillig buses do not meet the suggested criteria. These buses have already exceeded their useful life and therefore, are in the shop for repairs more frequently than desirable. The performance of the remainder of the Metro Transit bus fleet is slightly below the standard but acceptable.

Vehicle Servicing

After the completion of all daily runs, drivers return the buses to the garage for vehicle servicing. The servicing procedure begins with the hostlers driving the bus from a drop-off point in front of the service lane entrance into one of two service lanes. At the first servicing stage, fareboxes are emptied by one vault puller who services both service lanes. The bus is then moved to the next station where the cyclone cleaner is attached to the front door for interior cleaning by the hostler. While the cyclone cleaner is operating and the interior is being cleaned by the hostler, fuel is added and other vehicle fluids are checked and replenished if necessary by the fueler. There is one fueler per service lane. It should be noted that the servicing function is computerized. When the bus is parked at this stage, an appropriate key is inserted into the terminal to identify the bus. The fueler enters his or her number and notes the mileage from the hubodometer. The system automatically records the fuel added.

The next step in the servicing process involves the hostlers driving the buses through the automatic bus washer to clean the exteriors. After the wash cycle, buses are then driven to the vehicle storage area where they are parked for the night.

There is also a parker assigned to the service line whose function is to obtain defect cards from the drivers and determine the location in which the buses should be stored.

The time it takes to complete the servicing of each Metro Transit is relatively fast and indicates a very high level of activity. Also, the work method followed, whereby the service line employees work as a team, appears to be very efficient.

Metro Transit performs a more detailed interior cleaning of each bus with a goal of every 45 days, or about once every six weeks. Discussions with maintenance staff indicated that goal was not being met for a number of reasons, but primarily due to the limited number of staff that is devoted to this function. Currently, two cleaners are assigned the detailed cleaning function and are each able to clean two buses per day. At four buses per day, and 20 buses per week, it takes approximately 12 weeks to perform detailed interior cleanings on the entire fleet. This is about twice the Metro Transit goal. Metro Transit indicated in the past review that they recognized this problem and planned to hire two part time staff to work weekends on detailed bus cleans. This has not happened.

Overall, the vehicle servicing function at Metro Transit appears very efficient. The bus interiors and exteriors were observed to be clean. There were only a few cases where the bus backs were observed to be dirty.

Computer Maintenance Information System

Another favorable aspect of Metro Transit's vehicle maintenance function is the computer records maintained for every transit vehicle. The Transit Fleet system, which is the upgrade to the prior FleetMate system, is a work order system which keeps files that list every task performed on each vehicle. Consequently, recurring problems can be discovered and acted upon appropriately. This computerization of all vehicle maintenance records enables close monitoring of the vehicle fleet in terms of repairs, PM intervals, and rebuild intervals. The computer file also lists the amount of time it takes the mechanics to complete a task as well as the cost of repair parts associated with the repair. This has enabled Metro Transit to perform a number of analyses. One such analysis reviewed the cost of maintaining and fueling Metro Transit's five Hybrid buses compared to its newest Gillig Low Floor buses. These types of analyses allow Metro Transit to make more informed decisions regarding fleet maintenance and practices.

Status of Prior Audit Recommendations

During 2003, the management review conducted of the vehicle maintenance function identified three recommendations. Status of the actions taken by Metro Transit on each recommendation is summarized below:

- Facility Needs Assessment – Metro Transit should not delay on conducting the Facility Needs Assessment study and acting upon the recommendations that are made in the study.

This study was performed and has resulted in certain improvements such as moving the administrative offices to an adjacent building and expanding the space for the Transportation function. The study also identified that a new maintenance facility should be constructed on the existing site with automobile parking on the second floor and bus storage remaining in the same location.

- Cleaner Bus Floors – Metro Transit should develop a program to remove mud from the floors of its buses. This mud occurs for days after inclement weather.

During the recent inspection of buses, muddy floors were not observed. However, Metro Transit indicated that they have not taken any specific action to improve on this situation.

- New Computer System – Once the new Maximo computer system becomes operational, a number of analyses should be performed to evaluate the vehicle maintenance performance.

The Maximo system was never installed. However, the FleetMate computer system was upgraded and is now called Transit Fleet. The upgraded system has given Metro Transit the capability to perform a number of maintenance analyses.

Conclusions and Recommendations

As part of the current review of the Metro Transit's vehicle maintenance activities, certain conclusions were reached. The following are the favorable aspects of the maintenance activities at Metro Transit:

- Metro Transit's performance in terms of vehicle miles per mechanic, when compared to typical industry ratios as well as the average ratio among its peers, would suggest that the maintenance staff is appropriately sized. It was also observed that the staff is guided by an extensive and up-to-date set of systems and procedures.
- The Metro Transit fleet includes 69 buses that are at or older than the 12 year suggested replacement age. Metro Transit has recognized this fact and is in the process of obtaining 75 replacement buses in the next five years.
- Overall, the fleet was found to be in good condition with no broken or cracked glass and little body damage. Some ripped drivers seats were noted as a problem.
- The systems, procedures, and methods of the Maintenance Unit are excellent. The fleet appears to be well maintained as exhibited by its favorable road call and times in shop for defect repair performance.
- The decisions made in areas such as tire type, fuel type, and the performance of engine oil analyses are favorable and are aimed at a more effective vehicle maintenance program.
- The PM inspection activities are very extensive and well documented. Vehicles are inspected within the established mileage intervals. Further, the policy under which the mechanic performing PM inspection work also makes identified needed repairs, appears efficient. An important positive factor in this method is that the work which is identified as needed during the PM inspection is completed immediately.
- The need repair work interval is favorable for the newer bus fleet but not for the buses that are due for replacement.
- The computerized system of record keeping is excellent and is better than in the past with more analysis capability.

- Overall, the vehicle servicing function at Metro Transit appears efficient. The production levels of the service line staff are reasonable considering the number of buses that are serviced and the overall staff size.

During the review, certain areas of Metro Transit's performance appear to be questionable and warrant further analysis and possible change. Recommendations are also made and include:

- Metro Transit should move forward with its plans to construct a new maintenance facility on site. The problem with the current complex has been noted in each of the past three performance audits.
- Metro Transit should address the problem of having a large number of ripped driver seats on its bus fleet. While not a major issue, ripped seats do hurt the overall appearance of the system.
- Metro Transit should investigate its performance in terms of the apparent large number of PM inspections that are performed early. While inspecting the bus before the inspection due mileage may be beneficial in that problems can be discovered more sooner, it can also increase costs unnecessarily.
- Metro Transit should attempt to meet its detailed interior bus cleaning goal of a detailed clean for each bus at least every six weeks. This would mean that two additional bus cleaners would need to be hired to increase the staff size of this group to four employees. With four employees doing two buses a day each, 40 buses can be cleaned in one week and 240 in six weeks.

The lower In general, except for the few areas noted above, the maintenance activities at Metro Transit are very positive.

The Peer and Trend Analysis Report, prepared as part of this audit, noted that Metro Transit's maintenance costs per peak vehicle and per vehicle mile were lower than its peers. It was observed that this could indicate favorable performance, or could suggest that maintenance expenditures are too low. Metro Transit's lower maintenance cost on a per vehicle basis can be attributed to the fact that Metro Transit operates fewer vehicle miles per peak vehicle than its peers. This is due to the fact that Metro Transit's service area is much more compact, and a greater proportion of Metro Transit's service is operated in the urban core. This would not explain the lower maintenance cost per vehicle mile. However, while maintenance cost per peak vehicle was 28 percent below the peer average, maintenance cost per vehicle mile was only 11 percent below the peer average. This, along with the fact that there was nothing observed as part of this current review of the vehicle maintenance function that would suggest that Metro Transit is not expending sufficient resources on the maintenance function, would suggest that the lower ratio is the result of efficiencies or other factors.

FUNCTIONAL AREA REVIEW PARTS

This section presents a review of the Parts function of Metro Transit. This review addresses the procurement and inventory control functions as well as overall financial performance of this aspect of transit operations.

Organization and Staffing

As seen in the overall Unit organization chart shown in Figure 1, the Parts Unit is a separate unit that reports to the Transit Maintenance Manager. The Unit is headed by a Supervisor and includes two Parts Specialists. The Unit performs all functions associated with having parts available for mechanics to repair the Metro Transit fleet. The Supervisor is responsible for the entire materials management function and directly handles the parts procurement and inventory control activities. The two Parts Specialists are responsible for the receipt, storage and disbursement of parts necessary to maintain Metro Transit's vehicles.

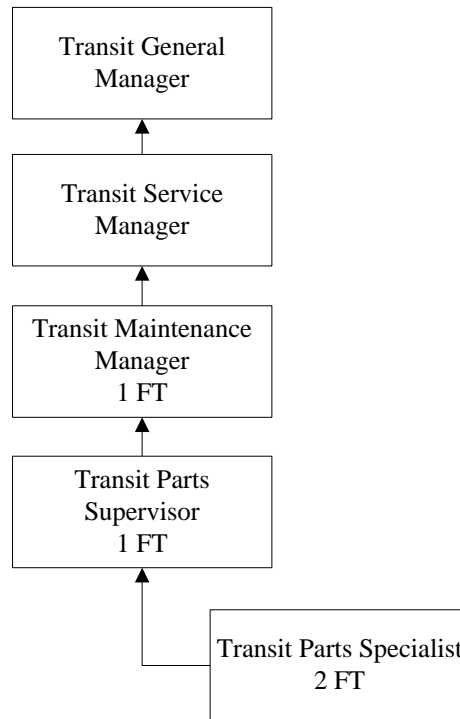
Procurement Function

The Supervisor is responsible for the procurement of all parts as well as some services for Metro Transit. In making these purchases, the Supervisor generally follows a set of procedures that he has developed to obtain the needed parts. He typically follows the City of Madison guidelines regarding the purchasing process. One of three purchasing procedures is generally followed. First, for high dollars items (generally \$5,000 or more, but in some cases less), a formal bid process or request for proposal is followed. Second, the most common purchase method used for most items is a fax quote system where three or more vendors provide written quotes. A price quote for the same item that was given during the past six to nine month period by a vendor is sometimes used to make a selection. However, if the vendor does not hold the prior price quote, the item will be re-bid. In the fax quote process, each selected vendor is sent out a purchase order about once a week. The final purchasing method is a direct purchase from a known vendor that is used in emergency situations where a part is needed within an expedited timeframe.

The methods used to make purchases of vehicle parts are reasonable and consistent with those followed by other transit systems.

Metro Transit has a completely automated parts inventory system that includes about 6,000 stock parts. Minimum and maximum inventory levels are set for each part based on past usage experience. The computer inventory system also identifies the vendors that supply the particular part as well as their most recent bid prices. Further, the system identifies the past usage of each part for the prior 12-month period. Parts not utilized are periodically removed from the inventory.

Organizational Structure – Parts Function



Metro Transit will also order special parts that are not in the inventory system. These are referred to as non-stock items. If these parts are found to be needed more than three times, they will be paced into the formal inventory. This review of the so called non-stock items occurs about every three months. Data from a prior review indicated that the value of the non-stock items represented about 20 percent of the total inventory. At other systems, these non-stock items were found to make-up a larger portion of the inventory.

Each day the computerized inventory system identifies a list of parts that are at or below the stock reorder point. This report is printed out daily and is used to prepare bids, most of which are currently purchased through a fax quote system. The Supervisor has identified about one dozen vendors that supply most of the needed parts. Several times a week, depending on the need, these vendors are sent via Fax, a quote form that contains the description of the part and the quantities needed. These are the parts that the vendor has supplied in the past. Space is provided for the vendor to note the unit price as well as whether the item is in their stock and readily available for delivery. The vendors are required to return their quote via fax on the form within 48 hours of receipt. Typically, on the day after the receipt of the vendor quotes, a purchase order is prepared and sent to the vendors.

There are several ways to measure the performance of this group. One key measure is the number of buses that are out-of-service awaiting parts. Typically, about one to two percent of the buses in a fleet would be out-of-service awaiting parts. Data from Maintenance Bus Status Report, a daily status report prepared by the Maintenance Unit, indicates that about three

to four buses are typically out-of-service awaiting parts, which represents between 1.5 and 1.9 percent of the 204 fixed route vehicles in the Metro fleet. This is within the acceptable range.

The Materials Management function is supported by the Transit Fleet computer software system that was developed about four years ago for the Metro Transit. While the computer system has been successfully used, it has some shortcomings such as not yet being set up for bar coding and inability to perform certain analyses.

Inventory Control

The Parts Specialists are responsible for maintaining the inventory at the Metro Transit parts room. All parts are received, stored and dispersed to the mechanics at this location.

When parts are received, they are matched to the packing slip and then to the purchase order. Once matched, the parts are entered into the computer by item category, i.e., revenue vehicles, non-revenue vehicles, Buildings & Ground (B&G) materials, shop supplies, etc. Some exceptions are made for those parts that are noted as specials and are needed on the bus immediately. These parts are not entered into the computer but rather are entered into the work order for that particular job. The part is then dispersed to the mechanic.

Once parts are received, they are typically placed into the appropriate location within the storeroom. The storeroom is generally arranged by part type and bus type.

There is one Parts Specialist assigned to handle the mechanics requests for parts at the parts window. This person is responsible for the complete inventory disbursement system during the first work shift. Typically, a mechanic will complete a Parts & Materials Used sheet listing the bus number the part is needed for, the part description and number and the work order number where the part will be charged. For subsequent work shifts, the maintenance unit foremen are responsible for the parts function.

Another responsibility of the Parts Specialists is the monthly physical inventory. Each month, a complete inventory is taken on a different section of the stock. The computer generates the parts to be counted. An annual count for the entire inventory is made each December. The monthly and annual count both show different values compared with the computer inventory value. Often times this error rate is due to several factors including the fact that the parts room is not a secure area and that the room is only controlled by parts staff from about 6:30AM to 5:00PM. During 2nd and 3rd shifts and on weekends, the parts room is open to all those who need parts, even though the policy is for foreman only to enter the room and retrieve parts. It is up to the person taking the part to mark on the Parts Charge Out Sheet the part that was taken along with the bus and work order number.

It should be noted that the two Parts Specialists are union members. Since the staff in this unit must perform a number of different duties, certain union restrictions limit the full use of the work force.

Financial Performance

As shown in the accompanying chart, the cost for bus parts has increased in the five year period spanning 2003 to 2007 from about \$503,215 to \$705,392, a 40.1 percent increase or about 10 percent a year. During the same period, miles operated increased by about 3.0 percent resulting in the bus parts cost per mile increasing from \$0.096 in 2003 to \$0.131 in 2007, about a 37 percent increase, not adjusted for inflation. However, it appears that 2003 was an unusually low year for the purchase of bus parts. Bus parts costs in the years 2004 to 2007 varied in a tight range of \$0.131 to \$0.145 per mile. Parts costs at other comparable transit systems are typically much higher and are often above \$0.20 per mile.

Bus Parts Cost Trend

Year	Cost of Bus Parts (\$)	Miles Operated (000's)	Bus Parts Cost Per Mile (\$)
2003	503,215	5,244.6	0.096
2004	783,419	5,410.6	0.145
2005	693,717	5,422.8	0.128
2006	680,996	5,428.1	0.125
2007	705,392	5,400.7	0.131

The value of the parts inventory at the end of 2007 was \$353,983, excluding fuel. This represents \$1,587 per vehicle for the 204 full size and the 19 paratransit type vehicles in the fleet and is below the range of parts inventory values of other transit systems that is typically about \$3,000 per vehicle. This current inventory level is much less than the amount spent on bus parts at the time of the prior audit in 2002 that was \$3,176 per vehicle.

The inventory turn ratio for 2007 is the inventory expended (\$705,392) divided by the parts on hand (\$353,983) at the year-end or a ratio of 1.99. Any value above 1.0 is an acceptable inventory turn ratio, since a value less than one indicates that inventory has not completely turned over throughout the year, suggesting that inventory is overstocked. It should be noted that the inventory turn rate in 2002 was 1.20.

Status of Prior Audit Recommendations

During the 2003 review, there were two recommendations made pertaining to the Parts Unit. Status of the actions taken by Metro Transit on each recommendation is summarized below.

- Implement the new Maximo computer system.

This recommendation was not followed since Metro Transit determined that the system would not meet their needs. In its place, Metro Transit determined that upgrading its current computer system would be more appropriate. However, the upgrade has not yet addressed certain improvements such as establishing a formal cycle count program and bar coding.

- Complete the plan to remodel the entire facility.

The facility remodeling has not been done and is awaiting the planned construction of a new maintenance complex at the current site.

Conclusions and Recommendations

From the review of the parts activities of Metro Transit, certain conclusions are reached. The following are the favorable aspects of the Parts Unit at Metro Transit.

- The Metro Transit Parts Unit staff appears to be properly trained and sized to meet the current demands and with the understanding that the parts room is staffed only during first shift hours on weekdays.
- The procurement procedures are aimed at obtaining the required parts in a timely manner and at the lowest possible price.
- The computer system for inventory control and record keeping provides staff with a tool to control the inventory size and yet to have sufficient parts on-hand so that buses are not out-of-service awaiting a repair part.
- The financial performance of the materials management function is favorable with a relatively low parts cost per mile, low parts on-hand per bus, and favorable parts turn ratio.

The peer group report prepared as part of this Management Performance Audit showed that Metro's maintenance costs, overall and on a per unit basis, were far lower than its peers. The peer report observed that this could be due to efficient operation or could indicate an insufficient level of resources dedicated to the vehicle maintenance function. Parts is an area that contributes to that cost performance. This report noted that Metro's parts cost per vehicle mile is much lower than the typically observed rate. This, again, may indicate efficient operation or an inadequate resource level being dedicated to the function.

Some observations that would suggest that an appropriate level of resources are being dedicated to the parts function include the fact that Metro has an acceptable inventory turn ratio, and a low level of buses out-of-service awaiting parts. Another potential indicator of the performance of Parts is the mean distance between failure (MDBF) rate of the Metro fleet. If

Metro is realizing cost savings in the parts function through the purchase of inferior parts, it would be expected that Metro's MDBF would be below 3,000 miles. Metro's MDBF performance in September and October 2008 was 6,923 and 8,594 miles respectively. This, again, would suggest that there is no issue with the Parts function. Each of these observations would indicate that Metro is realizing cost efficiencies while dedicating an appropriate level of resources to the function. Potential contributing factors to this performance include the fact that Metro has a fairly new revenue vehicle fleet and has a high degree of uniformity in its fleet.

There are only two recommendations that Metro Transit should make in the procurement and inventory control area. These recommendations are geared toward Metro Transit continuing to address those that were made in the prior audit and not yet fully implemented, including:

- Update the current computer system to addresses certain improvements such a establishing a formal cycle count program and bar coding.
- As part of the new facility construction project, emphasis should be placed on better security and access control to the parts room. Also, an effort should be made to centralize the bus parts now found in four or five different places into one or two.

The two recommendations noted above provide the unit with a continuing agenda of activities to improve the procurement and inventory control function at Metro Transit.

FUNCTIONAL AREA REVIEW BUILDINGS & GROUNDS

This section presents a review of the B&G function of Metro Transit. This review addresses the organization, staff size, janitorial function, and utility function. The information presented is based on staff interviews conducted during November 2008 with the Building & Grounds (B&G) supervisor.

Description of Facilities

The current Metro Transit maintenance facility is located at 1101 East Washington Avenue and was designed to service a fleet of approximately 200 vehicles. The facility was opened in 1981 and consists of a renovated existing warehouse structure along with a new addition. The renovated warehouse space is used for indoor vehicle storage that is needed to protect the fleet from inclement winter weather. The repair and maintenance of the fleet, as well as the parts storage, are accommodated in the new part of the building.

Metro Transit has recently obtained and moved into office space at 1245 East Washington Street, which is adjacent to the maintenance and bus storage facility. This office space accommodates the administrative staff that was located in the 1101 East Washington building as well as those located across the street.

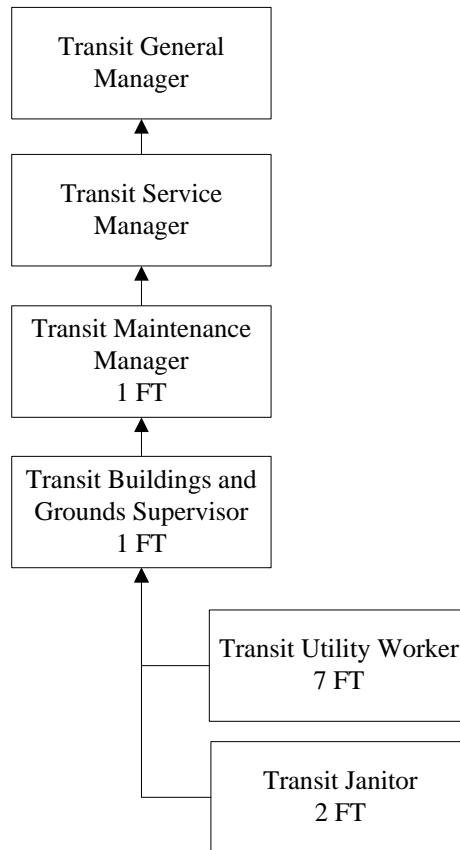
Metro Transit also utilizes 149 passenger waiting shelters throughout the service area, two park-n-ride facilities, and four transfer point terminals.

Organization and Staff

Metro Transit has its own in-house B&G unit. The unit is responsible for: cleaning office, maintenance and bus storage areas; upkeep of grounds including snow removal; and maintenance of building systems for the transit complex located at 1101 East Washington Street as well as the new office complex located at 1245 East Washington Street in Madison. The unit is also responsible for the upkeep of the 149 passenger waiting shelters, two park-n-ride facilities, and four transfer point terminals.

The unit is directed by the Building & Grounds Supervisor who reports to the Transit Maintenance Manager. The B&G unit consists of ten staff members that includes two Transit Janitors, seven Transit Utility Workers and the Supervisor. This staff size represents an increase of one utility employee compared with the 2004 audit. The janitors are responsible for cleaning the entire Metro Transit complex and the upkeep of the grounds, which includes lawn care and some yard snow removal. The utility workers are responsible for upkeep of the building systems, major facility equipment, bus shelters, park-n-ride facilities, and transfer point terminals.

Organizational Structure – Buildings & Grounds Function



Since Metro Transit has the capability of hiring skilled utility workers from outside sources, the skill level of this group is improving. The group has been able to undertake significant facilities projects, such as the current remodeling of the first floor office area at the 1101 East Washington Avenue.

A new feature of this unit is the requirement for all employees to complete a time sheet that describes the work that they accomplished each day. This has helped to monitor the effectiveness of the unit.

Janitorial Function

This group includes two Transit Janitors. The work of the group focuses on cleaning the office area, parts room, inside bus storage area and vehicle travel ways throughout the complex. The cleaning of the vehicle repair bays is the responsibility of the vehicle mechanics. The janitors will also do work on the grounds including mowing and trimming of plants and trees.

As part of an observational tour, the facility and grounds were observed to be in a generally clean condition. The cleanliness of the floor in the bus storage areas was impressive. This performance could be attributed to the fact that Metro Transit has purchased state-of-the-art equipment to assist in the facility cleaning process.

Utility Function

This group includes seven Transit Utility Workers. The group is primarily involved in three major functions -- maintenance and upkeep of 1) facilities, 2) equipment and 3) passenger waiting shelters, park-n-ride complexes and transfer center terminals. The role of utility workers in each of these areas is discussed below:

Facilities - The work of this group in terms of facilities is to perform basic preventive maintenance (PM) work on major building systems and facility repair work where needed. The previous audit noted that only an adequate but minimum amount of PM work was done on HVAC systems, air compressors, emergency generators, electrical switchgear, and building elevators (which was performed through an outside contractor). At that time, it was explained that there was too much time devoted to repair of building systems, and other activities such as passenger waiting shelter work, to devote more effort to the PM work. However, that process has now been changed. There is currently an adopted PM program for most building systems with PM work being tracked with computerized recordkeeping. Two utility workers are assigned the PM function.

Other facility related activities of this group include:

- Minor masonry repair work
- Minor roof repair work
- Computer and telephone system wiring
- Replacement of all light bulbs
- Facility painting
- Movement of office furniture
- Repair of fluid lines
- Removal of carpet
- Construction of some walls

Outside contractors are utilized for most of the major facility repair work as well as the work requiring a special skill, license, or the capability to certify a project. The staff does not include anyone certified in certain skilled areas such as plumbing or electrical work.

When Metro Transit staff members have a facility problem, they will e-mail the B&G office to explain the issue. All problems are addressed in a priority manner and will typically be completed within a few days of when the problem was identified.

Equipment - Utility workers are responsible for upkeep of most of the major pieces of equipment, all of which have a PM program. The PM program tracks 32 separate assets. The utility workers also will perform minor repair work on all shop and garage equipment including bus washers and bus vacuum systems. Outside contractors are used for more major equipment repair and for the removal of sludge from the bus washer and the oil/water separators.

Shelters and Terminals - The B&G staff is responsible for the upkeep of the 149 passenger waiting shelters, two park-n-ride facilities and four transfer point terminals. It should be noted that the City of Madison Street's Department staff remove trash from each shelter during the normal trash removal cycle in the areas of the shelters.

A recent project included the replacement of all glass panels in passenger shelters with a glass/graffiti film. This has resulted in a significant reduction in the work required to keep the passenger shelters in good condition. Before this program, there was an average of 70 broken panels annually. Since the replacement panels were installed, the broken panels have declined to only a few per year. Further, the panels can be treated with a non-toxic solution to remove graffiti.

Status of Prior Audit Recommendations

During the 2003 review, there were two recommendations made pertaining to the B&G Unit. As seen below, Metro Transit has taken action to implement both of the recommendations:

- B&G should develop a formal preventive maintenance inspection (PMI) program for all major building systems.

The 2004 review recommended that the PMI program should identify each building and major equipment system (e.g., HVAC, bus lifts, bus washer, cyclone vacuum system, etc.), the inspection interval, and the inspection activities. Metro Transit has implemented such a program and has assigned two utility workers to the PM program.

- Implement the new Maximo computer system.

This recommendation was not followed since Metro Transit determined that the system would not meet their needs. In its place, Metro Transit determined that upgrading its current computer system would be more appropriate. With this upgrade, the B&G unit has input its facility and equipment PM inspection requirements into the computer system. It has complete computer tracking of 32 assets that are under its responsibility.

Conclusions and Recommendations

Since the 2003 review, the B&G function at Metro Transit has greatly improved its effectiveness in maintaining the existing Metro Transit complex. Some of the evidence includes new quick opening garage doors, freshly painted walls in the maintenance and bus storage areas, clean floors in the bus storage areas, and separation of the bus storage area from the maintenance areas. However, the current Metro Transit facility is aging and has a crowded layout. This will present challenges to Metro Transit and will require a continuous and concerted effort on the part of Metro Transit in this area. In this regard, it is essential that Metro Transit act on a recently

completed facility needs study to expand its current complex to provide more efficient facilities. Along with upgrading the facility, the following recommendation is made for the B&G area:

- The computerized B&G recordkeeping system should be used to track and analyze expenditures on outside contractors. This information should then be used for costing analysis and decision making regarding in-house B&G staffing and the use of outside contractors. For example, after reviewing the amount spent annually on outside electrical contractors, Metro Transit may find it more economical to hire an electrician as part of the in-house staff to perform this type of work. During down-time, this person could also perform other functions that are not related to electrician work.

This recommendation provides the B&G unit with action items designed to further improve this function at Metro Transit.