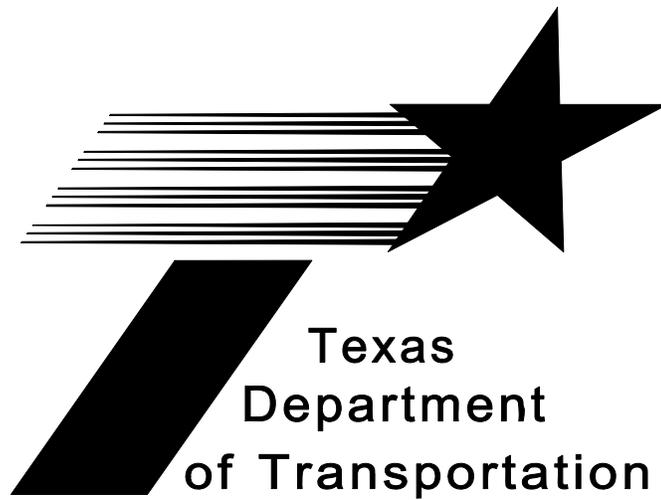


# **Public Transportation Maintenance Management Guide**



**Public Transportation Division**

**May 2000**

## ACKNOWLEDGMENTS

This manual is intended as general guidance to transit operators in the inspection and maintenance of their vehicles. Inspection procedures may vary according to each manufacturer and the specific vehicle.

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# OVERVIEW

The purpose of this Maintenance Management Guide is to assist the transit operator in developing a maintenance program. It is not intended to be prescriptive or mandatory. The urban transit operators and some of the larger rural operators have long-running maintenance programs that have improved vehicle safety, enhanced transit system performance, and increased the life-span of their fleets. Some of these operators were consulted in the writing of this guide.

The triennial review program used by the FTA to monitor maintenance in the urbanized program provides the framework of this guide. With some slight modifications to address state requirements and the needs of the rural and elderly & disabled transportation programs, this Maintenance Management Guide adopts the basic tenets of the triennial review as a maintenance standard for transit agencies in all three programs.

Although the scope of the maintenance program and the level of detail will vary depending on the size of a transit operation, every agency should have a maintenance program which encompasses the following six items:

1. a written maintenance plan;
2. preventive maintenance (PM) inspections and scheduled services;
3. provisions for the Americans with Disabilities Act (ADA);
4. management of maintenance resources;
5. warranty compliance and recovery; and
6. standards for subcontractors

Each of these six items is developed in this manual and some guidance is provided. This guide also addresses maintenance contracts and maintenance management information systems (MMIS). It also contains an assortment of sample forms, checklists, and maintenance plans that an operator might find useful.

Transit operators may adapt this guide to fit their specific needs. For instance, a small Elderly & Disabled Transportation provider that contracts for most of their maintenance might not want to address maintenance shop operations such as manpower scheduling, the proper use of tools, and the incorporation of new technology, but the operator might want to review their maintenance standards for subcontractors.

The Public Transportation Coordinator in the local Texas Department of Transportation district has an electronic version of this document available if an agency wants to copy any material into the agency's management plans.

## MAINTENANCE PLANS

Transit providers should have an up to date maintenance plan which outlines the maintenance philosophy of the organization and fixes responsibility for performing maintenance on all vehicles, real property, and equipment in the agency.

A written maintenance plan should include specific goals and objectives and a means of achieving them. Some components of the maintenance plan are covered in more detail by other sections in this guide. A sample maintenance plan is included.

The goals and objectives of the maintenance program should include or address:

- a schedule of preventive maintenance (PM) inspections and services, (see page 3)
- defect reporting, (see below)
- a fleet life plan, (see page 9)
- the proper management of parts, facilities, and equipment (see pages 8 - 15)
- a warranty recovery plan (see page 16)

### Handling of Reported Defects

Priorities of identified work should be separated and prioritized. Immediately following a preventive maintenance (PM) inspection, the technician must review the discovered defects and sort them into categories. The categories are:

**Safety defect.** Safety cannot be compromised. The vehicle cannot be released until repairs are completed.

**Mechanical defect.** A defect that will worsen and increase cost. Same as above category - cannot be released until repairs are completed, except for emergency.

**Elective Mechanical Defect.** A defect that does not compromise safety, will not cause further damage if operated, but needs to be corrected prior to next PM cycle. (Example: Thin brake linings that can operate another 1,000 miles) If parts are not readily available, the technician may calculate a time to reschedule vehicle into shop for brake relining within the 1,000 miles. But due to transportation costs and operational disruption, this decision should not be made lightly.

**Elective or Cosmetic Defect.** Defect will not compromise safety and will not cause further damage or cost as it is an aesthetic defect. Vehicle should be scheduled for a future off-peak time, or when repair parts will be on-hand, as determined by the technician, or delayed until the next scheduled PM.

# **PREVENTIVE MAINTENANCE (PM) INSPECTIONS AND SCHEDULED SERVICES**

Preventive maintenance (PM) inspections should be scheduled, performed, and documented according to a schedule. Preventive maintenance and services should follow the minimum required by the manufacturer, supplier, or builder.

PM is important, even for small operators. If PM inspections are not being done according to the guidelines of the manufacturer, supplier, or builder, a grantee may jeopardize any claim to a warranty. A PM maintenance program is based on PM inspections by the vehicle operator and a servicing schedule. **PM begins with a daily, pre-trip inspection.** A sample pre-trip inspection form is included.

## **PM Guidelines**

A common way to conduct operator PM inspections is to use an inspection checklist that follows a separate procedures manual. These may be provided by the manufacturer, vendor, or they can be developed by the agency.

The checklist will:

- specify each item to be checked;
- record repairs and the routine application of fluids; and
- indicate inspection interval ( ie. daily or weekly).

Each operation requires a check and completion requires a signature. Drivers and technicians are less likely to "forget" if a signature is required.

The inspection procedures manual will:

- describe the inspection procedures for each item on the checklist;
- contain a pass/fail standard for each item; and
- describe actions to correct each problem.

The manual can be adjusted as experience is gained or as requirements change.

## **Scheduled Services**

Using the manufacturer's suggested service schedule as a minimum, each vehicle should have a service schedule in the form of a table containing the following:

- when (mileage) each service is to be performed;
- date and actual mileage when service is performed; and
- a column for each service item (oil filter, tire rotation, brake inspection, etc.)

## **Levels of Maintenance**

Many transit systems group PM procedures into a few different levels. The levels commonly used are A, B, C, and D, with “A” comprising the most basic and frequent level of PM, and “D” consisting of more complicated procedures performed less frequently. It is advisable to use a big board in the shop that lays out A, B, C, and D inspections. In addition to mileage criteria, assign an approximate time guideline for inspections based on estimated mileage because odometers sometimes break.

Level A - Approximately 4,000 mile intervals. Change oil and filter, inspect tires, electrical system, service all fluid levels, lubricate chassis and doors, check A/C, hoses, fire extinguishers, belts, brakes, lights, test drive, body damage, etc. Take oil samples and send to the lab.

Level B - 16,000 mile intervals. All items in Level A, plus change transmission oil and filter, check coolant PH.

Level C - 32,000 mile intervals. All items in level B, plus change fuel filter, perform complete engine tune-up, test engine compression, replace air cleaner.

Level D - 64,000 mile intervals. All items in Level C, plus inspect and repack wheel bearings, extensive check of brakes.

## **PM Intervals**

The schedule should be on seven day cycles that closely match the mileage determined. In this manner, each vehicle will always be scheduled for the same day of the week. This method allows for an even scheduling of large and small inspections in a balanced, repetitive manner, allowing approximately the same number of man-hours to be expended each week. Such scheduling contributes to a high level of shop efficiency.

This method does not allow for employee absence or holidays, but assumes an expanded amount of effort by the technician to get the program back on schedule any time the schedule is impacted.

The recommended intervals are based on an approximate vehicle mileage per month. This program is designed to provide an adequate level of PM for all fleet vehicles. This program is calendar based, and designed to place vehicles in the same PM cycle for ease of manpower forecasting and vehicle management. As experience is gained, the program may be adjusted as required. The technician is authorized to adjust, increase, or delete functions in order to maintain a high level of efficiency.

PM inspections are scheduled based on projected mileage, and will increase in level of effort as vehicle mileage is gained. As each level of PM requires more time to complete, PM levels will be assigned in order to provide a balanced workload for the shop, while assuring that each vehicle is afforded some level of maintenance attention without imposing an unacceptable level of initial shop workload.

As all vehicles are not identical, time for completion will vary by a slight amount. The levels of PM assigned and their estimated time for completion are listed below:

LEVEL	CUMULATIVE MILEAGE	EST. TIME REQUIRED
A	4,000	1.7 HOURS
A	8,000	
A	12,000	
B	16,000 (A+CH.TRANS.OIL)	2.7 HOURS
A	20,000	
A	24,000	
A	28,000	
C	32,000 (B+ENGINE TUNE-UP)	4.0 HOURS
A	36,000	
A	40,000	
A	44,000	
B	48,000 (A+CH. TRANS.OIL)	
A	52,000	
A	56,000	
A	60,000	
D	64,000 (C+WHEEL BRG. INSP.)	6.5 HOURS
A	68,000	
A	72,000	
A	76,000	
B	80,000 (A+CH. TRANS. OIL)	
A	84,000	
A	88,000	
A	92,000	
C	96,000 (B+ENGINE TUNE-UP)	
A	100,000	
A	104,000	
A	108,000	
B	112,000 (A+CH. TRANS.OIL)	
A	116,000	
A	120,000	
A	124,000	
D	130,000 (C+WHEEL BRG. INSP.)	
A	134,000	
A	138,000	
A	142,000	
B	146,000 (A+CH. TRANS. OIL)	

REPEAT SCHEDULE

### Example:

A vehicle operates an average of 100 miles per day for five days per week. At 500 miles/week, the vehicle would accumulate 4,000 miles in 8 weeks. This would set the inspection intervals at every eight weeks, every eighth Monday. Another vehicle may be scheduled every eighth Tuesday, or every tenth Friday, as the schedule dictates.

In this manner, the effort for PM inspections has been established and allows for management to predict and assign both PM work and resources in an orderly and cost effective fashion. PM inspections and daily repairs should be consistent with the available daily manpower.

### **PM Management by Exception**

There are many good reasons for varying the planned inspection date. Managing by exception gives you the flexibility to intelligently manage the inspection program to get the best results. It will not hurt the vehicle to have the PM performed off schedule a few miles one way or the other, and it will allow you to manage your program to achieve all the goals you have set.

The technician must have the authority to make decisions on when to delete certain items listed on the PM guide, or make slight adjustments to PM schedule. For example, vehicle XXX comes in for a scheduled D inspection. The technician checks the vehicle's record and finds that the front wheel bearings were inspected and repacked at the time of the last front brake job, only 1300 miles ago. He could then delete the requirement to repeat this process.

As another example, vehicle ZZZ comes in for a scheduled Level B inspection. But, the vehicle history shows the vehicle only operated 190 miles since its last Level A inspection, and has spent the last several weeks in a local shop for body damage repair. The technician may then elect to delete portions of the current Level B inspection, substitute a very rigid inspection of damage related repair items, service all fluid levels, check all safety items, and test drive. He may then wish to change the next scheduled inspection from a Level A to a Level B inspection.

### **State Safety Inspections**

State of Texas safety inspections should be performed at the same time as the PM inspection. To set up a certified inspection station would not be worth the capital cost for smaller fleets. A general "rule of thumb" is that fleet size must be a minimum of 25 vehicles to justify an in-house State Vehicle Safety Inspection. The best time to perform this safety inspection is after the technician has completed PM inspection and repair. This will assure that there will not be problems that could cause rejection.

Fleet should be divided by 12 months in order to ultimately have the same number of inspections due each month. To achieve this goal, some vehicles may need to be inspected early. Likewise, if the vehicle is not scheduled for PM during the month prior to expiration, the cost of inspecting one month prematurely would be far less than scheduling a vehicle just for a state inspection.

## **AMERICANS WITH DISABILITIES ACT & MAINTENANCE**

A preventive maintenance plan for ADA-mandated accessibility features should be in place, including a system of maintenance checks for wheelchair lifts. The ADA elements may be incorporated in the regular maintenance plan or they may be addressed separately, so long as the agency can demonstrate that accessibility features are maintained and operational. Often this requirement of the maintenance program is absorbed into regular inspections and scheduled services.

An agency might want to keep this item separate if they have a lot of wheelchair lifts installed in their fleet. Sometimes wheelchair lifts exceed the life spans of their respective vehicles. TxDOT's policy is to purchase new vehicles with new lifts at the end of the vehicle's service life. However, an agency might be able to recover some costs by selling a well-maintained wheelchair lift on the open market if it has a few years of service life beyond the life of its vehicle.

Agencies should be aware that a vehicle with an inoperable lift must be removed from service before the next day, unless no spare vehicle is available. In this case, the vehicle must not be in service for more than five days (area population 50,000 or less) or three days (area population greater than 50,000).

## MAINTENANCE RESOURCE MANAGEMENT

Adequate resources should be provided by the grantee and used effectively to maintain FTA-funded equipment in good working order. Resources include operating funds to hire and train technicians and other personnel and to purchase tools for the proper maintenance of equipment.

To determine if resources are being maintained properly, the agency should keep records of annual maintenance expense data; lists of deferred maintenance; historical road call records or trends; and management of maintenance personnel (documented training programs, workload balance, etc.). Typical maintenance cost centers include fluids, tires, labor (including training), facilities, and parts.

### Vehicle Card File

A card file should be developed with a card for each vehicle. This card would contain valuable information, and could negate some current problems, whether repairs are performed in the shop or on the road. These cards could be standard 8.5"X 11" or any other size, stored in a file, and would contain vitals for each vehicle. The card need not be limited in size if more information is required. Card can be duplicated for the service center where vehicle is based. Such information is valuable for road calls or for determining that part is in hand before vehicle comes in for scheduled maintenance. Also, such parts may be hard to come by at night and on weekends in small cities. This information allows parts for road calls to be dispatched with the service truck, saving time and money. A blank form is provided at the end of this manual.

#### EXAMPLE:

Vehicle no. 123	Battery type - Group 27
Make Dodge	Model B-350 Ram
Year model 1988	Fuel Gasoline
Engine 318 cu.in.	License no. 137-884
Tire size 7.50x 16.5"	Wheel type 5
Fan belt Mopar # XXXZZZ, NAPA # ??????, GATES # JJJJJJ	
Alternator belt Mopar # ZZZXXX, NAPA # qqqqq, GATES DDDOOO	
Power steer. belt Mopar # WWWSSS, NAPA # NNNNN, GATES # 44444	
Upper radiator hose Mopar # JJJJJ, NAPA # bbbbb, GATES # 99999	
Lower radiator hose Mopar # 88888, NAPA # 77777, GATES # 66666	
Fuel filter Mopar # 22993, FRAM # PH-8A, PUROLATOR # 555555	
Air filter Mopar # 38574, FRAM # CA-336, PUROLATOR # 98765	

## Fleet Plan

A fleet plan is an internal, working document that can be updated whenever plans change or at least annually. This document should cover five (5) calendar years. The fleet plan addresses replacement and expansion without regard to funding availability. The fleet plan should be based on service needs and economic replacement life. It is used to project new equipment deliveries and disposal, and helps to plan grant activities. It keeps track of spare ratios and can help predict when to augment or reduce parts levels. It helps the transit manager consider vehicle rehabilitation or replacement in lieu of extensive repair or constant unscheduled maintenance. The plan can be adjusted as conditions warrant.

### Example:

Period: January 1, 1995 - June 30, 1995  
Procurements: 6 each accessible D/R buses, with A/C  
Funding Source: Section 5311, local  
Purpose: Fleet expansion-increased demand  
Disposal: None  
Adjusted Spare Ratio: 20.19%

Period: July 1, 1995- Dec. 31, 1995  
Procurements: 4 ea. 20 pass. accessible buses, w/AC  
Funding Source: TxDOT, local  
Purpose: Service start-up in \_\_\_\_\_ County  
Disposal: '86 Fords (4), 2 '79 Dodge lifts(2), (#103-106, #201-202)  
Adjusted Spare Ratio: 22.7%

Period: August 1, 1994 - July 31, 1995  
Procurements: (a) 4 ea. 20 pass. access. buses, w/AC  
(b) 6 ea. accessible D/R buses, w/AC  
Funding Source: (a) TxDOT, local  
(b) Section 5311  
Purpose: (a) Increased ridership demand  
(b) Replacement of equipment beyond economic operation.  
Disposal: 1- 1985 Chev.,# 604, 1-1986 Ford, #107, 4- 1987 Chev.,# 300-303  
Adjusted Spare Ratio: 22.7%

The plan could also be presented as a table.

## **Prevention of “Maintenance Deadlock” Cycles**

A subfleet is a portion of a fleet composed of vehicles of the same make and model purchased at the same time. A large subfleet significantly impacts maintenance and must be considered in the agency’s overall planning activities. If operated under identical conditions, all scheduled services on a subfleet will be due at the same time. Eventually, components such as engines and transmissions will need to be rebuilt or replaced at the same time

These simultaneous failure cycles cause “spikes” in workload and operating costs and can potentially interrupt service. Whenever possible, the impact of failure cycles should be kept to a minimum. Basically, the transit manager has to find a way to skew the schedule of services and scheduled rehab or repair to spread out these maintenance activities. The transit manager must make a subjective or qualitative assessment of the operation and the condition of the fleet to avoid simultaneous failure cycles. There is no automated or exact way to accomplish this. Here are a couple of ways to accomplish this depending on the nature of your operation and your maintenance philosophy:

### 1) Divide Subfleet and Dedicate them to a Particular Service

If your operation has some routes that are hard on buses (slow moving, lots of idling, or “gutter grinder” service) and some that are easier on buses (suburban, fast moving, or express service), then you have an easy way to split up the failure cycles on your subfleet. If you keep the same vehicles in the same type of service, then the vehicles that are being used in the “gutter grinder” service will need to be serviced, rehabbed, or replaced more quickly than the vehicles in the express service. When new vehicles are first placed in service, they are often placed into the most demanding service to take advantage of the vehicle warranty, and to "shake out" early defects.

### 2) Rotate Subfleet through Different Types of Service

Perhaps you don’t like the idea of the subfleet being worn out unequally and would prefer to rotate vehicles from difficult routes to easier ones to keep a balance among the service lives of your vehicles. Or maybe the transit system only has one type of service characteristic, so the subfleet can’t be divided into different service types. Then you must prioritize based on maintenance records and fuel consumption rates. You will want to put the vehicles with the highest operating costs on the top of your list.

By careful, subjective manipulation, the technician can skew and spread these cycles. For example, the PM interval can be extended slightly on the subfleet vehicle in easy suburban service. The PM inspection on the hard running vehicle can be done a little prematurely. A subfleet vehicle with thin brake pads can usually go a few more days if in easy service and watched carefully. If in hard urban service, brake pads can be replaced a few days early. This subjective effort can reduce the subfleet time-mileage relationships to the point that the "maintenance deadlock cycle" will be kept to a minimum or not experienced at all. Sadly, no magic formula has ever been developed. This can only be done through experience and expertise.

## Parts Management

By keeping a replacement part on hand for every vehicle component, a transit agency would be able to keep vehicle down-time to a minimum. However, this would be an expensive practice. Besides the cost of buying a part that is not immediately needed, there are storage and warehousing activity costs, and a potential future cost is incurred if a part becomes obsolete.

Obviously, a more balanced approach is required. All replacement parts should be identified, but not all of them are kept on hand. The supply source depends upon the frequency that the part fails, especially when part failures lead to road calls. If an agency can develop accurate parts statistics, it has an opportunity to benefit from parts cost controls by knowing where a part should be stored. For instance, a part with high failure frequency should be very accessible to the technicians:

Part Failure Rate	Part Source	Warehousing Cost	Vehicle Down-Time
High	In-Stock	High	Low
Medium	Local Vendor	Medium	Medium
Low	Remote Vendor	Low	High

## Fixed Mileage = Fixed Life

Some agencies adopt a fixed mileage approach when looking at the life expectancy of parts. For example you might consider changing key belts every 50,000 to 60,000 miles. Similarly, don't try to squeeze too much life out of an alternator. To safeguard against breakdowns or collateral electrical problems, consider changing alternators every 175,000 to 200,000 miles, regardless of their performance at the time.

## Core Value

Many parts retain a core value even though the part is broken. Suppliers may apply a credit or discount to the customer when the part is replaced if the customer returns the old part. In cases where an agency has many vehicles of the same type, with the same power trains and other parts, it is advisable to keep a few part cores on hand. In addition, consider keeping enough cores on hand for the remaining service life of a vehicle in cases where a part is becoming obsolete.

## **Maintenance Facility Management**

The shop and office facilities should receive the same level of care extended to the fleet. It is the responsibility of the technician to assure the facility and its equipment is kept clean and in good repair at all times. A sample facility inspection checklist is on page 29 of this manual.

## **Safety**

Safety is the most important concern in managing the maintenance facility. Safety must be practiced at all times, and mandated by management. It is the responsibility of management to ascertain that safe practices are in place at all times, and to conduct **REGULAR** and **DOCUMENTED** safety meetings. All safety posters and reminders should continually be posted in the shop. OSHA rules and regulations should be followed at all times.

Fire safety shall be observed at all times. Fire extinguishers should be professionally serviced annually. Advice and guidance from the local Fire Marshal should be solicited and followed. Storage of all flammable materials should be within code at all times. Good fire safety practices can prevent fires and lower insurance rates.

## Chemical and Waste Management

The Resource Conservation and Recovery Act (RCRA) of 1976 mandated a national regulatory system to control hazardous waste from “cradle to grave”. One of the implications of the RCRA regulations is that generators of hazardous waste can be held liable for a portion of the cleanup of spills or for mismanagement, even if the problem is caused by a waste transportation or disposal company without the knowledge of the generator. In other words, the act of giving, selling, or even paying for safe disposal does not relieve a transit system from financial responsibility of clean up costs, fines, and/ or prosecution.

In many cases, the seller of the new product can be required to accept the waste of that product for recycling. In many cases, it may be an advantage to include a requirement for the seller to accept and recycle the waste product in the purchase agreement. This must be done carefully to be certain the seller will handle the waste in the manner required by law.

### Waste Determination

Most fleet maintenance facilities generate some hazardous wastes and/or other wastes that are regulated by state or federal environmental programs. Hazardous wastes include those chemicals that are specifically “listed” in the EPA regulations (40 CFR 261.31-33) and/or wastes that exhibit any of the four hazardous characteristics: corrosivity, reactivity, ignitability, or toxicity:

*Corrosivity:* a pH less than or equal to 2 or greater than or equal to 12.5. Strongly acidic/alkaline.

*Reactivity:* chemically unstable, may react violently with air, water, other chemicals, or wastes that release any cyanide or sulfide. Not commonly encountered at vehicle maintenance facilities.

*Ignitability:* liquid with a flash point of less than 140 degrees F. Spent solvents and paint wastes are sometimes hazardous due to ignitability.

*Toxicity:* A list of 40 chemicals (heavy metals, pesticides, and organics) specified by EPA. The lab test used to determine toxicity is called the Toxicity Characteristic Leachate Procedure (TCLP). Trichloroethylene, benzene, and lead often make a waste hazardous based on the TCLP.

### Generator Status

Facilities that generate hazardous wastes are classified into three categories according to the amount of hazardous waste generated per month. A *large quantity generator (LQG)* generates more than 1000 kilograms (2200 pounds or about 260 gallons) per month. A *small quantity generator (SQG)* generates from 100 to 1000 kilograms of waste per month. A *conditionally exempt small quantity generator (CESQG)* generates less than 100 kilograms (220 pounds or about 26 gallons) of hazardous waste per month.

Most fleet maintenance facilities that generate hazardous waste are SQG or CESQG facilities.

Typically, the maintenance facilities of Metropolitan Transit Authorities are considered SQGs. CESQGs are exempt from many of the regulations so long as hazardous wastes are properly identified and sent to an appropriate disposal or recycling facility. CESQGs are allowed to accumulate no more than 1000 kg of hazardous waste on site at any one time without a hazardous waste storage permit.

SQGs may accumulate no more than 6000 kg of hazardous waste on site, and must dispose of the waste within 180 days (270 days if the disposal facility is more than 200 miles away) while complying with the accumulation, storage and disposal rules for small quantity generators.

### **Generator Requirements**

Facilities that are considered “industrial” must assign waste code numbers to both hazardous and non-hazardous wastes. But the TNRCC considers most fleet maintenance facilities to be “municipal” rather than “industrial” facilities. The TNRCC requires municipal facilities to assign waste code numbers to hazardous wastes only. However, it is important to note that all wastes are regulated and require proper management and disposal.

Municipal generators should include a Texas Waste Code Number on the manifest accompanying hazardous waste shipments. This number may be assigned by the generator, or, in the case of one-time shipments, assigned by TNRCC upon submission of the proper form. Information on classifying waste and assigning waste code numbers is summarized in TNRCC’s RG-22, “Guidance for the Classification and Coding of Industrial Wastes and Hazardous Wastes”.

Waste containers need to be properly labeled. Hazardous waste shipments should be accompanied by manifest documents with the appropriate copies maintained on file for at least three years. SQGs and LQGs must register with EPA and maintain a Notice of Registration with the TNRCC listing all hazardous waste streams. Facilities that generate hazardous waste and are not CESQGs will need to submit an Annual Waste Summary Report to TNRCC each year. This report requires the generator to quantify and account for the disposition of waste generated at the facility. Also, hazardous waste generators, except for CESQGs who are exempted, are required to submit a Source Reduction and Waste Minimization Plan to TNRCC.

### **Typical Waste Streams**

*Waste Vehicle Lubricants* - While generally not a hazardous waste, petroleum-based fluids must still be carefully managed. If kept in clean storage, used oil and other lubricants can usually be accepted by an authorized recycler (registered with TNRCC), at little or no cost.

*Spent Batteries* - These are commonly recycled, which can be made a condition of the purchase contract. They should be stored in a manner that prevents releases to the environment. Batteries with damaged cases should be containerized to prevent releases. Old batteries should be recycled or disposed within one year of generation.

*Scrap Tires* - not classified as hazardous waste, but generally not accepted by landfills unless split, quartered, or shredded. Tire recycling or disposal companies are available to collect used tires in most areas - usually for a fee.

*Used Oil Filters* - should be punctured and thoroughly drained to remove liquids. The recovered oil and filter are recycled separately. Containers used to store filters should be clearly labeled.

*Spent Solvents* - Solvent recycling programs are available in most areas and can reduce the liability associated with disposal. The use of non-ignitable (low flash) solvents for washing parts may result in a non-hazardous waste stream .

*Used Antifreeze* - Draining into the sanitary sewer is generally prohibited by local sewer and pretreatment ordinances. Authorized recyclers can usually pick up used antifreeze. Recycling equipment is available for purchase, but some equipment may not remove all impurities.

*Refrigerant* - Air conditioning refrigerants must be recycled. Technicians servicing these systems should be certified by an EPA approved training program.

*Paint Wastes and Thinners* - must be sent to an authorized treatment, storage, disposal or recycling facility. Frequently, the companies that service and recycle parts cleaning solvent can set up a waste stream to pick up paint wastes as well.

*Discharge to Sanitary Sewers* - Any discharges, such as vehicle wash water, should comply with municipal discharge ordinances and/or industrial sewage discharge agreements. The discharge of wash bay wastewater to septic systems should be avoided unless the appropriate State or county permits can be obtained.

### **Material Safety Data Sheets (MSDS)**

The Occupational Safety and Health Administration's (OSHA) Hazard Communication Standard, and the Texas Hazard Communication Act are designed to ensure that employers and employees are aware of all chemical hazards in the work place. MSDSs are the primary source of information on all chemicals used in the workplace. Each time a new product is procured, the data sheet should be obtained from the supplier, and placed in a designated location readily accessible to employees. The MSDS contains the physical and chemical characteristics and health hazards associated with the product, as well as handling precautions and emergency procedures.

A product's MSDS should be evaluated prior to purchasing or accepting trial samples of a product. This information can be useful in determining if accepting the product poses additional safety concerns or if unused residuals will require disposal as hazardous waste.

## **WARRANTIES**

A warranty is an assurance from a manufacturer that a product will perform properly for a specific time or usage level. Warranties cover new vehicles, new / replacement parts and most vendor's work. If the product fails to meet this assurance, the manufacturer is obligated to make restitution by replacing or repairing the defective product, or reimburse the owner for the cost of the repair or replacement. Warranties may be formal written policies or implied warranties.

Warranty claims should be pursued effectively and promptly. The warranty of rolling stock, physical plant, and equipment often is valid only if a grantee adheres to the manufacturer's recommended maintenance program. A warranty recovery system, warranty records, and annual summaries of warranty claims submitted and received should all be maintained by the agency.

A warranty program is also an opportunity to provide feedback to manufacturers regarding their product. Most manufacturers rely heavily on this information when considering product improvements. Some improvements can result in field corrections (recall notices and campaigns).

Prior to performing repairs and seeking restitution, the agency should request approval to perform warranty repairs from the vendor, and in some cases, the manufacturer. To facilitate the process of identifying warranty items, a review of the individual vehicle's history file should be conducted first. Towards the front of each file, a list of all warranties should be kept. This list can be a simple ledger of the warranty items and the expiration date. As individual warranties expire, they should be crossed out and as new warranty-covered work or parts are installed, they should be added to the list.

Whenever possible request the use of the agency's repair order as the warranty claim form. Documentation should include the date and mileage of the failure, the identification number of the vehicle, the work which was performed and why, and costs incurred. Make sure the part can be matched with the warranty claim.

### **It is helpful to know the following about your warranties:**

- compensation others are receiving - use this knowledge as leverage in bargaining;
- the reimbursable labor rate (this could be a flat rate, or it could be based on actual time and materials used). It should include a percentage for overhead; and
- if they only cover failed parts, or if modifications to correct the problem will also be covered.

### **Following are some reasons agencies don't receive maximum benefit from a warranty program:**

- warranty coverage is not understood, and therefore, never filed;
- repair work is performed before it is determined that the failure was warranty related;
- information for the warranty claim is lost;
- failed part cannot be matched to the warranty claim;
- warranty claim not submitted on time; and
- apathy or "too much paperwork."

## **SUBCONTRACTS**

When equipment is operated under contract to a private operator, the grantee should require a maintenance plan which should be monitored. When a grantee has contracted out a portion of its operation, a maintenance plan for federally funded equipment should be in existence and organized like the maintenance plan described on page two (2) of this manual.

Periodic inspections should occur, and written reports on maintenance should be required from a contractor. Contracts for service and maintenance reports from contractors should be on file. Contract language should include maintenance requirements when services are re-bid and should require contractors to correct all deficiencies and defects identified by the grantee's maintenance monitoring.

## MAINTENANCE CONTRACTS

The Federal Transit Administration (FTA) recognizes four ways to procure maintenance services, based primarily on the estimated cost of the service. A decision tree on the next page prescribes the best procurement method based upon the needs of the transit agency. In order to select the most appropriate procurement method, an agency must have some estimate of the price and must have a realistic self-assessment of the agency's ability to identify and articulate its own maintenance needs. (*Can the agency develop an adequate specification for the purchase?*)

In all cases, one quote should be solicited from a Disadvantaged Business Enterprise (DBE).

### 1. Small Purchase

Many small urban, rural, and specialized transit systems that have no in-house maintenance capabilities use small purchase procedures at least occasionally. The intent of a small purchase agreement is to avoid the high administrative costs of a competitive procurement for a single purchase. Splitting up a series of similar purchases from the same company or "chain buying" is illegal and does not conform to the intent of the small purchase agreement.

A small purchase is only allowable if the estimated purchase price is less than \$5,000. If it is less than \$1,000, an agency may award a purchase order based upon a single verbal quote. If the estimated purchase price is between \$1,000 and \$4,999, three verbal quotes will be solicited.

### 2. Competitive Sealed Bids

This process, often referred to as the invitation for bids (IFB), is used when price competition is the foremost concern of the agency. The agency should solicit a minimum of three bids. Other conditions which make an IFB appropriate include:

- a complete, adequate, and realistic specification or purchase description is available,
- two or more responsible bidders are willing and able to compete for the contract, and
- the procurement lends itself to a firm fixed-price contract and the successful bidder can be determined based on price.

An agency may consider other factors besides price, such as location of service facility, because it impacts the life-cycle cost of the contract, but this is generally discouraged in the IFB process.

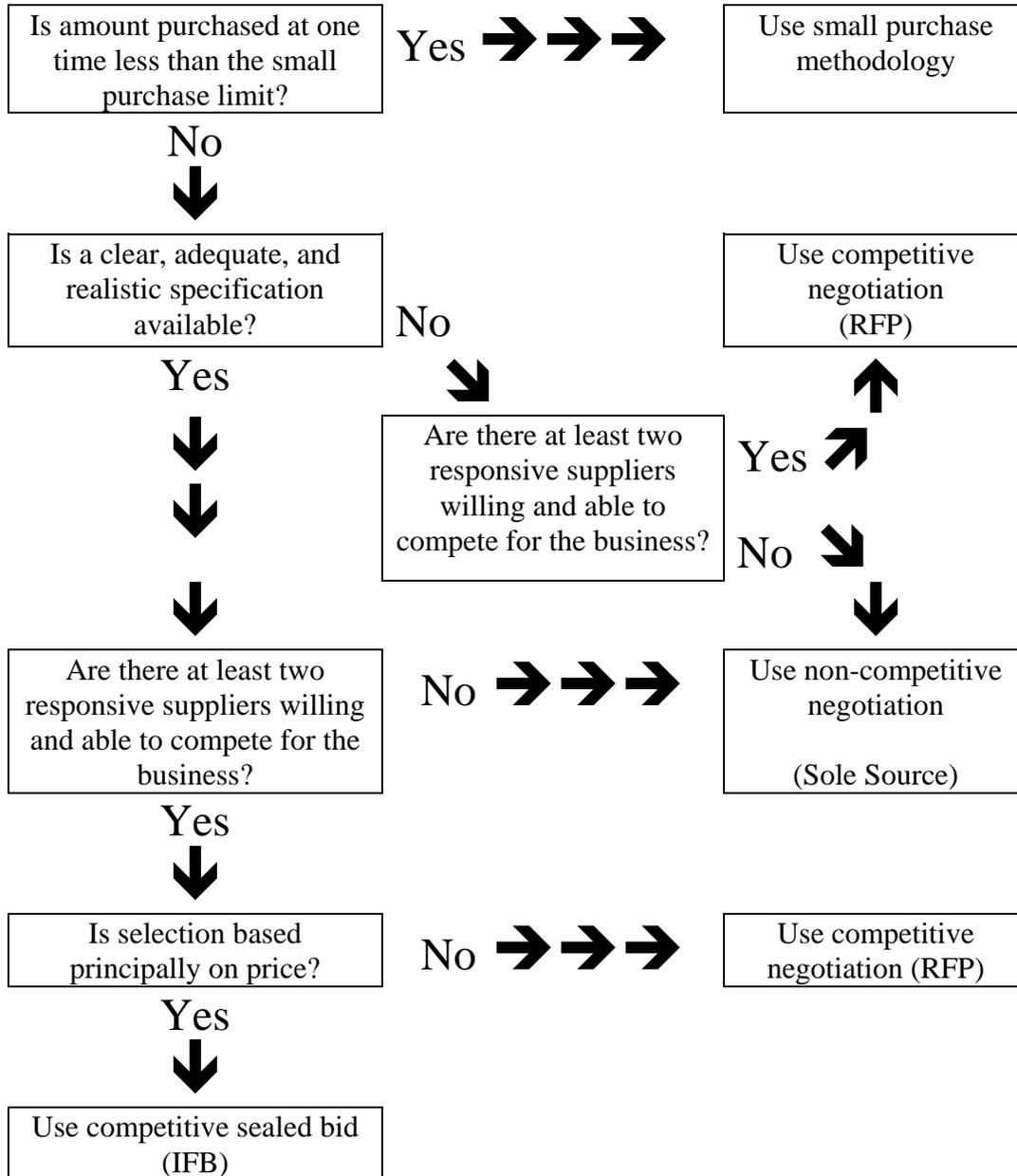
### 3. Competitive Proposal/Negotiation

This process, often referred to as a request for proposals (RFP), is used when other factors besides price are important to the agency. Prospective contractors submit proposals which are evaluated and scored. Factors commonly evaluated in RFPs include qualifications of technicians, capacity of facilities and equipment, financial stability of the contractor, experience with similar equipment, ability to complete work in a timely fashion, price, and other factors the agency deems important.

### 4. Sole Source

This method is generally permissible only in special cases, such as a complete lack of competition or where there is only one source for the needed service.

## Maintenance Procurement Decision Tree



Total	Quotes	Award to...
under \$1,000 or \$2,000*	single verbal	single quote
(\$1,000 or \$2,000*) to \$5,000	3 verbal-without central bid list	lowest responsive bidder
\$5,000 to \$10,000	3 verbal-with central bid list	lowest responsive bidder
\$10 to \$25,000	3 written	lowest responsive bidder

\*\$1,000 for a non-certified buyer or \$2,000 for a certified buyer (NIGP - National Institute of Government Purchasers or CPM - Certified Purchasing Manager)

## **GUIDANCE ON MAINTENANCE MANAGEMENT INFORMATION SYSTEMS (MMIS)**

Automated Maintenance Management Information Systems (MMIS) are useful to transit agencies of every size. Even an agency with 2 or 3 vehicles can benefit from an MMIS. A small agency can obtain a free MMIS on the internet (see the resource section of this manual for some helpful sites).

Larger agencies are encouraged to purchase an MMIS with accompanying technical support. Before doing so, agencies should browse the shareware site and sample different applications. Use various search terms like “fleet maintenance”, “vehicle maintenance”, and “preventive / preventative maintenance” for the widest selection. Do not discriminate against programs that are designed for trucks as opposed to buses; they are more similar than they are different.

An MMIS should be able to perform the following functions and generate accompanying reports:

1. Determine vehicle status, including the tracking of mileage
2. Track PM inspections
3. Schedule inspections and repairs
4. Update vehicle histories
5. Assign costs
6. Update Inventory
7. Issue purchase orders
8. Verify shipments
9. Document roadcalls
10. Track and document warranty recovery

Agencies purchasing maintenance software should ensure that the software is “millennium - friendly.”

# **TOP TEN MAINTENANCE PRACTICES**

**Adopted from Bus Ride Magazine's  
March 1998 Staff Report**

Good maintenance can be described by “the three Ts”: Tools , Training and Time. That is, the right tools at the right place to do the job. Take time for continuing education and training to assure proper techniques and procedures are being used, and take the time to do the job right.

## **1. Record Keeping**

Tracking maintenance work helps “ferret out” or recognize problems. Good record keeping also helps trace the performance of critical parts and equipment. It is important to understand the history of a unit or component.

## **2. Well - Equipped Parts Room**

Keep an appropriate amount of spare parts on hand at all times (See page 11 of this manual)

## **3. Networking**

Don't hesitate to pick up the phone and ask someone when you have a problem, and that includes vendors and manufacturers. Know your vendors and use their training programs.

## **4. Diligence**

Maintenance is a team effort beginning with the maintenance department and including drivers, parts, and accounting. The maintenance staff must review driver inspection reports and subsequent breakdowns to determine if they were preventable. If preventable, was the driver unaware of the symptoms or did maintenance fail to follow through? Communication with management, other shifts, and with other staff members is critical. Show your appreciation to your staff, including the floor cleaner, technicians, body shop specialists and clean up teams.

## **5. Driver Training**

Every driver should have a basic tool kit - screw drivers, vise grips, adjustable wrench, pliers, flashlight and the like. A technician can often give a driver simple instructions over the phone to fix the problem.

## **6. Assign the Right People to the Right Jobs**

Don't necessarily assign rebuilds to your top people. Top maintenance staff members should frequently be on the front line, servicing vehicles and looking for problems.

## **7. Read Service Literature and Stay Up-to-Date with New Procedures**

It is critical to keep current on chassis and body maintenance bulletins and information. Submit all necessary forms to manufacturers to receive service bulletins, product updates and recall notices. Also, stay in contact with your bus dealer and/or manufacturers regarding problem areas and make recommendations for improvements.

## **8. Use Oil Analysis**

Oil analysis should be run after each regularly scheduled oil change. A vigorous program of oil sampling, including transmission oil, can help extend engine and component life. Also, oil analysis can extend oil-drain intervals, increase driveline life, reduce maintenance cost and minimize on-site waste.

**9. Emphasize the Basics**

That means hitting the lube intervals and oil changes on schedule, keeping the air intakes clean and completing tune-ups as the OEMs recommend. Adhere to regular service intervals. (See pages 3 - 6 of this manual).

**10. Commitment from the Top**

The importance of first-rate maintenance must be emphasized from the top of the organization. Lead by example to put a strong effort behind the maintenance program.

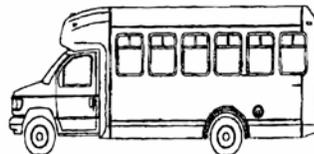
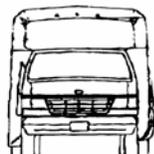
**SAMPLE  
MAINTENANCE PLANS,  
FORMS & CHECKLISTS**

## Procedures for a Pre-Trip Inspection

1. Begin the inspection with the vehicle turned off. Walk around the vehicle to inspect the body, windows, and mirrors for damages. Look for dents and cracks. Look for rust streaks (indicating a hole or crack) and shiny spots (indicating a missing part). Check the overall symmetry of the vehicle. This can help to identify missing parts. If the vehicle is leaning, there could be a suspension problem. Ensure that the license plates are secured.
2. Check the ground under the vehicle for leaks and the under carriage for loose parts.
3. Check the condition of all tires including the spare if provided. Look for cracks, bubbles, or nicks. Measure the tread depth and pressure. The correct maximum cold pressure is indicated on the tire's sidewall. When front tires are viewed from the front, and the rear tires from the back, they should not appear warped (warping indicates cord separation.) Ensure lug nuts are present and tightened.
4. Open the hood. Inspect the batteries. Check the fluid levels unless the batteries are maintenance free. Look for loose cable connectors. Tighten if loose and look for corrosion on the terminals.
5. Examine belts and hoses. When pushed in the middle between pulleys, any belt should not compress more than ½ inch. Twist the belt and look for cracks and excess wear. Rubber hoses need a similar test. If any hose is too hard, brittle or has cracks, report it immediately.
6. Measure fluid levels (-transmission). Be certain that the radiator fluid, oil, power steering, and windshield washer fluid reservoirs are filled. Record additions of fluid.
7. Start the engine. Cycle the lift. Pay special attention to the wheelchair securement system and how it operates. Double check safety barriers and make sure the lift runs smoothly through the entire cycle. Check for hydraulic leaks and cracked hoses. Check equipment necessary for manual operation.
8. Check the transmission fluid level. Make sure the vehicle is on level ground. Place chock blocks if equipped. Set and check the parking brake. Set the transmission in neutral. Close the hood when complete. Record additions of fluid.
9. Turn on the headlights and 4-way flashers. Check the dash lights, gauges, dome, and stepwell lights. Check the high and low beams on the headlights. Walk around the vehicle to check each lamp and lamp cover of the clearance lights and brake lights. Check all reflectors. Check destination signs. Have someone assist you in checking the turn signal lights, brake lights and the back-up lights and alarm (if installed). Check horn and windshield washers/wipers.
10. Check the inside of the vehicle for loose objects and cleanliness. Make sure all seatbelts, safety restraints, and securement devices are available and functioning. Check all ancillary equipment (fire extinguisher, first aid kit, emergency reflectors, farebox, radio, and passenger stop signal/chime). Check that emergency exits are clear and properly secured.
11. Make sure you have all the documentation (license, registration, proof of insurance) and anything else required (log book, gas card, etc.).
12. Refuel the vehicle if necessary.

## Pre-Trip Inspection Checklist

Procedure	Yes	No	Comments / Technician Referral
1. Walk around inspection			
2. Under vehicle check			
3. Tires			
4. Batteries			
5. Belts & Hoses			
6. Fluids (-transmission)			
Radiator			Added_____qts.
Oil			Added_____qts.
Power Steering			Added_____qts.
Windshield Wash			Added_____qts.
7. Cycle Lift			
8. Transmission Fluid			Added_____qts.
9. Lights / Signals			
10. Inside Vehicle			
11. Documentation			
12. Fuel			Added_____gal.



**PLACE AN X TO INDICATE BODY DAMAGE**

Vehicle #	Completed By	Signature	Date

## Vehicle Cleanliness Inspection / Task Sheet

<b>Date:</b>		<b>Vehicle #</b>	
<b>Cleaned By:</b>			
1. Stanchions Wet Wiped		15. Route Sign Front / Rear Cleaned	
2. Side/Rear Windows Washed		16. Inspect Seats for Cuts	
3. Interior Panels / Sidewalls Washed		17. Inspect Windows for Cracks	
4. Windshield		18. Interior Light Lenses Cleaned Inside & Out	
5. Dashboard		19. Ceiling Cleaned	
6. Driver's Seat		20. Inspect Tires for Excessive Wear / Damage	
7. Mirrors (Interior & Exterior)		21. Clean Wheels/Treat with Protectorant	
8. Destination Sign Wet Wiped		22. Clean Window Track	
9. Fire Extinguisher Checked		23. Clean Wheelchair Lift and Platform	
10. Wheel Housing Washed		24. Clean Upper Deck behind Rear Seat	
11. Remove Gum/Other Articles from Floor		25. Note Other Visible Damage	
12. Floor Washed			
13. Seats Washed / Wiped			
14. Interior Door & Stepwell Washed			
Special Instructions:			
Comments:			

## Tips for Seat Maintenance

1. Always start with the mildest cleaning agent available and work to the strongest.
2. Frequency of cleaning with mild solutions is most beneficial to the overall appearance of the interior.
3. It is important not to use the stronger solvents for overall cleaning. These solvents remove the plasticizers in the vinyl and will cause premature cracking.
4. The faster a stain is attacked, the easier it is to remove.

In the case of tears, cuts or burns, the most important thing is to stop the hole from expanding. There are many kits on the market for small hole repair which can be found at hardware stores. Basically, they use a solvent type glue or vinyl material to heal the rip. It is a good idea to glue in a reinforcing patch behind the hole.

For a more professional approach consider the use of vinyl repair services. A good source of information about these services is a auto dealer's used car detailing department. For large rips or tears, reupholster the seat before the foam is damaged.

### Stain Removal

Stain	Agent	Stain	Agent
Chocolate, Blood	a, b, c	Wine	a, c, f
Grape Juice, Washable Ink, Mucous	a, b	Paint (Latex)	a, b, e
Vomit, Water Colors	a, b, f	Oil	d, e
Rubber Cement, Shoe Polish	a, b, d	Iron Rust	a, g
Tea, Milk, Mustard, Egg, Gravy, Cola	b	Ink (Permanent / Ball Point)	b, d, e
Catsup, Linseed Oil, Carbon Black, Butter, Nail Polish, Chewing Gum,	d	Furniture Polish	b, e
Crayon, Lipstick, Paint (Oil)	e	Coffee	b, d, f
Beer, Urine	b, f		

#### Key to Cleaning Agents

- a. Water
- b. A detergent solution
- c. A detergent / Ammonia (3-6% solution)
- d. A volatile-type solvent
- e. A paint, oil, or grease remover
- f. Undiluted white vinegar
- g. Citric or oxalic acids

## PM GUIDE AND CHECKLIST

VEHICLE NO	TIME ON	TIME OFF
DATE	DATE OF LAST REVISION	
ODOMETER	DUE FOR (A B C D) INSPECTION (select one)	

SYMBOLS: A-ADJUST; C-CLEAN; CH-CHANGE; I-INSPECT; L-LUBRICATE; O-OBSERVE; OT-OPERATING TEST; S-SERVICE; T-TIGHTEN; D-TEST DRIVE.

PM LEVEL				ITEM	PROCEDURE
D	C	B	A		
				<b>VEHICLE INTERIOR</b>	Protect vehicle interior to prevent soiling cushions, controls, carpets, etc.
				<b>INSTRUMENTS</b>	While driving vehicle into shop, <b>O</b> and <b>I</b> all instruments and controls, indicator lights, <b>OT</b> brakes and steering
				<b>LIGHTS/MIRRORS INSIDE/OUTSIDE</b>	<b>I</b> lights, reflectors, and mirrors. Check all lenses, reflecting surfaces + mountings
				<b>WINDSHIELD WIPERS</b>	<b>O</b> operation, <b>I</b> blade condition <b>S</b> washer reservoir
				<b>BATTERY</b>	<b>I</b> specific gravity, <b>S</b> water level, <b>C &amp; T</b> cable connections, <b>I</b> cables
				<b>BRAKE SYSTEM</b>	<b>S</b> fluid level, <b>I</b> leaks & hoses
				<b>WHEEL BEARINGS</b>	<b>C, I, &amp; repack. I</b> lining wear, leaks
				<b>STEERING</b>	<b>S</b> fluid level, <b>I</b> for leaks
				<b>TRANSMISSION</b>	<b>S</b> fluid level, <b>I</b> for leaks, <b>I</b> linkage
				<b>TRANSMISSION</b>	<b>CH</b> fluid & filter
				<b>ENGINE</b>	<b>CH</b> oil & filter, <b>C</b> PCV valve & breather <b>I</b> all pollution control equipment, <b>I&amp;A</b> all belts, <b>C</b> or <b>CH</b> air cleaner element
				<b>CHASSIS</b>	<b>L</b> all fittings, <b>I</b> complete chassis, including universal joints
				<b>REAR AXLE</b>	<b>I</b> leaks, <b>S</b> lubricant level, <b>C</b> breather
				<b>ENGINE</b>	Perform tune-up per manuf. specifications <b>CH</b> spark plugs, <b>I</b> plug wires, distributor cap, rotor & mechanical and vacuum spark advance, <b>CH</b> air cleaner, <b>CH</b> fuel filter
				<b>SEATBELTS, WHEELCHAIR SECUREMENTS</b>	<b>I, C,</b> all
				<b>WHEELCHAIR LIFT</b>	<b>S</b> fluid level, <b>I</b> leaks, <b>T</b> lift, <b>L</b> and <b>I</b> mechanism, <b>I&amp;L</b> lift compartment doors, <b>I&amp;A</b> lift limit switches
				<b>WHEELS/TIRES</b>	<b>I</b> uneven wear, condition, <b>T</b> lug nuts
				<b>EXTERIOR</b>	<b>I</b> dents, paint and body damage
				<b>INTERIOR</b>	<b>I</b> seat belts, carpets, seats, headliner, door panels, fire extinguisher
				<b>ROAD TEST</b>	<b>D</b> short test drive

Inspected By: \_\_\_\_\_ Approved By: \_\_\_\_\_

## FACILITY INSPECTION CHECKLIST

A=MONTHLY  
B=SEASONALLY  
C=ANNUALLY

SYMBOLS: A-ADJUST; C-CLEAN; CH-CHANGE; I-INSPECT; L-LUBRICATE; O- OBSERVE; OT-OPERATING TEST; S-SERVICE; T-TIGHTEN; D-DRAIN

### ADMINISTRATIVE BUILDING

- A \_\_\_\_\_ Office HVAC System: CH air filters, I entire system, O operating pressures, L all bearings.
- C \_\_\_\_\_ Office HVAC System: C condensing coils, C blower fans, C air diffusers, I refrigerant and oil level.  
I & A pilot light operation. I heat exchanger.
- C \_\_\_\_\_ Office water cooler: C condenser coils, O operation, A water stream.
- C \_\_\_\_\_ Hot water heater: O operation, D tank sediment, A pilot light.
- A \_\_\_\_\_ Lighting, inside & outside: O all lights, CH all defective lamps, C light diffusers, reflectors.
- A \_\_\_\_\_ Refrigerator: O operation, defrost function.
- C \_\_\_\_\_ Refrigerator: C condensing coils.
- A \_\_\_\_\_ Restrooms & Kitchen Plumbing: O leaks, O operation.
- A \_\_\_\_\_ Fire extinguishers: I gauge, seal, tag, mountings.

### FACILITY GROUNDS

- A \_\_\_\_\_ O&A all sprinkler heads, spray pattern, function. O & A Timer function. Set for watering activity before or after normal facility hours.
- A \_\_\_\_\_ Perimeter and security fencing: O & I all fencing, gates, locks, etc. L gate hinges.

### TOTAL FACILITY

- B \_\_\_\_\_ Take all seasonal precautions to protect against sub- freezing weather and freeze damage. Turn off, drain or cover all water conduits, shrubs, etc. subject to freeze damage.

### SHOPS

- A \_\_\_\_\_ Air compressor: D water from air tank, I & A drive belts, S compressor oil level, L motor bearings,  
I & A pressure regulator cut-in & cut-out pressure.
- C \_\_\_\_\_ Air compressor: CH compressor lubricating oil.
- A \_\_\_\_\_ Fire extinguishers: I gauge, seal, tag, mountings.
- A \_\_\_\_\_ Vehicle lift: I & S & L. OT general operation.
- A \_\_\_\_\_ Shop tools and equipment: I & S.

\_\_\_\_\_  
COMPLETED BY:

\_\_\_\_\_  
DATE:

\_\_\_\_\_  
APPROVED BY:

## **Transit Agency: Maintenance Goals and Objectives**

**Goal:** To ensure proper running condition, cleanliness, and proper equipment of all the vehicles of our transit system. To provide less down time of the vehicles and timely maintenance for repairs before a break down can occur.

### **Objectives:**

1. To provide proper training classes for all drivers to understand the importance of pre-trip inspections and post-trip checks and provide proper checklists.
2. To perform pre-trip inspections of all vehicles before they make a trip and a post-trip inspection when the vehicle is returned.
3. To perform preventive maintenance (PM) on all the vehicles at 3 months or 3000 miles of use and a once a year or 50,000 mile complete check.
4. To have an emergency plan for vehicles that break down causing a road service call.
5. To have a monitoring system in place to ensure that the PM program is being performed.
6. To monitor repairs to see if they could have been prevented by a more complete PM or pre-trip checklist.
7. To perform maintenance and servicing as required by the manufacturer on new vehicles to allow us to maintain warranty coverage and recover costs of warranty repairs.

**The following are checklists** that will be used by all the subcontractors in our maintenance program which will be forwarded to the agency for filing:

1. The Daily Pre-Trip/Post-Trip inspection checklist
2. A 3000 mile/3 month maintenance program: change fluids and check for parts that may be worn out or may cause a break down. This must be done by a certified technician.
3. A 50,000 mile/once a year scheduled maintenance program for all the vehicles . This will involve a trained technician that will do service recommendations on all parts of the vehicle.
4. A vehicle emergency repair/road service call report filed with the agency for any vehicles that break down causing emergency repairs of the vehicle or emergency road service call.

The agency will be responsible for the monitoring of the vehicle maintenance program. The agency will make the forms necessary for performing PM emergency repairs. The agency will determine if the break down could have been prevented by adding an item to the checklist and supplying any updates to the PM program. The agency will also monitor all the safety equipment as required by the contract.

At the time the agency becomes aware of any failure to comply with the PM program or any failure to maintain safety equipment as required, a notice will be sent to the Project / Executive Director in charge of that vehicle or equipment requesting the defect be remedied. A follow-up monitor visit will be made 15 days after the notice is sent. If the defect has not been remedied within that time, no additional unit trip rates will be paid until the defect is remedied and the vehicle or equipment is again checked by agency personnel.

A violation of the safety inspection of the vehicle will not be funded from the month and year of the inspection sticker until vehicle has the proper safety inspection on the windshield.

TRANSIT AGENCY: PM Checklist  
3 Mo/3000 Mile Check by Technician

Vehicle # \_\_\_\_\_ Mileage \_\_\_\_\_ Date \_\_\_\_\_

1. To be completed by subcontractor:

Was any oil added this 3000 miles? No Yes How many quarts? \_\_\_\_\_

Was antifreeze added? No Yes Approx amount \_\_\_\_\_ gals

Any problems noted to be checked out; (be specific as Possible)

\_\_\_\_\_

\_\_\_\_\_

2. To be completed by technician: (circle corresponding answers)

Oil Pressure: arrival to shop \_\_\_\_\_ PSI departure from shop \_\_\_\_\_ PSI

Oil and Filter Change: 0-100,000 use 10W/30 100,000 + use 10W/40 or as recommended by manufacturer. # of quarts used \_\_\_\_\_ and type \_\_\_\_\_ Filter # \_\_\_\_\_

Was oil black? Yes No Was oil thick? thin med thick

Were all joints greased as recommended? Yes No

Was there any slack in the U-Joints? No Yes some needs replacing

Was air filter changed? No Yes Because: dirty oily both (circle)

Transmission Fluid Checked? OK Added Notes \_\_\_\_\_ Color \_\_\_\_\_

Power Steering fluid checked? OK Added Notes \_\_\_\_\_

Radiator and coolant reservoir? OK Added Notes \_\_\_\_\_ Color \_\_\_\_\_

Brake Fluid checked? OK Added Notes \_\_\_\_\_

Washer Fluid full? OK Added

A/C checked? OK Temp \_\_\_\_\_ Added Oil \_\_\_\_\_ cans

Muffler and Tailpipe? OK Needs replacing muffler tailpipe (approx cost \_\_\_\_\_)

Brakes check? Pads/Shoes: OK Needs Replacing Rotors/Drums: OK Needs Turning

Lines: OK Needs Replacing where \_\_\_\_\_

Pressure: OK Possible Leak Emergency Brake: OK Needs adjusting

Tires: Pressure: OK Added. Wear: OK worn notes \_\_\_\_\_

Need Rotation: No Yes, did you balance? yes no

Belts and Hoses: OK Which Needs Replacing \_\_\_\_\_

Dash gauges/lights: OK Which needs Replacing \_\_\_\_\_

Engine running: OK Problem located at \_\_\_\_\_

Notes/Comments \_\_\_\_\_

I certify that the above mentioned repairs were done to the best of knowledge.

\_\_\_\_\_  
Signature of Technician

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Date

TRANSIT AGENCY: Yearly/50,000 Mile Scheduled Maintenance

Vehicle # \_\_\_\_\_ Mileage \_\_\_\_\_ Date \_\_\_\_\_

Engine Tune Up:            Checked OK    Replaced    Parts used and notes

Spark Plugs			
Plug Wires			
Carburetor/Injectors			
Timing			
EGR System			
Fuel Filter			
Air Filter			
Belts and Hoses			

Tires and Front End:            OK            Problem    Notes

Rotated Tires & Bal			
Alignment			
Wear of Tread			
Wear of Joints			
Brake Pads and Rotors			

A/C Oil? Yes    No    Problems \_\_\_\_\_

Transmission: **Change Fluid and Filter**

Comments \_\_\_\_\_

Muffler and Tailpipe:            OK            Needs Replacing

Lift Equipment: Leaks and level    Y    N    Worn?

Parts \_\_\_\_\_

Vehicle Inspection:            Yes            No    Next due date: \_\_\_\_\_

**Subcontractor check list:**

Fire Extinguisher Certified: OK            No    Next due date: \_\_\_\_\_

First Aid Kit:            OK            Needs Supplies

Warning Triangles:            OK            Order

Flashlight:            OK            Needs batteries/replacing    Order

Jack, Spare, and Wrench:            OK            NO

I certify that the above mentioned repairs were done to the best of knowledge.

\_\_\_\_\_  
Signature of Technician

\_\_\_\_\_  
Printed Name

\_\_\_\_\_  
Date

**TRANSIT AGENCY VEHICLE MAINTENANCE: WEEKLY REPORT**

VEHICLE # \_\_\_\_\_

INSPECTION STICKER DATE \_\_\_\_\_

Last oil change date / mileage \_\_\_\_\_ / \_\_\_\_\_

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Date--							
End Mileage							
Start Mileage							
Total Daily Miles							
Oil Added							
Fuel Add Mileage							
Fuel Added Cost	_____	_____	_____	_____	_____	_____	_____
Fuel Added Gals	_____	_____	_____	_____	_____	_____	_____

**PRE-TRIP INSPECTION**

Drivers initials	M	T	W	T	F	S	S	Drivers initials	M	T	W	T	F	S	S
Interior check								Exterior check							
Turn indicators								Headlights							
Wipers								4-way flashers							
Horn								Brake Lights							
Mirrors								Reverse lights/signal							
Seat Belts								Tires, Rims, & Lugs							
Registration/Insurance card								Logos/ Clean							
Accident Forms/ instruction								Windows							
Credit Card								Exhaust Pipes							
Parking Brake Test								Fluid Deposits							
First Aid Kit								Engine Belts/Hoses							
Fire Extinguisher								Coolant Level							
Flares/Reflectors								Oil Level							
Jack & Spare								Transmission Fluid							
Ramp/Lift Cycle								Brake Fluid							
Radio/Phone								Power Steering Fluid							
Clean inside								Windshield Washer Fluid							

**POST TRIP**

Unusual Noises/Problems								Body Damage							
Damaged Lights/Lenses								Clean Inside & Out							

O means is OK, A means added, X means needs repairs, and R means Remarks. Remarks can be written on back of page.

**TRANSIT AGENCY**

Emergency Maintenance Form

Vehicle # \_\_\_\_\_ Mileage \_\_\_\_\_ Date \_\_\_\_\_

1. To be Completed by driver or responsible person:

Type of Emergency(Circle one): Breakdown Vandalism Accident Other: \_\_\_\_\_

Where Emergency Happened: \_\_\_\_\_  
Street/Road City County

Time of emergency: \_\_\_\_\_AM/PM Was vehicle towed away? Yes No

Explain in detail what happened at time of emergency:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_.

A pre-trip inspection was performed by me before leaving:

\_\_\_\_\_

Signature

2. To be completed by technician or responsible shop personnel:

Damage to vehicle: None Other \_\_\_\_\_

Could Emergency have been prevented? No Yes How? \_\_\_\_\_

Estimated Time of Repair: \_\_\_\_\_hrs/days/wks

Estimated Cost for parts: \$\_\_\_\_\_.\_\_\_\_ Estimated Cost of labor: \$\_\_\_\_\_.\_\_\_\_

Other Cost: \$\_\_\_\_\_.\_\_\_\_ For: \_\_\_\_\_

I understand that this vehicle was reported by me for Emergency Maintenance.

\_\_\_\_\_  
Driver's Signature Printed Name Date

I understand that this is an estimate for work of this vehicle and I will not perform any work until approved by Subcontractor or the agency.

\_\_\_\_\_  
Technicians Signature Printed Name Date

1 copy agency/ 1 copy vehicle file/ 1 copy subcontractor/ 1 copy driver/ 1 copy technician

## **SHOP RULES**

**The following Shop Rules must be strictly enforced:**

- a. Clean Shop - The shop facility shall be kept clean at all times.
- b. Safety - Safe working practices shall be practiced at all times.
- c. Material Safety Data Sheets shall be current at all times, and available to all employees. This is a federally mandated requirement and cannot be compromised.
- d. All labor and all materials shall be charged to the appropriate work order.
- e. All vehicles released for service shall be clean and in safe operating condition.
- f. All operators shall be treated as customers, and shall be treated fairly at all times.
- g. All expendable materials will be purchased in cost effective quantities at competitive prices without having excessive amounts on hand.
- h. All overtime work shall be authorized on time sheets and approved by the appropriate supervisor. The failure to submit time sheets by deadline may result in a delayed paycheck.
- i. Every effort shall be made to minimize non-productive time expended for vehicle transfer, whether that non-productive time is expended by the technician or the operator.
- j. PM and repair work is to be performed in a professional manner. Work will be performed as directed by system guide forms or by the vehicle manufacturer's manual.
- k. Attendance is most important. All requests for time off should be made early enough to allow adjustment to the work schedule.



## REFERENCES AND RESOURCES

This manual serves as an introduction to transit maintenance management fleet maintenance facilities. A detailed discussion of all the rules, regulations, and circumstances which could affect maintenance management practices for every situation is beyond the scope of this document. Therefore, a list of some publications, helpful phone contacts, internet sites, and reference documents are included below to assist you with specific issues.

### TRAINING RESOURCES/PUBLICATIONS

Basic Theory of Air Brake Systems, Basic Theory of Air Conditioning, Bus Maintenance Training Program: Basic Theory of Diesel Engines, and , Bus Maintenance Training Program: Basic Theory of Electrical Systems are all manuals which are available by contacting:

Jack Apostolides, Program Manager  
Virginia Department of Rail and Public Transportation  
1401 East Broad Street  
Richmond, VA 23219  
(804) 786-1722

Pre-Trip Inspection/Emergency Repairs, consisting of an Instructor's Guide and a Student's Guide, is available by contacting:

Neil Sherman, Program Manager  
Virginia Department of Rail and Public Transportation  
1401 East Broad Street  
Richmond, VA 23219  
(804) 786-7425

Fundamentals of Electricity is a book available through the US DOT:

Chuck Morison  
Office of Technical Assistance  
Federal Transit Administration  
US Department of Transportation  
400 Seventh Street, SW  
Washington, DC 20590  
(202) 366-0245

Wisconsin Pre-Trip Inspection Procedures, consisting of six (6) 40-minute VHS tapes, produced by Wisconsin DOT, is available for loan by contacting:

Pamela Parins, Community Assistance Coordinator  
Office of Statewide Transportation Programs  
University of Wisconsin - Milwaukee  
POB 413  
Milwaukee, WI 53201  
(414) 229-4891

Transit Vehicle Inspections, is a guide to conducting delivery, pre-trip and annual inspections which was produced by the FTA and Kansas DOT. Contact:

Patricia Weaver  
Kansas University Transportation Center  
2011 Learned Hall  
Lawrence, KS 66045  
(913) 864-5658

#### GUIDANCE DOCUMENTS / PUBLICATIONS.

“Vehicle Maintenance Facilities: A Federal Compliance Guide”; Published by Specialty Technical Publishers Inc., Phone: (604) 983-3445 - This reference book is a comprehensive guide to federal environmental and safety rules applicable to vehicle maintenance facilities.

TNRCC Publication GI 145 “Local Government Guide to the TNRCC”; Available from TNRCC Publications at (512) 238-0028 or download from the TNRCC web page. This guide provides assistance to local governments ON environmental compliance.

TNRCC Publication RG-22 “Guidance for the Classification and Coding of Industrial Waste and Hazardous Waste”; Contact the TNRCC Waste Evaluation Section at (512) 239-6832.

#### TELEPHONE ASSISTANCE

TNRCC Waste Evaluation Section (512) 239-6832

This section can provide information and forms needed for waste classification, reporting, recycling, one-time waste code numbers, as well as answers to general waste related questions.

TNRCC Local Government Assistance Office (800) 687-9222 or (512) 239-5300

This office can provide information and guidance documents to assist local governmental agencies in complying with environmental regulations, including hazardous waste management.

*TNRCC Pollution Prevention and Recycling* (512) 239-3100

This office can provide assistance with Source Reduction and Waste Minimization Plans as well as serving as a clearinghouse for recycling information and opportunities.

*TNRCC Automotive Waste Section* (512) 239-6702

This section can provide information on used tire management, used oil and filter management, and other waste streams commonly associated with the operation and maintenance of motor vehicles.

INTERNET SITES

<http://www.zdnet.com/downloads/>

This brings up ZDNet's software library to research MMIS software.

<http://www.gsc.state.tx.us>

This is the Texas General Service Commission's website. They maintain a bid list (see CMBL) for automotive maintenance services (code 929).

<http://www.ccar-greenlink.org>

This internet site is sponsored by the Coordinating Committee on Automotive Repair (CCAR) and has links to EPA guidance documents and checklists related to management of wastes associated with servicing vehicles.

<http://www.tnrcc.state.tx.us>

This is the web address for the TNRCC home page. From there you can access information, publications, and forms from most of the TNRCC Divisions, as well as link to the environmental rules and regulations.

<http://www.sos.state.tx.us>

The Texas Register and the entire Texas Administrative Code are available for on-line viewing on The Secretary of State's home page. Environmental regulations are included in Title 30 of the Texas Administrative Code.

<http://www.epa.gov>

EPA's web page provides general information on the agency as well as links to the federal regulations.

<http://siri.org/msds/>

This site contains a large collection of MSDS sheets compiled by the University of Vermont, as well as other safety related information.

# Internet Resources

## Fleet Maintenance Pro

Company: Brian Kennedy

Rating: 

Version: 7.00

Date: April 12, 2000

File size: 6.63 MB

License: Shareware (Free to try), \$149 if you decide to keep it.

Location: Shareware.com, Download.com or ZDNet Software

Fleet Maintenance Pro tracks maintenance on fleet vehicles by mileage, informs the user when maintenance is next due, and automatically builds history reports. The program keeps individual records and can track common and user-defined maintenance item, each with their own intervals, including miles, months, or hours.

It can also maintain data on fuel consumption, warranties, insurance policies, registrations, inspections, and other administrative data. Other features include notifications, report customization, a parts database, history logs and organization by departments. A network edition is available.

Minimum requirements:, Windows 9x, NT, or 2000

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## OmniFleet Pro (32 bit)

Company: Resolute Solutions Corporation

Rating: 

Version: 6.01

Date: July 6, 1999

File size: 3.40 MB

License: Shareware (Free to try), \$449 if you decide to keep it.

Location: Shareware.com & ZDNet Software

OmniFleet Pro is management software for fleet and equipment maintenance. It provides separate

sections for entering and maintaining equipment, employees, vendors, repairs, fuel, and preventive maintenance, with toolbars for access and navigation. Because the databases interact, you can choose from drop-down selection boxes, making data entry much easier. A preventive maintenance wizard module guides you through a group of services for a selected piece of equipment. Other features include sample data, a thorough help file, inspection documentation, integrated backups, quick queries, and wizards for cost-analysis queries and custom reporting. You can optionally track fuel taxes and tax exempt fuel purchases, repair histories and employee certification status. Reports can be archived for use at a later time, or exported.

Minimum requirements: Windows 95, 98, or NT

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## Truck Tracker Pro

Company: Modern Business Computing

Rating: 

Version: 4.0

Date: April 26, 1999

File size: 1.7 MB

License: Shareware (Free to try), \$695 if you decide to keep it.

Location: Shareware.com or ZDNet Software

Truck Tracker for Windows is a database for managing a vehicle fleet. It records vehicle maintenance records as well as repairs, fuel and permit information. It also stores driver and vendor information. You can keep business costs easily accessible, track gas mileage, monitor maintenance issues, and get alerts on periodical service due. Online help is included with the shareware, along with detailed sample data to illustrate the program features. This shareware version lets you enter a maximum of 10 vehicles with 10 entries per category.

Minimum requirements: Windows 9x, or NT

## Shop Manager (Foothill)

Company: Foothill Software

Rating: 

Version: 4.03  
Date: July 8, 1998  
File size: 3.5 MB  
License: Shareware (Free to try), \$44.95 if you decide to keep it.  
Location: Shareware-shop and ZDNet Software

Shop Manager is a database system for record keeping in a vehicle fleet repair shop. Button bar access provides tracking and reporting on vehicles, parts, work orders, personnel, financial transactions and vendors. Some stock reports are available, but choices are minimal. Shop Manager provides some documentation, but no overview to orient someone new to the system.

Minimum requirements: Windows 9x, or NT

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## PowerFleet for Windows

Company: Resolute Solutions Corp.

Rating: 

Version: 1.01  
Date: February 29, 1996  
File size: 1.2 MB  
License: Shareware (Free to try), \$149 if you decide to keep it.  
Location: ZDNet Software

PowerFleet is intended as a productivity tool for fleet managers. You can maintain records, and create up to 35 reports. Store information such as vehicle descriptions and other equipment, employee information, fuel purchased tires, repairs, and preventive maintenance. Equipment assignments can be broken down into departments, employees, and regions. Track maintenance records for reminders, and generate a variety of reports. Access extensive on-line help, a button bar, and a drop-down window system with dialog help.

Minimum requirements: Windows 95, 98 or NT

## FAST (32-bit)

Company: TBX Software

Rating: 

Version: 3.1  
Date: June 22, 1999  
File size: 5.25 MB  
License: Shareware (Free to try), \$29-88 if you decide to keep it.  
Location: ZDNet Software

FAST (Full Automotive Service Tracking) is a vehicle-fleet management program. Enter vehicle data, then set the service requirements and intervals. You can build data tables of parts, vendors, and fuel-consumption figures. Relational data lets you link maintenance tasks to many vehicles or many vehicles to a common task. Print work orders, service alerts, fuel-economy charts, parts/labor details, and more. An alert system cues you that service is due by miles, dates, or time elapsed. Online help is available, but no sample data is included. This shareware version lets you test the system with three vehicles. Pricing is based on the number of vehicles in your fleet.

Minimum requirements: Windows 9x, or NT