NATIONAL COOPERATIVE TRANSIT RESEARCH & DEVELOPMENT PROGRAM

10 Synthesis of Transit Practice

Bus Inspection Guidelines

TRANSPORTATION RESEARCH BOARD
National Research Council

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10 Synthesis of Transit Practice

Bus Inspection Guidelines

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Subject Areas
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Vehicle Characteristics

Mode
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TRANSPORTATION RESEARCH BOARD
National Research Council
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NATIONAL COOPERATIVE TRANSIT RESEARCH & DEVELOPMENT PROGRAM

Administrators, engineers, and many others in the transit industry are faced with a multitude of complex problems that range between local, regional, and national in their prevalence. How they might be solved is open to a variety of approaches; however, it is an established fact that a highly effective approach to problems of widespread commonality is one in which operating agencies join cooperatively to support, both in financial and other participatory respects, systematic research that is well designed, practically oriented, and carried out by highly competent researchers. As problems grow rapidly in number and escalate in complexity, the value of an orderly, high-quality cooperative endeavor likewise escalates.

Recognizing this in light of the many needs of the transit industry at large, the Urban Mass Transportation Administration, U.S. Department of Transportation, got under way in 1980 the National Cooperative Transit Research & Development Program (NCTRP). This is an objective national program that provides a mechanism by which UMTA's principal client groups across the nation can join cooperatively in an attempt to solve near-term public transportation problems through applied research, development, test, and evaluation. The client groups thereby have a channel through which they can directly influence a portion of UMTA's annual activities in transit technology development and deployment. Although present funding of the NCTRP is entirely from UMTA's Section 6 funds, the planning leading to inception of the Program envisioned that UMTA's client groups would join ultimately in providing additional support, thereby enabling the Program to address a large number of problems each year.

The NCTRP operates by means of agreements between UMTA as the sponsor and (1) the National Research Council as the Primary Technical Contractor (PTC) responsible for administrative and technical services, (2) the American Public Transit Association, responsible for operation of a Technical Steering Group (TSG) comprised of representatives of transit operators, local government officials, State DOT officials, and officials from UMTA's Office of Technical Assistance, and (3) the Urban Consortium for Technology Initiatives/Public Technology, Inc., responsible for providing the local government officials for the Technical Steering Group.

Research Programs for the NCTRP are developed annually by the Technical Steering Group, which identifies key problems, ranks them in order of priority, and establishes programs of projects for UMTA approval. Once approved, they are referred to the National Research Council for acceptance and administration through the Transportation Research Board.

Research projects addressing the problems referred from UMTA are defined by panels of experts established by the Board to provide technical guidance and counsel in the problem areas. The projects are advertised widely for proposals, and qualified agencies are selected on the basis of research plans offering the greatest probabilities of success. The research is carried out by these agencies under contract to the National Research Council, and administration and surveillance of the contract work are the responsibilities of the National Research Council and Board.

The needs for transit research are many, and the National Cooperative Transit Research & Development Program is a mechanism for deriving timely solutions for transportation problems of mutual concern to many responsible groups. In doing so, the Program operates complementary to, rather than as a substitute for or duplicate of, other transit research programs.

NCTRP SYNTHESIS 10

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NOTICE

The project that is the subject of this report was a part of the National Cooperative Transit Research & Development Program conducted by the Transportation Research Board with the approval of the Governing Board of the National Research Council. Such approval reflects the Governing Board's judgment that the program concerned is of national importance and appropriate with respect to both the purposes and resources of the National Research Council.

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PREFACE

A vast storehouse of information exists on nearly every subject of concern to the transit industry. Much of this information has resulted from both research and the successful application of solutions to the problems faced by practitioners in their daily work. Because previously there has been no systematic means for compiling such useful information and making it available to the entire transit community, the Urban Mass Transportation Administration of the U.S. Department of Transportation has, through the mechanism of the National Cooperative Transit Research & Development Program, authorized the Transportation Research Board to undertake a series of studies to search out and synthesize useful knowledge from all available sources and to prepare documented reports on current practices in the subject areas of concern.

This synthesis series reports on various practices, making specific recommendations where appropriate but without the detailed directions usually found in handbooks or design manuals. Nonetheless, these documents can serve similar purposes, for each is a compendium of the best knowledge available on measures found to be successful in resolving specific problems. The extent to which these reports are useful will be tempered by the user's knowledge and experience in the particular problem area.

FOREWORD

By Staff
Transportation
Research Board

This synthesis will be useful to maintenance managers, general managers, and others concerned with preventive maintenance and inspection of buses. Information is presented on the features of preventive maintenance programs in use at selected transit agencies and this information should be useful in evaluating current practices and alternative approaches.

Administrators, engineers, and researchers are continually faced with problems on which much information exists, either in the form of reports or in terms of undocumented experience and practice. Unfortunately, this information often is scattered and unevaluated, and, as a consequence, in seeking solutions, full information on what has been learned about a problem frequently is not assembled. Costly research findings may go unused, valuable experience may be overlooked, and full consideration may not be given to the available methods of solving or alleviating the problem. In an effort to correct this situation, NCTRP Project 60-1, carried out by the Transportation Research Board as the research agency, has the objective of reporting on common transit problems and synthesizing available information. The synthesis reports from this endeavor constitute an NCTRP publication series in which various forms of relevant information are assembled into single, concise documents pertaining to specific problems or sets of closely related problems.

Preventive maintenance and inspection programs are the backbone of effective fleet maintenance. This report of the Transportation Research Board describes current

criteria and procedures used by transit agencies and gives some general guidance that may be useful to agencies in revising or improving their preventive maintenance and inspection programs.

To develop this synthesis in a comprehensive manner and to ensure inclusion of significant knowledge, the Board analyzed available information assembled from numerous sources, including a large number of public transportation agencies. A topic panel of experts in the subject area was established to guide the researcher in organizing and evaluating the collected data, and to review the final synthesis report.

This synthesis is an immediately useful document that records practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As the processes of advancement continue, new knowledge can be expected to be added to that now at hand.

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NCTRP TECHNICAL STEERING GROUP

Annual research programs for the NCTRP are recommended to UMTA by the NCTRP Technical Steering Group (TSG). Under contract to UMTA, the American Public Transit Association is responsible for operation of the TSG, the membership of which is as follows.

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Special appreciation is expressed to Clarence Giuliani, Giuliani & Associates, Bellaire, Texas, who was responsible for the collection of data and the preparation of the report.

Valuable assistance in the preparation of this synthesis was provided by the Topic Panel, consisting of George G. Caria, Director, Equipment Maintenance, Metropolitan Transit Commission; James Foerster, Assistant Professor, University of Illinois; G. Kenneth Hussong, Vice President, Maintenance Engineering, Trailways, Inc.; Michael J. Kurtz, Assistant Director of Maintenance Support, Washington Metropolitan Area Transit Authority; Ralph Malec, Assistant Superintendent, Equipment and Plant, Milwaukee County Transit System; T. J. Ross, Director of Maintenance, Phoenix Transit System; and Liaison Member Shang Q. Hsiung, Transportation Program Manager, Urban Mass Transportation Administration.

Adrian G. Clary, Engineer of Maintenance, of the Transportation Research Board, assisted the Project 60-1 Staff and the Topic Panel.

Information on current practice was provided by many transit agencies. Their cooperation and assistance were most helpful.

BUS INSPECTION GUIDELINES

SUMMARY

This synthesis was conducted to review bus inspection and preventive maintenance procedures at large and medium-sized transit agencies. Although most of the agencies selected for evaluation or inspection were among those known in the industry for active maintenance programs, many of them had preventive maintenance programs that had not changed for years except for patchwork additions or alterations to include periodic acquisitions of newer models or types of buses. Perhaps 10 to 15 percent have made major modification of the preventive maintenance procedures, such as rewriting procedures, development of job instruction sheets, incorporation of training programs for inspection crews, and the addition of some form of quality control programs and reinspection procedures. Another ten percent of the agencies have elected to include some of the above changes to their basic programs without complete redesign.

Of the agencies that had developed modern preventive maintenance programs, either whole or in part, all have reported substantial improvement in the reliability of the fleets in service. The realization that an effective program requires that the inspection crews be adequately informed and trained is the primary improvement factor noted. Along with that, agencies have been instituting requirements that the inspections be done as scheduled and that defects found be corrected before the inspection can be called complete. To be sure that the plans are being executed properly and that accountability is in place, a quality control program has been found essential. This program can be in the form of increased supervision, reinspection by separate quality control personnel, or spot-checking by successive levels of maintenance management. There was a lack of use of state-of-the-art diagnostic test equipment and measuring devices, which resulted in subjective analysis of bus condition and performance.

Every agency professes to give top priority to preventive maintenance activities. However, virtually every agency visited had indications that the established priority was not followed when buses were in demand for peak requirements or when maintenance crews were reduced by illness or vacations. In these instances, it appeared that other maintenance functions would receive precedence. Some of the loss of priority was attributed to provisions of the union contract agreement that prohibited the transfer of mechanics between job functions.

Some feeling existed that top management did not support preventive maintenance as strongly as it should. It was felt by some maintenance managers that this attitude prevailed because some general managers did not fully comprehend the maintenance processes and the loss of performance and efficiency that resulted when program support was lacking. It was also pointed out that meetings of industry leaders often were primarily concerned with political and financial matters, and thus left a void in understanding maintenance management priorities.

On a few observed occasions, some maintenance programs were not being carried out as designed or intended. Well-designed preventive maintenance programs and

procedures were sometimes not being properly executed by foremen or mechanics because they did not follow instructions and orders or they misinterpreted those instructions. These cases showed the necessity for supervisory follow-up to ensure that programs are functioning.

It was hoped that this synthesis would show that there is a consensus among transit agencies relating to the content of preventive maintenance programs. Unfortunately, this did not prove to be the case; there has not been a considerable amount of transfer and exchange of proven successful programs and ideas.

If the indications prevail wherein future funds for public transit operations continue to become more difficult to obtain, better and more cost-effective maintenance management ideas will be required. One of the most potentially cost-effective programs will be found in the preventive maintenance programs. The payback for a well-planned and carefully executed preventive maintenance bus inspection program will be enormous in personnel utilization, improved equipment availability and reliability, and generally improved operating performance.

CHAPTER ONE

STUDY OUTLINE AND METHODOLOGY

OBJECTIVES OF SYNTHESIS

Although it has been apparent to transit industry managers for quite some time that preventive maintenance programs should be the backbone of fleet maintenance, a detailed analysis of this posture has not been attempted industry wide. The purpose of this synthesis is to review bus inspection procedures at large and medium-sized transit systems, with specific reference to frequency of inspections, use of pre-run inspections, items included in the inspection process, organization for inspection, effect of work rules, record keeping, facilities and equipment provided, and reinspection. This information should be helpful to management in evaluating the adequacy of current practices and analyzing the costs and benefits of alternative approaches.

SELECTION OF TYPICAL AGENCIES

Within the guidelines of the project, it was determined that a sampling of medium and large sufficient transit systems would be surveyed and inspected to explore the questions and subjects designated in the scope.

From the roster of American Public Transit Association (APTA) members, a list of potential participants was selected according to recommendations of members of the topic panel and by personal knowledge of the reputations of the maintenance programs of various transit agencies and those of the responsible maintenance directors. Because there were far more potential transit properties to study than time and funds would allow, a balance had to be struck after proper consideration of size, geographic location, numbers of operating garages, and other significant criteria.

To systematically retrieve as much pertinent information as possible from the selected transit agencies, a questionnaire was developed for basic data gathering purposes (Appendix A). A matrix of the 24 responses is illustrated in Appendix B. Separate analyses of these responses are covered in subsequent sections of this report.

RESPONSES TO QUESTIONNAIRE

Analysis of the responses shows a wide disparity in many of the answers to questions about such basic factors as frequency of inspections, scope of inspection, amount of training, and quality control attention. Considering that there is frequent communication between maintenance staffs of the various transit systems, it was expected that there would be greater commonality of inspection procedures and systems because of shared testing, research, and experiences. Because most of the responses were brief and lacked back-up data, it had to be assumed that the bus inspection programs at those agencies were considered to be routine and nondemanding functions. Follow-up visits to selected agencies tended to support this assumption.

SITE VISITS

In keeping with the synthesis program outline, a limited number of transit systems were selected for site visits. Those selected were from the responses received. A number of significant observations were made in these visits. Of a positive nature was the satisfying discovery that agencies recognize the importance of the bus inspection programs. Several agencies have determined that to obtain maximum efficiency of the inspection crews, they must be properly trained and instructed. There is an increasing belief that the supervision of preventive maintenance and inspections is critical and that inspection requires constant attention and frequent follow-up review. However, it was surprising to find that some positive-thinking maintenance directors were not aware that the programs that they believed were functioning were, in fact, not being operated according to plan, as was discovered when the garage foremen and inspection crews were interviewed while performing the inspection process.

CHAPTER TWO

INSPECTION CRITERIA

OBSERVATIONS

Preventive maintenance and inspection procedures were discovered to vary from relatively simple check sheets with vaguely identified functions to very detailed groups of inspection outlines in all categories of the bus configuration (from air conditioning to body inspection instructions). There is no evidence of any recent developments where the inspection procedures were developed systematically according to need, timeliness, labor utilization and cost, supervision, management, and record-keeping criteria. The fact that very similar buses operating in almost identical service conditions vary in frequency of inspection from 2,000- to 12,000-mile intervals seems to indicate that preventive maintenance and inspections are both under- and over-performed. Because most systems are experiencing fairly good reliability as measured by miles between road calls, it would appear that much of the preventive maintenance and inspection efforts have some degree of redundancy. This fail-safe philosophy seems to compensate for the deficiencies attributable to poorly performed inspections and inadequately designed inspection procedures.

DEFINITION OF TERMS

Preventive maintenance generally refers to maintenance activities performed on a predetermined schedule. Thus, bus inspections that are performed at various intervals are included in the general category of preventive maintenance. There is some disagreement whether the after-inspection repairs fall into this same category. Local accounting procedures and classification of accounts will determine local policy. However, the consensus of the group interviewed seemed to be that the inspection cannot be considered complete until all of the items on the inspection report card are completed, or, in the case of non-safety items, have been deferred and scheduled at a later date, at which time a work order or other shop document will be initiated.

NEED FOR SYSTEMATIC PROCEDURES

There are continuing indications being reported by APTA and others that over the next few years the transit industry will be faced with moderate to severe budgetary restrictions. For most agencies to continue to provide adequate local service, any and all measures will have to be explored to reduce expenses. Because it is generally accepted by most transit managers that the preventive maintenance programs must be retained as fundamental to an effective fleet-maintenance program, labor efforts devoted to this activity must be expended in the most cost-effective manner. To achieve this efficiency will require the development of vehicle-inspection procedures that allow the necessary activities to be performed at the least frequent interval while providing the necessary degree of safety protection in the schedule.

INSPECTION CRITERIA FACTORS

Most survey respondents indicated that the basis for the inspection routine followed was developed from a combination of manufacturer's recommendations, local conditions, and past experience. Although all these and other factors are relevant to the ingredients for a successful preventive maintenance schedule, they must be carefully blended to avoid the patchwork development that results in overstatement and redundancy.

Manufacturer's recommendations are certainly important because the bus builder should be in a position to know the construction of the vehicle and the operations that must be performed on a regular basis to maintain its reliability and safety. Occasionally, however, disagreement exists between component suppliers and coach manufacturers on proper intervals and procedures. To enforce the requirement that the vehicle owner must maintain the fleet in the recommended manner, the bus builder has the power to withhold warranty reimbursements if the recommendations are not followed. Virtually all manufacturer-recommended preventive maintenance procedures are extremely conservative. If the procedures were followed to the letter, most transit agencies would be required to spend more time on inspections than their budgets allow. It is also true that the manufacturer will accept local inspection practices less than the recommended if the experience with the customer shows that changes from the recommendations were based on good local experience and are being carried out by inspectors who are properly trained and supervised.

Local operating conditions contribute greatly to the continuing deterioration of the fleet status. Climate and weather, street condition, passenger loading, and average operating speeds should all be taken into consideration in planning the preventive maintenance and inspection programs. Certainly the age and make-up of the fleet must be given adequate attention. Because of the variations in these categories, it may be necessary to design a program that has different procedures for seasonal problems as well as variations for types of vehicles; and separate programs for both low-mileage, heavy and slow service vehicles as contrasted with line-haul service with relatively high-average-speed operation. In this category of parameters must be included

such factors as the availability of space and qualified mechanics to establish whether this operation is more effectively performed during the day or night-shift hours.

Past experience must play an important role in the establishment of inspection procedures. Extremely important to being able to profit by past experience is the availability of sufficient accurate data and records from which determinations can be made. Reliance on memory of participants in the past programs can be deceiving and misleading. This is especially true when trying to evaluate the results of test programs established to examine new products or procedures to be used in the inspection programs.

There are some fundamental reports that the maintenance director and the general manager can use to determine the adequacy of an existing inspection program or to establish a new schedule of preventive maintenance activities. These basic reports are:

1. Daily bus availability report.
2. Daily road failure report, with appropriate codes for analysis.
3. Daily report of consumables that can be summarized and analyzed periodically.
4. Monthly summaries of these reports so that trends of local characteristics can be observed for changes.

Reports should be based on locally established definitions that must be maintained throughout the study period for consistency. Generally, these reports cannot be used to make comparisons with other transit systems because of differences in definitions and terminology, organizational structures, and operating conditions. Current research into methods of categorizing transit systems along with the future development of common definitions may make these comparisons possible.

USE OF DAILY OPERATOR CHECKS

There is a noticeable lack of the use of daily operator vehicle checks as a fundamental part of the preventive maintenance procedures. Appendix C shows an example of what one transit system uses for a daily report of visual vehicle condition and operations. Most of these items that could be checked daily by the operator are currently included in the periodic inspection check sheets. Requiring the inspection mechanics to check all these items extends the time required for the periodic inspections, and, because time is money, the cost of the inspection program is unnecessarily increased.

In a recent study* on this subject, it was established that many transit agencies that were interviewed did not utilize the operator-performed pre-run inspection very effectively. The principal reasons for this were a lack of funds to pay for additional personnel time (principally supervisors) and lack of knowledge about how to operate and enforce pre-run inspection programs.

RESULTANT BENEFITS

If the knowledge from all the above sources of information is properly organized and tabulated, a new program can be developed or existing programs can be analyzed for effectiveness. The data should be organized into categories of need, such as lubrication, safety, adjustments, and observations. All items in the classification of "nice to do" while the bus is on the pit or hoist, should be analyzed and eliminated if found to be nonessential for the system. By this selective system, the inspection procedure can be reduced to its very minimum and, if the allotted time for the inspection is reduced accordingly, the time for the inspection crew can be reduced accordingly. This time saving can be transferred to performing more timely inspections, more expeditious completion of after-inspection defect work, or accomplishment of other maintenance work, or, in the ultimate, being able to reduce maintenance personnel positions.

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*Puente, S., J. Duffy, and J. Foerster, "Transit Bus Pre-Run Inspection Procedures," University of Illinois at Chicago for UMTA, Report No. IL-11-0030-85-1 (June 1985).

CHAPTER THREE

INSPECTION FREQUENCY

REVIEW OF RESPONSES

Data obtained from the survey indicate that there is a great disparity in frequency for all types of inspections (Table 1). Despite the differences in local operating conditions and environment, there does not appear to be objective criteria for such variations. Lubrication intervals that range from 3,000 to 12,000 miles cannot be rationalized for equipment that is basically similar and petroleum products that are generally available. Oil and filter changes that vary from 4,000 to 12,000 miles for similar engines is not readily explainable. However, with relation to oil-change intervals, it was noted that substantially more agencies are using oil analysis to either determine the oil-change interval or use the analysis to monitor the condition of the oil at the drain periods to detect potential or developing problems in engines and transmissions. Of the 24 responses received, 8 agencies indicated that oil analysis was currently being used. This ratio of one in three is substantially higher than could be found only a few years ago.

Some agencies have determined that buses that operate primarily under severe traffic conditions with low average speeds, especially in the peak operating hours, do not generate enough miles to require maintenance if mileage were the sole criterion. At these agencies, certain identifiable portions of the fleet were placed on time intervals for routine inspections. Another variation of this system of generating inspection intervals is the use of mileage or time frequency so that the principal factor receives attention at the selected interval. Some agencies cover both variations by calling for inspections after the use of a predetermined amount of diesel fuel, which compensates for both time of operation and mileage travelled.

TABLE 1

RANGE OF INTERVALS FOR VARIOUS INSPECTION/PM TASKS

Task	Mileage	Time
Safety	1,000 - 9,000	Daily - weekly
Lubrication	3,000 - 12,000	Quarterly
Oil change	4,000 - 12,000	Semi-annual
Minor tune-up	6,000 - 46,000	-
Major tune-up	24,000 - 100,000	-

Table 2 summarizes the intervals for lubrication and oil change that were reported by the agencies responding to the survey.

DAILY OPERATING MILEAGE

One of the most difficult tasks in scheduling and implementing preventive maintenance and inspections is the ability to obtain timely, current accumulated mileage or operating-time information for each bus in the fleet. Mileage is captured in one of four ways. First, and least frequent, is the use of the odometer on the dash (included as part of the speedometer unit). These units are highly inaccurate and subject to intense maintenance costs and are, therefore, seldom kept in a dependable condition. Second, and the most common source, is the hubodometer. Because of administrative problems, most agencies read this mileage at weekly, bi-weekly, or monthly intervals. By the time this information is processed and returned to the maintenance clerk for scheduling of inspections, the information is outdated; this leads to extended inspection intervals. The third method utilized is the generation of mileage figures by those responsible for calculating daily vehicle utilization that incorporates route assignment by vehicle, including any service disruptions and vehicle service changes. This system can also result in delayed information for inspection scheduling. Delays in mileage reporting can be extremely critical on those operating systems where daily operating utilization exceeds 200 to 300 miles per day.

Only two examples were found using the fourth system of determining mileage for inspection. This method uses accumulated fuel consumption to calculate mileage according to a predetermined figure of so many miles per gallon of fuel. The advantage of this system is the ability of the maintenance clerk to use the daily tabulation of fuel consumption (generated within the maintenance department) to determine timely and accurately which buses are due for inspection on a daily basis.

Another method uses vehicle operating hours as the basis for scheduling inspection and maintenance. The advantage of this method is the ability to compensate for various operating conditions and speed. The major disadvantage given during discussions on the procedure was the unreliability of the hour meters available to the industry.

Appendix D illustrates the method that the Port Authority Transit (PAT) in Pittsburgh uses to track its fleet with relation to the vehicles due for inspection. This report is circulated to maintenance foremen and superintendents on a weekly basis to show which buses are due for the various types of inspections

TABLE 2

NUMBER OF AGENCIES PERFORMING LUBRICATIONS AND OIL CHANGES AT VARIOUS INTERVALS[a]

Interval (miles or time)	Task	
	Lubrication	Oil Change
3,000	4	
4,000	8	1
5,000	2	1
6,000	6	6
8,000		4
9,000	1	2
10,000		1
12,000	1	7
16,000		1
Quarterly	1	
Semi-annually		1

[a]24 agencies responding to survey.

at that time. From this report, the maintenance clerk is able to schedule inspections several days in advance.

PLANNED INSPECTION INTERVALS

In Chapter 2, the criteria for inspection procedures were discussed for sources of information in the establishment of minimal and cost-effective preventive maintenance and inspections. This same analysis can be applied to inspection frequencies. If the basic inspection criteria are tabulated according to necessity, the same system of selecting the maximum allowable interval to perform these operations must be selected with sufficient latitude for safety, but not so conservatively as to become redundant and excessive. When the operations are grouped according to frequency, the inspection procedures begin to take shape. Integration of the Daily Operator Vehicle Reports (Appendix C) into the overall inspection program can not only reduce time consumed by the routine inspection, but can also allow more flexibility in determining intervals between successive inspections. Judgment based on available data, experience, and comparison of programs with other transit agencies can develop a series of inspection procedures that satisfies the bus manufacturer according to local conditions and experience.

Equally dangerous are the two extremes of (a) attempting to take another agency's procedure and transfer it intact to local use and (b) refusing to utilize the knowledge and experience of other transit agencies in order to preserve local pride and inflexibility.

Data used for planning inspection intervals and analyzing results of the program should be based on local conditions and the standards and definitions adopted in the process. The reporting system should have as its prime objective the ability to distinguish trends based on locally established criteria. The comparison of data generated with that observed in other transit agencies should be avoided. Conclusions reached from these comparisons can be grossly misleading because of differences in parameters and can lead to morale deterioration and attempts to manipulate data if unfairly applied.

CHAPTER FOUR

INSPECTION CREW QUALIFICATIONS AND TRAINING

OBSERVATIONS

In the majority of the agencies observed, the inspection crew positions are filled by contractually determined job-selection procedures. Although both qualifications and seniority are supposed to be considered, in most cases it appeared that seniority prevailed. It was encouraging to note the emergence of some transit maintenance managers who were exerting their prerogative of demanding experience and technical qualifications. Although most managers assigned new inspectors to work with other inspectors as a form of on-the-job training (OJT), there is a definite pattern developing that recognizes the importance of the inspection process and the need for inspectors to be properly qualified in these activities. To achieve this objective, several agencies both small and large, have developed formal training to accompany OJT to ensure that the preventive maintenance and inspection investment is realized to the maximum (Table 3). This training is done in the classroom or on the job, and utilizes various forms of training aids to properly demonstrate the correct procedures required as well as sufficient technical knowledge of the vehicle to properly conduct the inspection. Additionally, most agencies procuring new buses take advantage of various training programs offered by coach manufacturers and major-component suppliers.

As can be observed from Table 3, a large proportion of the reporting systems rely solely on OJT for training of new inspection crews. This practice may lead to improperly indoctrinated and prepared mechanics who are not able to comprehend the goals of a good preventive maintenance and inspection program. Without proper orientation and training, new inspectors can acquire bad habits and incorrect procedures from prior crews and inadequate supervision.

TABLE 3

SUMMARY OF TRAINING FOR MAINTENANCE INSPECTORS

Type of Training	Number of Agencies
Formal Program	4
Orientation plus OJT	5
Periodic Instruction	1
OJT only	13
None	1

TRAINING PROCEDURES AND FACILITIES

Where formal training existed, it normally was created within the maintenance department organization to conduct a variety of training assignments. This included job proficiency training to prepare mechanics for career advancement, special classes in technical subjects such as air-conditioning and electrical system troubleshooting, technical features of newly acquired buses, as well as specialized training for inspection crews.

Training facilities also varied from rather complete and formalized classroom and practical training facilities to modified existing spaces in the maintenance shops and garages. The qualifications of the training staffs also varied from experienced vocational training types to selected foremen and supervisors with some recognized ability to transmit technical information and training procedures.

BENEFITS OF TRAINING

Virtually all those interviewed about the training programs for inspection crews were positive that the investment in the training programs was an essential ingredient to ensure that the inspection of buses was conducted in an effective and cost-efficient manner. This was especially true of those transit agencies that never had a maintenance training program, or had discontinued the training quite some time before renewal.

CHAPTER FIVE

INSPECTION SUPERVISION AND CONTROL

ROUTINE SUPERVISION

The direct supervision of the inspection crews was commonly found to be under the foreman or superintendent of the shift during which the inspections were done at virtually all of the agencies with small fleets and most of those with medium-sized fleets. However, in most agencies with larger fleets and an increasing number with medium fleets, the importance of the inspection process was recognized by assigning a full-time foreman (or lead person who reports directly to the superintendent or shift supervisor) to oversee the inspection activities. Where this dedicated supervision was in place, the foreman was responsible for making decisions relating to the repair work to be done as part of the inspection or the transfer of the work to a special repair crew. A very important part of this foreman's responsibility was the determination of whether defects found by the inspection crews were critical to safety and had to be corrected before the vehicle could be released for service before corrections were made.

CRITICAL DECISIONS

One of the most difficult supervisory decisions forced on maintenance foremen is that relating to the release of vehicles for service with known defects uncorrected. This is especially true where there are periodic or regular shortages of sufficient buses to make the morning or afternoon peak requirements. The pressures from the public on the transit management staff to fulfill all scheduled service is real and requires hard decision-making efforts. Most agencies that responded to this question said that most items were taken care of immediately, especially safety-related problems, and others completed in 24 to 72 hours. During the site visitation at some of the transit agencies, it was found that the pressures of making the line sometimes caused the release of buses for service before all non-safety defects were corrected.

REINSPECTION AND QUALITY CONTROL

In a variety of methods, transit agencies have given credibility to the importance of the preventive maintenance program by instituting quality control review of the inspection process. This included agencies that require various levels of maintenance supervision to reinspect prescribed percentages of the regular inspections. Discrepancies or incomplete inspection items are then called to the attention of the inspectors and recorded. Subsequent discrepancies could lead to disciplinary procedures and/or retraining. In some cases, a separate group of quality control inspectors would perform this function with the objective of practicing the review out of the normal supervisory channels of the maintenance department. In virtually all of the control programs reviewed, a definite improvement in inspection integrity was noted with the corollary improvement in reliability and reduction of road service requirements.

Although it is not one of the prime functions of the quality control programs, a supplemental benefit is received because the inspection routine functions are also observed for effectiveness and subsequent changes or improvements in the inspection programs are recommended.

INSPECTION REVIEW SYSTEMS

To periodically evaluate the accomplishments of the preventive maintenance and inspection program, the maintenance manager should have a system to monitor the activities of the program. This review will show whether inspections are being done on time as scheduled and whether the inspections are balanced so that a relatively even work load can be predicted. One example of a review system is the report used by the PAT in Pittsburgh to record deviations from the planned 4,000-mile inspections (Figure E-1, Appendix E). This report considers inspections that are completed plus or minus 250 miles from 4,000 miles to be on time. Other records of inspections performed early or late are shown according to the degree of deviation. This report is furnished to the maintenance foremen and superintendents as well as upper management on a monthly basis. Accompanying this report is a summary, month by month, showing the trend of accomplishment for inspections done on time. This report is also distributed monthly and a sample is shown as Figure E-2 in Appendix E. Figure E-3 illustrates the method used by the Kansas City Area Transportation Authority to summarize the monthly production of the Maintenance Department on certain key items including inspections completed. This report also is circulated to the maintenance foremen and staff as well as certain upper management staff persons.

CHAPTER SIX

MANAGEMENT PRIORITIES

OBSERVATIONS

The survey responses were made by maintenance directors or their delegates, and the actual attitude of top management in regard to the relative priority of preventive maintenance activities had to be assumed to be in agreement with those responses. However, there were many incidents that seem to contradict this assumption as seen in the day-to-day garage operations. Examples of this lack of priority implementation that were seen included:

- backlogs of overdue inspections,
- routine delays in completing after-inspection repairs,
- reports from inspection foremen that the pressures to "make the line" forced placing vehicles in service with incomplete inspections,
- occasional reports of the inspection program being postponed completely to perform other maintenance work,
- inadequate inspection supervision,
- lack of adequately trained crews, and
- several examples of what was assumed to be standard inspection policy that either had just been implemented or was pending implementation.

NEED FOR MANAGEMENT UNDERSTANDING

There appears to be a real need for a high-level management understanding of the preventive maintenance programs of the maintenance departments of the transit agencies. On a regular basis, the general managers should be given the necessary information relating to preventive maintenance programs so that they understand what the programs are, what they can be expected to cost, what happens if the programs are not executed according to plan, and, finally, what priorities must be assigned to sustaining the programs. The method of providing this information is subject to further study and analysis. What is clear, however, is that with all the forces on transit management to reduce expenses so that available funds can be stretched to the maximum, every department must be scoured to find cost savings that are real and do not result in deferred costs of a much greater magnitude than the immediate attraction of across-the-board budget trimming.

MAINTENANCE TRAINING FOR TOP MANAGEMENT

It has been suggested by several knowledgeable and experienced maintenance professionals that some formal training be provided for general managers or top operations directors so that they will better understand the complexities of maintenance management. This training, in the form of seminars or workshops, would strive to explain the complexities of maintenance requirements with emphasis on preventive maintenance programs, desirable maintenance information reports, use of reports in trend analysis, requirements of new equipment maintenance to protect warranty recovery, and how these items are utilized in the establishment of priorities.

CHAPTER SEVEN

MISCELLANEOUS OBSERVATIONS

USE OF DIAGNOSTIC EQUIPMENT

One of the frequently noticed deficiencies in the inspection programs surveyed and/or inspected was the general lack of utilization of instrumentation and diagnostic equipment. Because it is generally assumed that the function of preventive maintenance and inspections is to prevent or anticipate impending equipment failures before they happen in a service environment, it would follow that the objective determination of equipment condition would require the use of measuring devices of one type or other. However, most of the reporting agencies did not use diagnostic equipment on a regular basis.

Table 4 is a summary of the use of diagnostic equipment by the 24 responding transit agencies. It should be noted that although 13 agencies reported the use of brake decelerometers, only 7 reported use on regularly scheduled inspections; the others used the decelerometer for troubleshooting or accident investigation.

Some agencies reported the use of manometers to detect restrictions in the engine air inlet, and a few still test and record the engine stall speeds. Very few reported testing the air system for buildup and leak tests.

Examples of simple diagnostic instruments used during the inspection process are shown in Figures 1 through 7.

TABLE 4

SUMMARY OF USE OF DIAGNOSTIC EQUIPMENT AMONG 24 AGENCIES

Type of Equipment	Number of Agencies
Decelerometer	13
Emission Test	7
Electric Diagnostic	3
Chassis Dynamometer	5
Other	6

INSPECTION CHECK LISTS AND JOB SHEETS

Of encouragement to the inspection process was the increasing realization by more transit system general managers and maintenance directors that the inspection check sheet by itself was incomplete and unprofessional in appearance and application. At the very least, the inspection card must show values for items requiring measurements and the actual readings recorded on the card for supervisory review and development of the vehicle-history file.

Appendix F contains some examples of inspection check lists used at several transit agencies.

An increasing number of agencies have developed a supplementary document that provides a detailed backup, item by item, as given on the inspection card. This document provides the inspector with references for details of each inspection line item, and also serves as an excellent training outline for new inspectors. Several of the transit agencies visited used various versions of printed detailed instructions for use by the inspectors to provide technical data or procedural descriptions for performing the actual inspection operations. In Milwaukee, Job Instruction Sheets were prepared to correspond with the inspection check lists used by the inspection crews. Appendix G illustrates how not only detailed descriptions of the inspection operations are given to correspond by number with the lists, but additional information such as adjustment values, meter reading ranges, and lubrication chart information are included. Several other transit agencies were either using similar instructions, or were in the process of developing such documents.

Typical examples of some routine inspection operations are illustrated in Figures 8 through 11.

FIGURE 1 Battery condition check with hydrometer and ammeter-voltmeter tester along with container for distilled water.

FIGURE 2 Mechanic prepares to test brake-stopping ability with Tapley decelerometer.

FIGURE 3 Inspector checking wheel nuts with torque wrench.

FIGURE 4 Mechanic checking air intake restriction with the manometer tube.

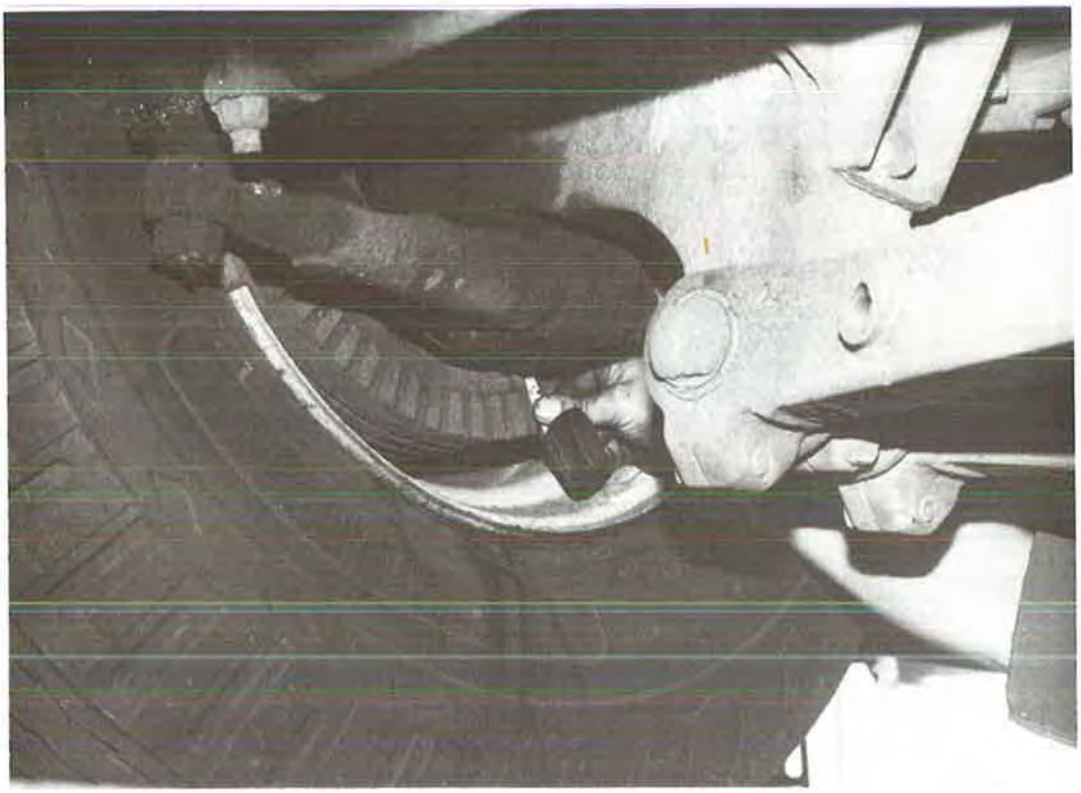


FIGURE 5 Inspector checking thickness of remaining brake blocks with ruler.

FIGURE 6 Mechanic checking engine speed with electronic tachometer.

FIGURE 7 Mechanic checking front axle brakes, steering, and alignment as part of a 12-minute complete diagnostic check of both axles and power units with a combination chassis dynamometer/brake tester/high-speed road-test simulator.

FIGURE 8 Adding engine oil with calibrated dispenser nozzle.

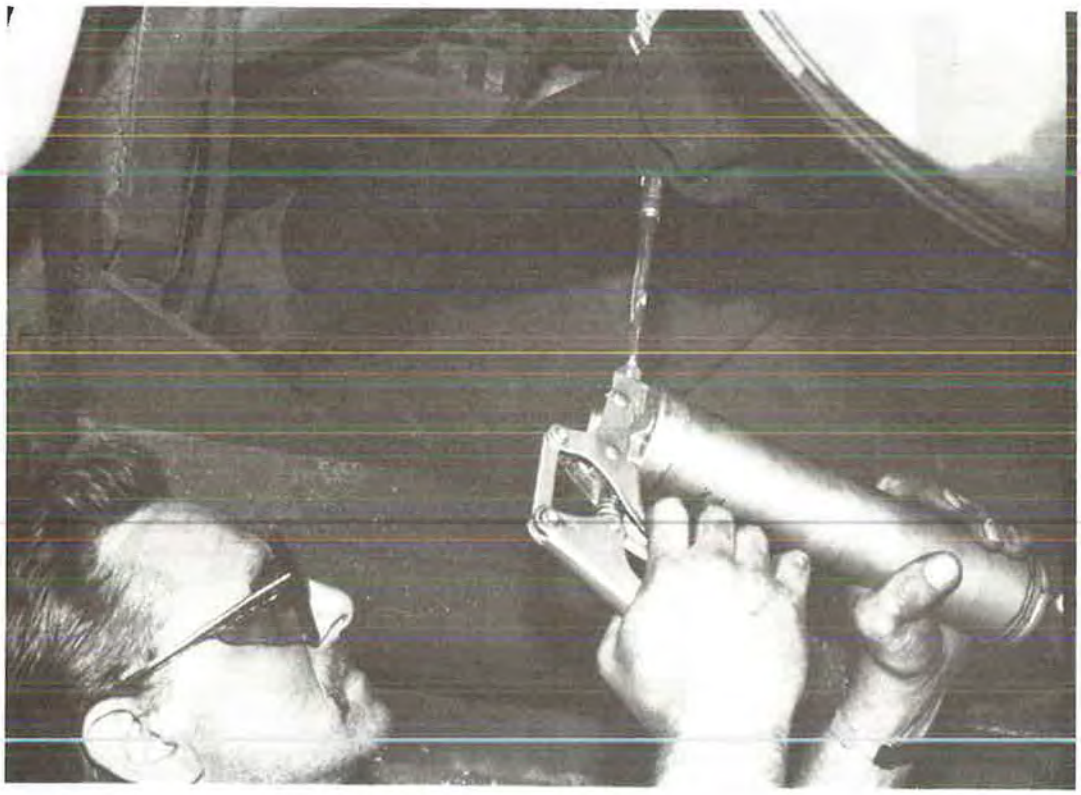


FIGURE 9 Lubrication of driveshaft fittings with hand-operated grease gun.

FIGURE 10 Lubrication of engine compartment door hinges with a spray oil dispenser.

FIGURE 11 Inspector adding pre-mixed coolant with a calibrated dispenser nozzle.

CHAPTER EIGHT

GENERAL RECOMMENDATIONS

During the review of the responses to the questionnaire and on reflection of the observations made and discussions held during the on-site visits with the participating transit systems in the bus inspection synthesis program, it was apparent that some recommendations would be helpful to other transit organizations. Among the key items noteworthy of recommendation are the following:

1. General managers must be convinced that the condition of the fleet is critical to the functioning of a successful transit system. A well-maintained fleet can sustain local operations with a minimum of spare vehicles, which are costly to acquire, store, and maintain. A well-maintained fleet will provide clean, safe, and dependable service much to the satisfaction of the riding public who are interested in point-to-point transportation with a minimum of distractions. The foundation of a well-maintained fleet is an efficiently organized and administered preventive maintenance (PM) program. To achieve this type of program, the maintenance department must have the support and encouragement to practice astute and well-planned PM programs with no interruptions and diversions of efforts. If this policy is established and implemented, fleet maintenance can be spared the two most-feared symptoms: deferred maintenance and degeneration of fleet conditions. This support must be real, followed through by observation and supervision, and be given the necessary external and internal control measures. It has been suggested that seminars or workshops be developed specifically for general managers to provide them with the basic knowledge so that they will be assured that the maintenance programs in place are effective and productive.

2. Maintenance managers should review the preventive maintenance programs to ensure that the inspection routine covers all essential elements at the proper intervals so that inspection personnel are fully utilized. Inspection items that are nice to do, but not essential, should be removed from the process so that critical safety items, lubrication procedures, and adjustments are performed properly without wasted time. Once a basic inspection outline and frequency are developed, these periodic inspections should be performed on schedule, whether by time or mileage, with little deviation from schedule. Within practical limits, inspection defects should be corrected immediately to avoid procrastination and potential safety violations.

3. Inspection crews should be selected from qualified applicants, even at the risk of involving union disagreement from time to time to preserve the right of management in these matters. To properly implement this philosophy will require the necessary measurement and evaluation tools to avoid subjective selections.

4. New inspection crews should be given adequate training before being given the responsibility to perform inspections. Training should also be given to existing crews when new types of equipment are acquired or when changes or modifications are issued by manufacturers.

5. Greater use should be made of diagnostic and other state-of-the-art measurement devices. Engine performance should be measured at prescribed intervals to avoid breakdown and to obtain the maximum mileage from each gallon of fuel. Electrical system integrity can be maintained by the use of numerous instruments currently available to the maintenance profession. The use of chassis dynamometers as an indoor electric road can provide measured and documented information about moving parts, such as brakes, steering, engine, transmission, and other vehicle functions normally observed on road tests, without the exposure to traffic, weather, and wasteful and unmonitored mechanic time.

6. The daily operator's vehicle report and the daily fuel-service line can provide much routine observations of fleet conditions that can be incorporated into the preventive maintenance sequences. Properly implemented and supervised, these two procedures can become the foundation of a complete preventive maintenance and inspection program.

7. All of the recommendations will lead to a better program. However, none will work by itself without the associated supervision. Just developing and publishing a procedure will not necessarily ensure its continued application. Periodic follow-up by the general manager, maintenance manager, and other supervisors is necessary to ensure compliance.

8. Specific programs and internal communication should be developed for general managers so that they fully understand and support the preventive maintenance need and requirement of high priority support from the highest level. Within this dialogue must be conveyed the idea that deferred costs from postponement or elimination of preventive maintenance and inspection programs will assuredly result in costs that far exceed the immediate savings and in a reduction in the reliability of service.

APPENDIX A

SURVEY FORM

BUS INSPECTION GUIDELINES

Transit System _____ **Number of Buses** _____

Service Area _____ **Number of Garages** _____

INSTRUCTIONS:

The following questions have been worded to apply to most systems. If the nomenclature differs from that employed in your system, adapt your method as closely as possible so that similiar procedures can be tabulated from all respondents. Please attach copies of such written procedures applicable to your system such as inspection cards, inspection detailed instructions, summaries of inspection performance, training programs for inspectors, and other pertinent information.

INSPECTION INTERVALS:

1. What is the name and frequency of the following inspections on your system?

Generic	Local Name	Frequency
Daily	_____	_____
Safety	_____	_____
Lubrication	_____	_____
Oil Change	_____	_____
Minor Tune-up	_____	_____
Major Tune-up	_____	_____
Other	_____	_____

2. What determined the frequency and content of inspection procedures?

Manufacturer Recommendations _____

Local Conditions of Operation _____

Past Experiences _____

Other (specify) _____

3. How are inspections scheduled into the daily shop work assignments?

Operator Daily Defect Cards _____

Scheduled Daily Mileage _____

Other (specify) _____

4. What management level is required to review and sign each inspection card?

_____

INSPECTION MANAGEMENT:

1. What skill level is used on inspection crews? _____

_____

2. How many man-hours are planned for each type of inspection? _____

_____

3. What type of training is given to inspection crews? _____

_____

4. When are the following inspection defects corrected?

   a. Minor adjustments and light bulb replacement _____

   b. Repairs and unit changes _____

   c. Safety items _____

5. Who determines whether bus can be used for service before defect is corrected? _____

6. What percentage or mileage over scheduled interval is acceptable?

_____

7. What periodic summary or reports are made to record inspections completed? (specify) _____

8. Is a correlation between road calls and operator defects made to previous inspections? _____ If so, does this lead to corrective training or disciplinary actions? _____

9. What diagnostic instruments are used during the inspection programs?

Instrument	Frequency
a. Decelerometer _____	_____
b. Emission Test _____	_____
c. Electronic Diagnostic____	_____
d. Chassis Dyno _____	_____
e. Other _____	_____

INSPECTION RECORDS:

1. How long are inspection records kept on file? _____

2. Are inspection results transferred to the MIS file where such records are part of the normal maintenance record system? _____

3. Are inspection and maintenance records normally used in accident or claims litigations? _____Rarely, _____ Occasionally, _____ Frequently.

4. Who is normally called to testify with the records when requested? Maintenance Manager _____, Foreman _____, Inspection Mechanic _____, Record Clerk _____, Other (Specify) _____

SPECIAL COMMENTS:

1. How important is the periodic inspection considered in your system management policies? _____
2. In determining priorities in the maintenance budget, how does the amount allocated for inspection crews rate when cut backs in numbers of personnel are contemplated? _____
3. Should maintenance meetings and conferences consider more discussions and panels to compare inspection procedures? _____
4. Do you have any special comments or ideas relating to the subject of bus inspection procedures that you would like to have included in the synthesis? _____ If so, comment here in or with attachments. _____

_____

_____

SUBMITTED BY:

Name _____

Title _____

Phone _____

If required, could an on-site inspection be made to obtain additional information for the synthesis? _____YES _____ NO

APPENDIX B

SUMMARY OF RESPONSES TO SURVEY

	Responses From Transit Agencies					
Question	Trailways U.S.A.	PAT Pittsburgh	Metro Seattle-King County	MTC Minneapolis-St. Paul	RTA Greater Cleveland	OCTA Orange County, California
Buses	1400	995	1065	1085	925	485
Garages	45	5	5	5	5	3
Inspection Intervals						
Frequency						
Daily	Biweekly (A)	Service lane	Driver	Service lane	Service lane	Service lane
Safety	-	1,000	1,000	Service lane	1,500	All
Lubrication	4,000 (B)	4,000	4,000	3,000	3,000	Quarterly
Oil change	16,000 (C)	8,000	12,000	6,000	6,000	Semi-annual
Minor tune-up	32,000 (D)	None	None	-	24,000	As needed
Major tune-up	As needed	48,000	24,000	24,000	-	As needed
Other						Trans.=weekly Brake=bimonthly
Frequency and content determination						
Manuf. recommendation	X	X	X	X	X	X
Local conditions	X	X	X	X	X	X
Past experience	X	X	X	X	X	X
Other						
Scheduling						
Operator defect cards	X					
Daily mileage	X		X	X	X	
Other		Fuel use				Fuel use
Management review level	Shift superv.	Gar. foreman	Gar. foreman	Foreman	Shift foreman	1st line superv.
Inspection Management						
Skill level	A & B	Seniority	Mech./Svc.	Mech.	Mech. 2	B mech.
Planned man-hours	A=0.5, B=1.0 C=2.0	A=2, B=4 C=16	A=0.5, B=1.2 C=2.6, D=3.6	3000=2, 6000=6, 24,000=8	1500=1.5, 3000=2.5, 6000=4.0	Minor=1.5, Major=4.5
Crew training	Periodic	2-week course	On-job	8-hr in-house; slides	Visual aids; manuals; OJT	In-house; OJT
Defect correction						
Minor adjust.; bulbs	A	Inspection	Inspection	Inspection	Inspection	Daily
Repairs	As required	Follow-up	24 hours		Inspection	As needed
Safety items	A, B, C	Follow-up	Before used	Inspection	Inspection	Immediate
Decision to hold bus	Shift superv.	Gar. foreman	Chief/LDMgr.	Foreman	Shift foreman	Maint. super.
% over mileage allowed	10	50 max.	10	10-15	200 miles	200 gallons
Periodic reports	Weekly prod.	Computer	-	Manual	Weekly	MBO rept.
Road call/defect correl.	Yes	No	Yes	No	No	Yes
Corrective actions	Yes	Not yet	Yes	Spot checks	-	Yes
Diagnostic instruments						
Decelerometer	Reline/Comp.	Acc./Br. fail	-	-	Brake reline	All PM
Emission test	-	-	-	-	-	As needed
Electronic diagnostic	-	-	-	-	-	VAT 33, UOM
Chassis dynamometer	-	-	-	24,000	Annual; driver complaint	Each major
Other	-	Voltmeter	Manometer	-	-	Oil analysis
Inspection Records						
Length on file	90 day/3 years	3 years	Life	2 years	Life	Life
Transfer to MIS file	No	Yes	Yes	Yes	Yes	Not yet
Used in litigation	Frequently	Frequently	Occasionally	Occasionally	Occasionally	Occasionally
Testify about records	Foreman, mech.	Asst. Gen. Supt.	Foreman/Supt.	M.M.	M.M.	M.M./Supt.

Question	DART Dallas	MCTS Milwaukee County	NFTMS Buffalo	SORTA Cincinnati	CCYC Syracuse	COTA Columbus
	Response From Transit Agencies					
Buses	635	590	473	384	182	323
Garages	4	3	4	2	3	2
Inspection Intervals						
Frequency						
Daily	Service lane	Service lane	Service lane	Service lane	Service lane	Service lane
Safety	6-9,000	2,500	4,000	900-2,000	6,000	3-4,000
Lubrication	6-9,000	5,000	4,000	5,000	12,000	3-4,000
Oil change	6-9,000	10,000	8,000	8,000	12,000	12,000
Minor tune-up		30,000	6,000 mech.	41,000	-	As needed
Major tune-up	As needed	100,000	12,000 body	As needed	36,000	As needed
Other			32,000 chassis			
Frequency and content determination						
Manuf. recommendation	X	X	X	X	X	X
Local conditions	X	X	X	X	X	X
Past experience	X	X	X	X	X	X
Other						
Scheduling						
Operator defect cards		X				
Daily mileage	X		X	X	X	X
Other	Time			Hubodometer		
Management review level	Insp. superv.	Foreman	Asst. Gar. Sup.	Foreman	Superv.	1st line Sup.
Inspection Management						
Skill level	1st class A & B	A & C	A	A & B	Mech.	A2
Planned man-hours	9000=16, 18,000=24	Lube=3.25	Varies	1 (no brake), Lube=3	1-2.3	3-4
Crew training	OJT & manual	3 days & OJT	In-house	OJT	OJT	None
Defect correction						
Minor adjust.; bulbs	Immediate	Follow-up	Daily	Brake	Immediate	Immediate
Repairs	After insp.	Follow-up	Daily	Inspection	Schedule	Schedule
Safety items	Insp. Superv.	Immediate	Daily	Inspection	Immediate	Immediate
Decision to hold bus	Shop superv.	Foreman	Gar. Superv.	Foreman	Supervisor	1st line super.
% over mileage allowed	0	500 miles	8-10	6.3	500 miles	10
Periodic reports	Daily	Monthly	Daily	Weekly/monthly	Computer	None
Road call/defect correl.	Yes	No	No	Yes	Yes	Yes
Corrective actions	Yes	-	Yes	Yes	At times	Yes
Diagnostic instruments						
Decelerometer	6-9,000	5,000	4,000	Accident	Brake defect	As required
Emission test	-	-	12,000	-	36,000	-
Electronic diagnostic	-	-	No	-	36,000	-
Chassis dynamometer	-	30,000	No	-	36,000	As required
Other	Manometer	-	-	Power v. RPM at 40,000	-	-
Inspection Records						
Length on file	3 years	Indefinitely	7 years	1 year	6 years	Indefinitely
Transfer to MIS file	Not yet	No	None	Yes	Yes	N/A
Used in litigation	Rarely	Frequently	Frequently	Occasionally	Occasionally	Occasionally
Testify about records	Foreman/mech.	Foreman	Foreman	M.M./foreman	M.M.	Gen. foreman

Question	Responses From Transit Agencies					
	VIA San Antonio	KCATA Kansas City	Phoenix Phoenix	RT Sacramento	GRTC Richmond	TARTA Toledo
Buses	473	313	294	211	232	228
Garages	1	1	1	1	1	1
Inspection Intervals						
Frequency						
Daily	Operator	Service lane	Driver	Service lane	Service lane	Service lane
Safety	4,000	1,500-2,000	Weekly	Weekly	Weekly	Service lane
Lubrication	4,000	6,000	4,000	3,000	6,000	6,000
Oil change	4,000	6,000	8,000	6,000	12,000	12,000
Minor tune-up	As required	12,000	30,000	48,000	12,000	As needed
Major tune-up	As required	As required	100,000	85-100,000	24,000	As needed
Other	After run		Mini 2,500			
Frequency and content determination						
Manuf. recommendation	X		X		X	X
Local conditions	X	X	X		X	X
Past experience	X	X	X		X	X
Other			Equip. age			
Scheduling						
Operator defect cards						
Daily mileage		X	X	X	X	X
Other			Spec. problems			
Management review level	Foreman	Foreman	Foreman	Sen. superv.	Shop foreman	Foreman
Inspection Management						
Skill level	Mech.	A	A, AA	C & B	Mech. 2 cl.	Mech.
Planned man-hours	-	Lube = 6	3	3000 = 1, 6000 = 4	4	4-8
Crew training	OJT	Orientation 4-week trial	Classes, OJT 8-12 day trial	OJT	OJT	OJT
Defect correction						
Minor adjust.; bulbs	Immediate	Immediate	Immediate	Nightly	Immediate	Immediate
Repairs	Scheduled	Scheduled	Scheduled		Scheduled	Immediate
Safety items	Immediate	Immediate	Immediate		Immediate	Immediate
Decision to hold bus	Foreman	Foreman	Foreman	Sen. superv.	Insp. foreman	Supt.
% over mileage allowed	4000-7500	-	None	20	500 miles	None
Periodic reports	History	Monthly	Computer	Daily	Daily	None
Road call/defect correl.	Yes	No	Yes	Yes	Yes	Yes
Corrective actions	Yes	-	Yes	No	Yes	Yes
Diagnostic instruments						
Decelerometer	No	12,000	4,000 & brake	Brake problem	-	-
Emission test	No	6,000	No	-	24,000	-
Electronic diagnostic	No	No	Yes	-	6,000	-
Chassis dynamometer	No	No	Not yet	6,000	-	-
Other	No	No	-	-	12,000	-
Inspection Records						
Length on file	Life	Life	Life	1 year	Life	5 years
Transfer to MIS file	No	Yes	Yes	Yes	Yes	-
Used in litigation	Occasionally	Occasionally	Occasionally	Frequently	Frequently	Rarely
Testify about records	M.M.	Mgr. Safety, Foreman	M.M., Dir. of Safety	M.M.	M.M., Foreman, Mechanic	Supt.

Question	Responses From Transit Agencies					
	SUNTRAN Tucson	CITRAN Fort Worth	MTA Nashville	CTS Charlotte	WMATA Washington	Metro Houston
Buses	159	144	138	100	1800	750
Garages	1	1	1	1	9	4
Inspection Intervals						
Frequency						
Daily	Service lane	None	-	Bus lane/driver	-	Operator
Safety	-	-	Weekly	-		2 weeks
Lubrication	6,000	4,500	9,000	4,000		6,000
Oil change	12,000	9,000	9,000	12,000	5,000	6,000
Minor tune-up	24,000	-	As needed	As needed		
Major tune-up	72,000	36,000	100,000	As needed		
Other				A/C 4,000	Brake adj. ea. time on hoist	
Frequency and content determination						
Manuf. recommendation	X	X				
Local conditions	X	X				
Past experience	X	X		X		
Other			Mileage			
Scheduling						
Operator defect cards						
Daily mileage	X	X	X			X
Other				Actual miles		
Management review level	Foreman	Lead foreman	Foreman	Foreman		
Inspection Management						
Skill level	AA mechanic	1, 2, 3 mech.	A	A, B, C	A mech.	
Planned man-hours	B=6, C=8, D=10	3, 4, 8	4	Not set		
Crew training	None	Classroom, OJT	OJT	OJT	Complete	
Defect correction						
Minor adjust.; bulbs	Daily	Immediate	Immediate	Immediate	Immediate	
Repairs	Scheduled	Scheduled	Scheduled	Scheduled	Scheduled	
Safety items	Immediate	Immediate	As needed	Immediate	Immediate	
Decision to hold bus	Foreman	Foreman	Foreman	Foreman	Supt.	
% over mileage allowed	None	None	500 miles	500 miles		
Periodic reports	Monthly	Daily	Card file	Bimonthly		
Road call/defect correl.	Yes	No	No	No		
Corrective actions	Yes					
Diagnostic instruments						
Decelerometer	No	-	9,000	No		
Emission test	No	-	No	No		
Electronic diagnostic	No	-	No	No		
Chassis dynamometer	No	-	No	No		
Other				A/C hoses		
Inspection Records						
Length on file	Life	2 years	3 years	1 year		
Transfer to MIS file	Yes	Yes	Yes	Yes		
Used in litigation	Occasionally	Occasionally	Rarely	Rarely		
Testify about records	M.M.	M.M.	M.M.	Mgr. Safety		

APPENDIX C

OPERATOR'S DAILY COACH CONDITION REPORT

COACH CONDITION REPORT

Form: 60-131 (Rev. 3-77)

OPERATOR

Date | Pay No. | Route | Unit | Coach No.

		REPAIRS MADE BY	PAY NUMBER
BRAKES	SLACK		
	UNEQUAL		
	GRAB		
	NOISY		
ENGINE	NO POWER		
	HEATS		
	STALLS		
	CUTS OUT		
	RACES		
	KNOCKS		
	FUMES		
	WON'T START		
CL. & TURB.	SLIPS		
	NOISY		
	WON'T SHIFT		
STEER.	HARD		
	LOOSE		
	SHIMMY		
DOORS	SLOW		
	FAST		
	WON'T CLOSE		
	WON'T OPEN		
BODY	AIR COND.		
	BUZZER		
	W.S. WIPER		
	HEAT		
	HORN		
	LIGHTS		
	WINDOWS		
	SEATS		
	STEPS		
	MIRRORS		
	FLOORING		
	STANCHIONS		
MISCELLANEOUS	TIRES		
	RADIO		
	GENERATOR		
	STARTER		
	AIR SUS.		
	H. BRAKE		
	COACH O.K.		

Route Foreman and Driver's Remarks:

APPENDIX D

WEEKLY REPORT OF BUS MILES SINCE LAST INSPECTION (PAT)

PROG=MNT~~05~~ RUN TIME=20:56:47 LOC 56 BUSES DUE FOR INSPECTION/BRAKE ADJUSTMENT RUN DATE=12/10/84 PAGE 1

	INSPECT							BRAKE ADJUSTMENT		
	LAST			LAST 48000		DUE		LAST		
BUS #	MILES SINCE	DATE	TYPE INT	MILES SINCE	DATE	TYPE INT	1ST DAY ON LIST	MILES SINCE	DATE	1ST DAY ON LIST
BUSES DUE FOR BRAKE ADJUSTMENT ONLY										
2512								1934	05/19/84	05/31/84
3767								1734	11/27/84	12/07/84
3674								1734	11/27/84	12/06/84
3775								1664	11/29/84	12/07/84
3760								1663	11/27/84	12/07/84
3564								1547	11/14/84	12/07/84
3857								1545	11/27/84	12/07/84
3678								1520	11/28/84	12/07/84
1629								1493	11/29/84	12/07/84
2534								1486	11/12/84	12/03/84
3843								1467	11/29/84	12/07/84
3571								1411	11/29/84	12/07/84
1916								1403	11/26/84	12/07/84
1511								1380	11/12/84	12/06/84
3572								1373	11/29/84	12/07/84
3859								1371	11/30/84	12/07/84
1630								1359	12/01/84	12/10/84
3838								1344	12/01/84	12/07/84
3560								1324	12/03/84	12/10/84
3661								1311	11/30/84	12/10/84
1141								1308	11/27/84	12/07/84
2673								1307	11/19/84	12/07/84
2719								1298	11/20/84	12/07/84
3778								1290	11/17/84	12/07/84
1631								1281	11/28/84	12/07/84
2692								1267	11/05/84	12/07/84
1512								1239	11/21/84	12/07/84
3670								1238	11/27/84	12/07/84
1919								1235	11/27/84	12/07/84
1918								1220	09/26/84	10/10/84
3766								1220	11/29/84	12/10/84
2706								1216	08/09/84	12/07/84
1174								1204	11/28/84	12/07/84
1172								1177	11/29/84	12/10/84
3845								1163	12/01/84	12/10/84
3768								1162	12/03/84	12/10/84
3769								1149	12/03/84	12/10/84
3774								1149	12/01/84	12/10/84
1149								1135	11/29/84	12/10/84
1136								1114	11/27/84	12/07/84
3761								1107	12/01/84	12/10/84
2708								1106	11/28/84	12/07/84
3663								1086	12/01/84	12/10/84
2676								1079	11/21/84	12/07/84
1144								1070	11/27/84	12/10/84
3856								1063	11/30/84	12/10/84
2670								1062	11/26/84	12/07/84
3835								1059	11/29/84	12/10/84
1140								1043	11/29/84	12/10/84
1633								1035	12/01/84	12/10/84
1145								1017	11/28/84	12/10/84
2707								1012	11/28/84	12/10/84
2672								995	11/21/84	12/07/84

SAMPLE: 'Pick sheet' for determining which buses are due for brake adjustments and/or PM inspections

PROG=MNT005 RUN TIME=20:56:47 LOC 56 BUSES DUE FOR INSPECTION/BRAKE ADJUSTMENT RUN DATE=12/10/84 PAGE 2

BUS #	INSPECTION – LAST – MILES SINCE	LAST DATE	LAST TYPE	LAST INT	– LAST 48000 – MILES SINCE	LAST 48000 DATE	DUE TYPE	DUE INT	DUE 1ST DAY ON LIST	BRAKE ADJUSTMENT – LAST – MILES SINCE	LAST DATE	1ST DAY ON LIST
BUSES DUE FOR BRAKE ADJUSTMENT ONLY												
2711										992	11/26/84	12/10/84
1260										985	10/24/84	11/05/84
3669										977	12/01/84	12/10/84
2563										974	11/26/84	12/07/84
1134										973	11/21/84	12/05/84
3671										972	12/03/84	12/10/84
3851										971	11/24/84	12/10/84
1634										970	12/04/84	12/10/84
2677										968	10/30/84	11/15/84
1139										966	11/30/84	12/10/84
3842										959	12/04/84	12/10/84
2713										955	11/28/84	12/10/84
2716										954	11/27/84	12/10/84
1142										924	11/20/84	12/10/84
3566										911	12/04/84	12/10/84
2712										903	11/28/84	12/10/84
BUSES DUE FOR 48,000 MILE INSPECTION												
3763 10	4162	11/13/84	04	44	50405	99/99/99	48	48	12/06/84	1201	12/01/84	12/10/84
2575 ok	3033	10/26/83	08	40	49668	10/26/82	48	48	12/10/84			
BUSES DUE FOR 8,000 MILE INSPECTION												
2574 ok	4663	08/07/84	04	20	27365	01/16/84	**08	24	09/14/84	1004	09/11/84	09/26/84
1143 ok	3924	08/10/84	04	20	25920	03/05/83	**08	24	09/17/84	1457	09/01/84	09/18/84
3667 10	3799	11/13/84	04	28	33221	04/17/84	08	32	12/06/84			
3772 11	3779	11/15/84	04	04	8125	10/21/84	08	08	12/07/84			
3847	3737	11/15/84	04	04	7427	10/24/84	08	08	12/07/84	1684	11/30/84	12/07/84
3773 10	3730	11/13/84	04	12	18816	08/03/84	08	16	12/06/84	1847	11/26/84	12/06/84
3844	3694	11/17/84	04	04	7190	10/31/84	08	08	12/07/84			
3839	3580	11/13/84	04	04	7693	10/14/84	08	08	12/07/84	987	11/30/84	12/10/84
2843 11	3555	10/14/84	04	20	25658	12/29/83	**08	24	12/07/84			
3071	3531	11/02/84	04	04	7982	09/15/84	08	08	12/06/84			
3830	3503	11/12/84	04	04	7606	10/19/84	08	08	12/07/84			
3836	3503	11/23/84	04	04	7045	10/25/84	08	08	12/10/84	1713	12/01/84	12/07/84
3837	3497	11/12/84	04	04	7724	10/12/84	08	08	12/07/84	1066	12/03/84	12/10/84
2682 10	3475	10/18/84	04	12	17048	02/26/83	08	16	12/06/84			
3848 ok	3424	11/07/84	04	04	7279	10/14/84	08	08	12/05/84	1201	11/22/84	12/06/84
3565	3329	11/15/84	04	20	25978	04/12/84	**08	24	12/07/84	1004	12/01/84	12/10/84
3771	3316	11/15/84	04	12	17676	07/31/84	08	16	12/07/84			
3062	3272	10/27/84	04	04	7947	09/07/84	08	08	12/06/84			
3057	3253	11/05/84	04	04	7116	09/27/84	08	08	12/06/84			
3833	3227	11/17/84	04	04	6968	10/26/84	08	08	12/10/84			
1442	3138	11/07/84	04	12	17291	04/27/84	08	16	12/10/84			
2515	3046	11/03/84	04	12	17349	06/09/84	08	16	12/10/84			
2671	3045	10/16/84	04	20	23758	12/23/83	**08	24	12/10/84			
1138	3013	11/13/84	04	20	44259	09/11/81	**08	24	12/10/84			
BUSES DUE FOR 4,000 MILE INSPECTION												
2583 pl	4583	07/07/83	08	40	46002	08/20/82	04	44	08/25/83	4583	07/07/83	07/26/83

PROG=MNT005 RUN TIME=20:56:47 LOC 56 BUSES DUE FOR INSPECTION/BRAKE ADJUSTMENT RUN DATE=12/10/84 PAGE 3

BUS #	INSPECTION - LAST MILES SINCE	INSPECTION - LAST DATE	INSPECTION - LAST TYPE	INSPECTION - LAST INT	INSPECTION - LAST 48000 MILES SINCE	INSPECTION - LAST 48000 DATE	INSPECTION - DUE TYPE	INSPECTION - DUE INT	INSPECTION - 1ST DAY ON LIST	BRAKE ADJUSTMENT - LAST MILES SINCE	BRAKE ADJUSTMENT - LAST DATE	BRAKE ADJUSTMENT - 1ST DAY ON LIST
BUSES DUE FOR 4,000 MILE INSPECTION												
3561	4225	08/09/84	08	08	14376	04/30/84	04	12	09/14/84	1530	08/30/84	09/18/84
2846	3731	09/27/84	08	40	45259	06/07/83	04	44	10/24/84			
2701	3668	10/30/84	08	32	37631	05/04/83	04	36	12/06/84	1017	11/28/84	12/10/84
2504	3598	10/26/84	48	48	3598	10/26/84	04	04	12/06/84			
3578	3559	11/12/84	08	16	21964	05/04/84	04	20	12/07/84			
3665	3500	11/07/84	08	24	27535	05/10/84	04	28	12/07/84			
2688	3481	09/18/84	08	32	37335	09/16/83	04	36	12/06/84	991	11/29/84	12/10/84
2569	3471	11/01/84	08	40	43028	04/20/83	04	44	12/07/84			
2562	3423	11/02/84	08	24	29780	01/18/84	04	28	12/06/84			
3019	3361	10/13/84	08	24	27105	10/17/83	04	28	12/06/84			
1264	3343	11/03/84	08	16	21603	04/13/84	04	20	12/07/84			
2685	3306	10/30/84	48	48	3306	10/30/84	04	04	12/07/84			
2700	3281	10/18/84	08	16	20630	03/12/84	04	20	12/07/84	907	11/27/84	12/10/84
3070	3274	10/30/84	48	48	3274	10/30/84	04	04	12/10/84			
2684	3260	10/20/84	48	48	3260	10/20/84	04	04	12/07/84			
1628	3244	11/08/84	08	40	43957	99/99/99	04	44	12/07/84			
3858	3239	11/20/84	08	32	34533	99/99/99	04	36	12/10/84			
3849	3237	11/15/84	08	08	13567	09/12/84	04	12	12/07/84			
2687	3210	11/04/84	08	32	37153	10/04/83	04	36	12/07/84			
2507	3193	10/27/84	48	48	3193	10/27/84	04	04	12/07/84			
1436	3172	11/12/84	08	24	30206	02/06/84	04	28	12/10/84			
3765	3055	11/19/84	08	08	11981	09/26/84	04	12	12/10/84	1447	11/29/84	12/07/84
3764	3041	11/13/84	08	08	13234	08/23/84	04	12	12/10/84			
1296	3026	10/20/84	08	24	30376	10/10/83	04	28	11/27/84			

APPENDIX E

EXAMPLES OF INSPECTION SUMMARIES

INSPECTIONS

***** SYSTEM TOTALS *****

LOC	TYPE	TOTAL INSP PERFORMED	% LESS THAN 3750 MI.	% FROM 3750 MI. TO 4500 MI.	% FROM 4501 MI. TO 5250 MI.	% FROM 5251 MI. TO 6000 MI.	% OVER 6000 MI.
10	04	54					
10	08	50					
10	48	8					
**********	PERCENTAGES	**********	24.1	57.1	10.7	5.4	2.7
24	04	63					
24	08	61					
24	48	4					
**********	PERCENTAGES	**********	28.1	39.1	24.2	7.0	1.6
46	04	78					
46	08	61					
46	48	10					
**********	PERCENTAGES	**********	25.5	65.8	7.4	1.3	0.0
56	04	120					
56	08	83					
56	48	13					
**********	PERCENTAGES	**********	55.1	44.0	0.9	0.0	0.0
60	04	37					
60	08	25					
60	48	16					
**********	PERCENTAGES	**********	84.6	15.4	0.0	0.0	0.0
SY	04	352					
SY	08	280					
SY	48	51					
**********	PERCENTAGES	**********	41.9	46.7	8.2	2.5	0.7

SAMPLE: End-of-month summary showing per cent of inspections done early, late, 2nd degree of lateness, and 3rd degree of lateness

FIGURE E-1 Pittsburgh (PAT) monthly summary of inspections performed on time.

SYSTEM
INSPECTIONS
ON TIME PERCENTAGE

1984 -	<3750	3751-4500	4501-5250	5251-6000	>6000
JAN	15.2	44.0	25.6	11.1	4.1
FEB	9.9	46.7	28.8	10.6	4.1
MAR	17.3	58.7	17.6	4.9	1.4
APR	23.0	64.5	10.4	1.4	0.6
MAY	14.3	57.0	21.0	5.8	1.9
JUN	8.7	38.5	30.5	12.6	9.7
JUL	26.0	37.0	20.3	8.1	8.5
AUG	24.0	34.5	26.6	10.8	4.1
SEP	15.4	34.5	25.9	15.9	8.3
OCT	24.3	35.4	22.8	11.1	6.4

OCTOBER

SAMPLE: Graph showing ~~November~~ 1984 % of inspections completed on time, vs. % on time for previous months

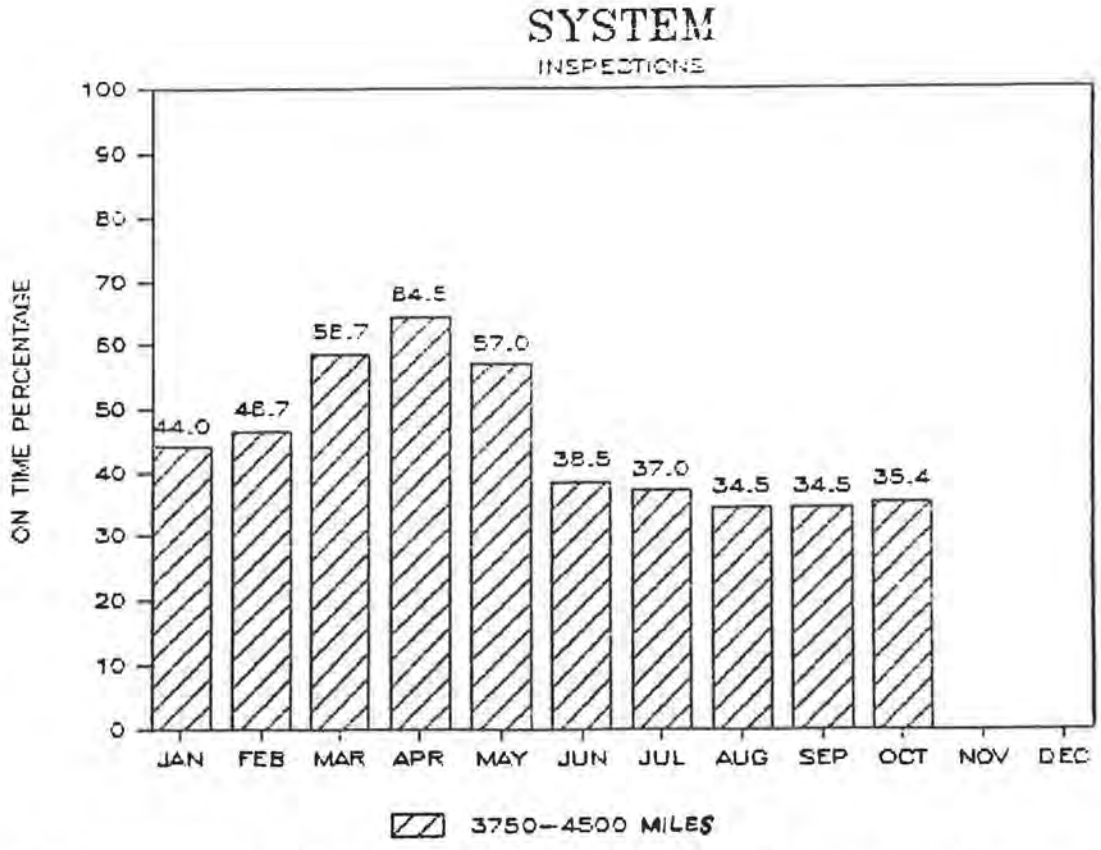


FIGURE E-2 Pittsburgh (PAT) month-by-month summary of graph of inspection completions.

KANSAS CITY AREA TRANSPORTATION AUTHORITY

MAINTENANCE PRODUCTION REPORTS

PRODUCTION STATISTICAL SUMMARY

1984 and 1983 Comparison by Month

MONTH	BUSES TOWED IN 1984/1983	(WEEKDAY AVG) 5:30 PM SERVICE LINE 1984/1983	(WEEKDAY AVG) DAY SERVICE LINE 1984/1983	(AVG) SERVICE LINE TOTAL 1984/1983	(AVG) BO'S WORKED 1984/1983	(AVG) BUSES HELD 1984/1983	1,500 MILE INSPECTIONS 1984/1983	INSPECTIONS PERFORMED METRO-KCI 1984/1983	INSPECTIONS COMPLETED METRO-KCI 1984/1983	INTERIOR CLEANING 1983/1982
January	25 / 15	240 / 260	01 / 06	241 / 266	61 / 56	45 / 35	625 / 611	107-4 / 102-0	94-4 / 98-0	118 / 140
February	24 / 18	244 / 254	09 / 10	253 / 264	55 / 63	43 / 39	622 / 576	93-4 / 90-6	73-4 / 83-6	149 / 95
March	21 / 15	242 / 251	08 / 09	250 / 260	56 / 65	45 / 41	654 / 667	94-2 / 87-0	91-2 / 81-0	211 / 142
April	17 / 27	238 / 248	07/ 06	245 / 254	52 / 50	45 / 40	613 / 625	81-4 / 78-0	72-4 / 77-0	176 / 136
May	22 / 24	235 / 242	06 / 06	241 / 248	48 / 52	47 / 42	653 / 620	84-4 / 89-6	75-4 / 73-6	217 / 79
June	24 / 23	242 / 241	07 / 08	249 / 249	49 / 51	42 / 44	615 / 642	62-3 / 90-2	60-3 / 79-2	174 / 107
July	31 / 17	236 / 229	07 / 39	243 / 268	45 / 58	41 / 49	564 / 582	59-4 / 89-3	53-4 / [illegible]	[illegible]
August	36 / 21	236 / 239	07 / 04	243 /243	53 / 64	49 / 54	611 / 676	69-0 / 76-3	57-0 / 58-3	183 / 52
September	25 / 15	238 / 246	06 / 07	244 / 253	45 / 57	52 / 47	528 / 617	55-4 / 89-4	44-4 / 77-4	84 / 160
October	8 / 20	243 / 241	05 / 07	248 / 248	47 / 54	39 / 42	658 / 625	87-5 /103-5	70-5 / 77-5	176 / 276
November	22 / 09	235 / 240	06 / 07	241 / 257	48 / 55	35 / 32	619 / 629	82-2 /111-1	72-2 / 94-1	159 / 213
December	16/ 33	243 / 240	06 / 15	249 / 255	51 / 60	29 / 30	550 / 503	74-2 / 81-2	55-2 / 70-2	135 / 150
YEAR TO DATE	271/ 237	239 / 245	06 / 10	245 / 255	51 / 57	43 / 41	7,382 / 7,373	947-38 /1,047-34	818-38/939-34	1983 /1,603

1/1/85

FIGURE E-3 Kansas City (KCATA) monthly summary of inspections performed and completed.

APPENDIX F

INSPECTION CHECK LISTS

This appendix shows some of the check lists used in Milwaukee, Fort Worth, Houston, Seattle, and Phoenix for routine bus inspections.

The Milwaukee forms are for the lead inspector (A Mechanic) and for the mechanic helper (C Mechanic).

The Fort Worth form shown is for the 9,000-mile inspection. Similar forms are used for inspections at 3,000, 18,000, and 36,000 miles.

In Seattle, one of seven different forms is used, according to a schedule that depends on the bus mileage. A short form is used for the inspections at odd 1,000-mile intervals and a slightly longer list is used for even 1,000-mile intervals. The other five forms are used at 4,000, 6,000, 12,000, 24,000, and 48,000 miles. The appendix shows the forms used at 4,000 miles (B Inspection) and at 12,000 miles (D Inspection).

DIESEL MINOR INSPECTION
5,000 Mile: A Mechanic

MILWAUKEE (MCTS)

Garage _____ Bus No. _____

Date of Last Insp. _____ Card No. _____

Date Due _____ Speedometer Reading When Completed _____

Speedometer When Due _____ Date Completed _____

Brake Adjustment _____ Date Done _____

	OK	DEFECT
A. CHASSIS		
1. Brakes		
2. Suspension		
3. Shocks		
4. Air Leaks		
5. Steering Linkages		
6. Interlocks		
7. Minimum Brake Lining Thickness (record)		
8. Loose Bolts		
9. Toe In		
10. Air Box Drain Tubes		
11. Pinion Shaft		
12 Differential Gears		
B. ENGINE COMPARTMENT		
1. Primary & Secondary Fuel Filter Replace (cards 1, 3, 5, 7, etc.)		
2. Oil & Filter Replace (cards 2, 4, 6, etc.)		
3. Air Cleaners		
4. Oil Pressures		
5. Starter		
6. Solenoids		
7. Alternator		
8. Compressor		
9. Radiator		
10. Hoses, Clamps & Vent Cocks		
11. Fan Operation		
12. Ping Chamber—Drain		
13. Transmission & Power Steering		
14. Transmission Heat Exchanger		
15. Lubrication		
16. Engine Idle (record)		
17. Engine Stall (record)		
18. Engine No-Load (record)		
19. Water & Oil Leaks		

	OK	DEFEC
C. TAPLEY READING		
1. Tapley Reading		
2. Anti Skid		
3. Check Shift		
4. Parking Brake Test		
5. Interlocks—Check		
6. Unusual Noises		
7. On 3001-30, and 3100-49 Check PA		

NAME _____

EQ61

DIESEL MINOR INSPECTION
5,000 Mile: C Mechanic

Garage _____ Bus No. _____

Date of Last Insp. _____ Card No. _____

Date Due _____ Speedometer Reading When Completed _____

Speedometer When Due _____ Date Completed _____

Brake Adjustment _____ Date Done _____

	OK	DEFECT
A. PREPARATION		
B. OPERATOR'S SEAT		
1. Governor Air Pressures		
2. Switches, Warning Lights and Gauges		
3. Accelerator & Brake Pedals		
4. Hand Brake		
5. Door Control Valve		
6. Accelerator & Brake Interlocks		
7. Doors—Timing		
8. Windshield Wipers & Washers		
9. Transmission Control Lever		
10. Steering		
11. Transfer Cutter		
12. Mirrors		
13. Operator's Seat		
C. BODY INSIDE		
1. Passenger Signal		
2. Doors—Front & Rear		
3. Steps and Floor Covering		
4. Interior Lights		
5. Seats, Stanchions & Hand Holds		
6. Windows		
7. Fire Extinguisher		
8. Broom, Sand Bags, Ice Scraper & Thermometer		
9. Heater & Defroster Fans		
10. Destination, Route, Run Number Signs		

	OK	DEFECT
D. BODY OUTSIDE		
1. Outside Lights		
2. Wiper Arms and Blades		
3. Advertising Signs		
4. Body Inspection		
5. Compartment Doors & Hinges		
6. Battery		
7. Air Intake Ducts & Vents		
8. Static Ground Strap		
E. CHASSIS		
1. Tires—Wear & Inflation		
2. Wheel Nuts		
3. Wheel House Clearances		
4. Lubrication		
5. Rear Axle Flange Nuts		
6. Drive Shaft		
7. Radius Rods		
8. Air Tanks		
9. Change Heater Filters		
10. Change Defroster Filters on RTS Coaches		
11. Radio Check		

NAME _____

EQ60

FORT WORTH (CITRAN)

9,000 MILE INSPECTION CHECKLIST (RTS-II)

Bus No. _____ **Date Due** _____ **Date Completed** _____ **Inspector** _____

	Symbol		Symbol
I. COACH INTERIOR	X	Headlamp Operation (Bright/Dim)	
Dashlights, Gauges and Switches		Directional Signals Operation	
Driver Seat and Belt		Hazard Flashers Operation	
Tilt Steering Wheel Lock		W/S/W Blades and Arms (Oil Pivots)	
Horn Operation		"Wheelchair" Decal (Exit Door)	
Accelerator/Brake Pedal Operation/Condition		"Kneeling Bus" Decal (Entrance Door)	
Windshield Wiper/Washer Operation		Exact Fare Decal	
Air Parking Brake Operation		Adv. Sign Frames Secure	
Driver's Shield Secure		Mirrors (Cracks/Tighten/Convex)	
Gear Shift Lever In Full Detent		Wheel Lug Nuts (Tighten, using only 1" impact)	
Check Backup Alarm Signal Operation		Check For Body Damage	
Check Interior Lights Operation		Radio Compartment (Secure/Sealed)	
Dest. Sign Displays and Lights		Access Doors (Check Operation/Oil Latches)	
Entrance/Exit Door Operation		Tire Pressures (Front-90 PSI/Rear-80 PSI)	
Rear Door Interlock (Operation/Lights)		Tread Depth, LF__ RF__ LRO__ LRI__ RRO__ RRI__	
Dest. Sign Code Listing Secure		Open Battery Quick—Disconnect	
Radio Equipt. Secure		Clean Batteries	
Engine Alarm System Operation		Check Battery Cables (Condition)	
Free Zone Card Rack Secure		Torque Battery Terminals	
Transfer System Secure		Check Battery Specific Load	
Record Odometer Reading_____		Close Battery Quick Disconnect	
Light Dimmer Switch Operation		**III. POWER TRAIN/UNDER CARRIAGE**	X
Windows (Cracks/Security Latched)		Transmission Fluid Level/Leaks	
Stepwell and Floor Coverings		Change Engine Oil and Filters	
"Watch Your Step" Decals		Check for Fuel Leaks	
Elderly/Handicapped Seating Decals		Coolant Level/Leaks	
Fire Ext. (Mounting/Charge/Current Inspection)		Power Steering Fluid Level/Leaks (10 W40 Oil)	
Windshield Washer Fluid Level		Differential Oil Level/Leaks (Clear Vent)	
Passenger Chime (Ck. Each Tape Station)		Grease All Zerk Fittings (See Lube Chart)	
Front/Rear Trash Can Condition		Visually Check Steering Linkage	
Emerg. Escape Hatch Operation (Rear)		Visually Check Power Steering Hoses/Lines	
Ventilation Hatch Operation (Front)		Shock Absorbers Secure	
Interior Mirrors (Cracks/Tighten)		Radius Rod Bushings Secure/Condition	
Eng. Inspection Panels (Seals/Secure)		Brake Lining Thickness	
Clean Air Return Filters (Soap and Water)		Exhaust System Leaks/Tailpipe Opening	
Check Entrance/Exit Door Hinges		Engine Fan Drive Belt (Tightness/Condition)	
Replace Missing Screws In A/C Panel		A/C Compressor Drive Belt (Tightness/Condition)	
Replace Missing Screws in Dash Area		Air Cleaner (Change if above 25 In H^2O)	
II. COACH EXTERIOR	X	Air Throttle Air Leaks/Operation	
Clearance Lights Operation		Drain Air Tanks	

Check Wiring For Worn Insulation		**V. CLIMATE CONTROL SYSTEM**	X
Low Air Pressure Switch Connections		Check System Operation	
Safety Valve Operation		Check Defroster Operation	
Check For Air System Leaks		Check Driver's Booster Blower Operation	
Engine Mounting Bolts Secure		Check Main Blower Operation	
Replace Missing Screws In A/C Panel		Check Operation of Water Mod Valve	
Main Frame (Check For Cracks/Broken Welds)		Check Operation of Water Booster Pump	
		Clean Condenser Coil	
IV. WHEELCHAIR LIFT AND KNEELING	X	Check A/C Compressor Oil Level (7/8 sight glass)	
Check Kneeling Operation		Check Freon Level	
Check Wheelchair Lift Operation			
Check Wheelchair Restraint Operation		**VI. ROAD TEST**	X
Panel Screws Secure		Upshift/Downshift Speeds	
		Steering (Smooth, Not Binding)	
		Noise/Rattles	
		Brake Operation (No Pulling/Slack)	
		General Operation of Coach	

Mechanic will ensure that every blank is filled on this form.

Time Assigned _____

FOREMAN'S APPROVAL _____

ENGINE/RADIATOR STEAMED _____ **NOTES**

Time Completed _____

SYMBOLS

√ - Checked and Found OK
R - Repaired
O - Discrepancy Not Corrected (Defect Card Initiated)
N - Replaced
T - Tightened
X - Explanation Under Notes
A - Adjusted
D - Drained

REPORT ANY UNUSUAL CONDITIONS ON THIS COACH TO YOUR SUPERVISOR

71119-B1

METRO
MAJOR INSPECTION

HOUSTON (MTA)

Coach No _____ Type _____ Fuel Mileage _____ M P G

Date Completed _____ Date _____ Oil Mileage _____ M P O

DESCRIPTION	REPAIRS MADE	ADJ.	O.K.	MECH. INITS.
ENGINE AND TRANSMISSION INSPECTION				
Throttle and Shift Control Conduits and Seals				
Engine Supports and Insulators				
Radiator - Surge Tank - Caps - Gaskets - Hoses - Pressure (7 P.S.I. Max.)				
Check Anti-Freeze Reading and Record				
Fan Blades and Hub for Loose - Check Hub Seal for Leak				
Fuel Filters - Clean Replace				
Fuel Pressure Idle [ ] Full Throttle [ ]				
Oil Pressure Reading Idle [ ] Full Throttle [ ]				
Blower Pressure Hoses [ ] Clamps [ ]				
Air Intake Vacuum at 2100 RPM				
Air Box Drains				
Idle Engine and Check for Full Throttle (to spec.)				
Check Engine Shut Off - Regular and Emergency				
Check Engine Fast Idle				
Check Forward and Reverse Shift Control				
Shift Actuator Travel and Lock Nut and Plugs on VS-2 Transmission				
Repair Oil and Transmission Leaks				
Check Stall Speed				
Replace Perry Filter Element				
Muffler and Ex. Pipe for Leaks				
Smoke Test OK [ ] Light [ ] Heavy [ ]				
Change Engine Oil				
Filter Element Change				
Clean Engine Air Cleaner - Check Gaskets and Felts				
CHASSIS INSPECTION				
Axles - Flanges Studs - Wheel Lugs - Torque to 550 Ft. Lbs.				
All Wheel Bearing Adjustment				
Frame and Cross Members				
Shock Absorbers				
Service Brake Adjustment - Lining Thickness F [ ] R [ ]				
Slack Adjusters				
Brake Shoe Springs and Cam Rollers				
Brake Chambers - Air Leaks with Brake Applied				
Brake Valve Pressure - Interlock Pressure				
Hand Brake Adjustment - Lining Thickness (Adj. to 3 Clicks) P.T.S. [.020]				
Steering Wheel for Excessive Play				
Spindle and King Pins Bushings and Seals				
Pitman Arm - Drag Link and Tie Rod Ends				

DESCRIPTION	REPAIRS MADE	ADJ.	O.K.	MECH. INITS.
CHASSIS INSPECTION (Continued)				
Front Wheel Alignment - Check with Alignment Bar				
Drive Shaft and Universal Joints				
Differential Pinion Backlash and Oil Leaks (2" ") Max				
Wipe Off All Grease Fittings and Grease				
Check Differential Grease Level - Change at 12,000 Miles				
Drain All Air Tanks and Check Spitter Valve Operation or Dryer				
Check Converter Oil Level - Change at 48,000 Miles - Clean Sump				
Tires - Inspect and Inflate to 90 lbs. Cold				
BODY INSPECTION				
Exterior Body Damage				
Clean Engine Air Inlet Screens				
Condition of Steps and Floor Covering				
Operator's Seat - Adj. Mechanism				
Destination and Route Signs				
Rear View Mirrors				
Fire Extinguisher				
Clean Heater System Filters				
Hand Rails - Stanchions				
Seats and Cushions				
Window Glass - Latches and Guides				
Interior Body Damage				
Emergency Door Operation				
Fare Box Mounting and Light				
Door Engines - Air Leaks - Linkage				
Door Valve Operation - Leaks				
State License and Inspection Sticker				
Heaters - Hose Connections				
Disinfect				
Check Speedometer for Operation				
Check for cracked Frame or Bad Weld and Notify Foreman				
Check for Air Dryer Spitting out Dump Valve on Compressor				
Governor Cut Out at 115 or 120 P.S.I.				
Door Operation - Touch Bars				
Front and Center Door Adjustment				
Remove Destination Sign and Clean Glass				
Windshield Wipers - Arms - Blades - Speed - Add Solution				
Tire Tread Depth in 32 of Inch				
RFO ☐ RFI ☐ LFO ☐ LFI ☐ LF ☐ RF ☐				

METRO

Form 7111 Back R[illegible] d 9 81

MAJOR INSPECTION — (Continued)

DESCRIPTION	REPAIRS MADE	ADJ.	O.K.	MECH. INITS.
ELECTRICAL				
Battery Tray Clean - Lubricate				
Hydrometer Reading of Battery				
Battery No 1 Min _____ Max _____				
Battery No 2 Min _____ Max _____				
Battery Cell Voltage (with lights on)				
Battery No 1 Min _____ Max _____				
Battery No 2 Min _____ Max _____				
Main Cable Resistance				
Battery Water Level				
Battery Cables and Conns add Corrosion Free				
All Elect Relays for Proper Operation				
Generator and Starter Brushes, Springs, Holders and Commutators				
Blower Motor Brushes and Commutators				
Heater Pump Motor Brushes				
Voltage Reg for Proper Setting				
Wiring Connections and Fuses				
All Heaters for Proper Operation				
All Instruments and Safety Devices for Proper Operation				
Buzzer and Buzzer Cords				
Horn				
Power Packs and All Lights				
Directional Signals				
Alarmastats				

DESCRIPTION	REPAIRS MADE	ADJ	O K	MECH INITS
ELECTRICAL (Continued)				
Speedometer and Cable				
Cooling Fan Motor Amps				
Voltage Drop - Starter _____ Battery _____				
AIR SUSPENSION INSPECTION (ALL BUSES)				
Check Clearance Between Axle Bumpers - 3 ½" at Front Axle				
Use Height Gauge at Rear				
Front U Bolt Nuts - 150 to 165 lbs				
Rear Suspension Support to Axle U Bolt Nuts - 210 to 240 lbs				
Visually Inspect all Bellows for Cracks, Bruises or Other Damage				
Check Height Control Linkage				
12,000 MILES				
Tighten Cyl Head Nuts (Retorque to Spec.)				
Valve Adjustment - .008 Go .010 No Go				
Injector Timing with Gauge				
Set Governor Spring Plunger Gap				
Injector Control Rack Adjustment				
Adj Idle Speed and Gov Buffer Screw - Fast Idle Setting				
Remove - Clean - Lube - Adj Tele-Flex Cables				
Turbine Pressure				
Check Shut Down Cyl for Travel				
Replace Secondary Filter Element - Both				
Timing Tool Used on V-8, V-8 - 1484				
Throttle Delay				

LUBRICATION (Do Not Over Lubricate)

CHASSIS	WORK DONE	BY
Oil all Moving Linkage in Engine Compartment and Under Coach		
Lube Air Cond Compr Drive Shaft		
Grease Brake Anchor Pins		
Grease Steering Gear		

	WORK DONE	BY

REPORT OF ADDITIONAL REPAIRS TO BE MADE

_____

_____

_____

THIS IS TO CERTIFY THAT EACH ITEM HAS BEEN CHECKED ACCORDING TO INSTRUCTIONS

MECHANIC'S SIGNATURES: FOREMAN_____

_____ _____ _____ _____ SIGNED AND FILED_____

SUPT OF MAINTENANCE

SEATTLE

METRO

STANDARD — B INSPECTION

Interior

- ☐ Farebox (Seal, Cyclometer, Telltale)
- ☐ Fire Extinguisher (Seal, Pressure)
- ☐ Wipers-Washers (Service Washer)
- ☐ Alarms — Gauges (Gen, Oil, Low Air, Backup Alarm, Engine Fire Alarm)
- ☐ Check Heat, Defrost System
- ☐ Check Sander Operation — Fill Sand Buckets (Winter Only)
- ☐ Doors (Operation, Interlock, Sensitive Edge)
- ☐ Wheel Blocks, Flares, Reflectors
- ☐ Interior (Cleanliness, Damage)
- ☐ Destination Signs
- ☐ Dash & Dome Lights
- ☐ Passenger Chime & Stop Request System
- ☐ Check Horn

Exterior

- ☐ Lights (Head, Tail, Marker, Turn, Back-Up)
- ☐ Check For Damage
- ☐ Mirrors
- ☐ Batteries (Electrolyte, Wash, Lube Tracks)

Engine Compartment

- ☐ Visual Check For Leaks (Air, Oil, Trans, Coolant)
- ☐ Correct Fluid Levels (Oil, Trans, Power Steering, Coolant)
- ☐ Check Fan Drive
- ☐ Coolant Additive Test (DCA-Flyers)
- ☐ Check Air Intake System For Loose Clamps, Seals, etc.
- ☐ Check Exhaust Pipes, Clamps, Muffler
- ☐ Check Emergency Stop
- ☐ Check Hydrofan Reservoir (500's)

Under Chassis

- ☐ Inspect Undercarriage (Broken, Worn, Loose Parts)
- ☐ Drain Air Tanks
- ☐ Check For Air Leaks (Brakes, Suspension, Supply Lines)
- ☐ Drain Throttle Air Tank (AMG/Flyer)
- ☐ Brakes (Inspect Linings, Pins, Cams, Adjust)
- ☐ Tires
- ☐ Lube Chairlift Screw & Cyclinder Anchor Pins
- ☐ Lube All Chassis Fittings
- ☐ Check Differential (Leaks, Level, Security)
- ☐ Check Steering Gear (Leaks, Level, Mounting, Clean Vent)
- ☐ Check Steering Transfer Case (Leaks, Level, Mounting)
- ☐ Visual Check For Oil and Fuel Leaks

Wheelchair Lift

- ☐ Check W/C Lift Operation
- ☐ Lube Lift — Blow Out Tracks

METRO

STANDARD — D INSPECTION

Interior

- ☐ Farebox (Seal, Cyclometer, Telltale)
- ☐ Fire Extinguisher (Seal, Pressure)
- ☐ Wipers-Washers (Service Washer)
- ☐ Alarms — Gauges (Gen, Oil, Low Air, Backup Alarm, Engine Fire Alarm)
- ☐ Check Heat, Defrost System
- ☐ Check W/C Lift Operation
- ☐ Check Sander Operation — Fill Sand Buckets (Winter Only)
- ☐ Doors (Operation, Interlock, Sensitive Edge)
- ☐ Wheel Blocks, Flares, Reflectors
- ☐ Interior (Cleanliness, Damage)
- ☐ Destination Signs
- ☐ Dash & Dome Lights
- ☐ Passenger Chime & Stop Request System
- ☐ Check Horn
- ☐ Lube Door Shafts

Exterior

- ☐ Lights (Head, Tail, Marker, Turn, Back-Up)
- ☐ Check For Damage
- ☐ Mirrors
- ☐ Batteries (Electrolyte, Wash, Lube Tracks)

Engine Compartment

- ☐ Visual Check For Leaks (Air, Oil, Trans, Coolant)
- ☐ Correct Fluid Levels (Oil, Trans, Power Steering, Coolant
- ☐ Check Fan Drive
- ☐ Coolant Additive Test
- ☐ Check Air Intake System
- ☐ Check Exhaust Pipes, Clamps, Muffler
- ☐ Check Emergency Stop
- ☐ Check Hydrofan Reservoir (500's)
- ☐ Test Low Water Warning
- ☐ Take Manometer Reading _____
- ☐ Replace Air Filters As Needed
- ☐ Check Fan Level Gear Oil (500's)
- ☐ Check Shift Lever Arm (700's)
- ☐ Check For Rubbing Hoses/Lines
- ☐ Change Engine Oil & Filters
- ☐ Lube Governor & Throttle Linkages
- ☐ Replace Compressor Filter (500's)

Under Chassis

- ☐ Inspect Undercarriage (Broken, Worn, Loose Parts)
- ☐ Drain Air Tanks
- ☐ Check for Leaks (Brakes, Suspension, Supply Lines)
- ☐ Drain Throttle Air Tank (AMG/Flyer)
- ☐ Brakes (Inspect Linings, Pins, Cams, Adjust As Required)
- ☐ Tires
- ☐ Lube Chairlift Screw & Cylinder Anchor Pins
- ☐ Lube All Chassis Fittings
- ☐ Check Differential (Leaks, Level, Security)
- ☐ Check Steering Gear (Leaks, Level, Mounting, Clean Vent)
- ☐ Check Steering Transfer Case (Leaks, Level, Mounting)
- ☐ Check Air Dryer (Clean As Needed)
- ☐ Heaters Filters (Clean Or Replace)
- ☐ Lube Chairlift Chains & Arms (As Needed)
- ☐ Visual Check For Oil & Fuel Leaks

Phoenix Transit
City of Phoenix
Transit Operations -
Fleet Maintenance

METRO-A P.M. INSPECTION

PHOENIX

Coach _____

Date _____

Work Order # _____

Division _____

ON EACH ITEM SHOW:
"V" if OK
"X" if adjusted
"O" if repairs are necessary
(for each "O", give explanation under defects section)

DRIVE IN INSPECTION

Steam Clean Engine, Battery Carrier, & Clean Radiator Core

Hubometer Reading | | | | | | |

ITEM #

1. _____ Inspect all instrumentation for operation
2. _____ Check rear door interlock operation using pullaway test

UPPER VEHICLE INSPECTION

ITEM #		BODY INSPECTION
3.	Inspect:	Wiper Blades and wiper operation (wet)
4.		Windshield washers
5.		Bumper Bolts
6.		Wheels for cracks, lugs secure
7.		Windshields for cracks
8.		All compartment doors and latches
9.		All body damage, in and out
10.		Decals, signs, numbers, in and out
11.		Transfer cutter
12.		Mirrors, sunvisor, reflector kit
13.		Seats and frames, wear or damage
14.		Windows for cracks, latches free
15.		Emergency window release
16.		Head and route signs
17.		Reflectors in place and secure (unbroken)
18.		Heat and vent motors, defroster
19.		Fire extinguisher, full and secure
20.		Grab rails and stanchions
21.		Floor covering and step treads
22.		Driver seat adjustment
23.		Farebox mounting and operation
24.		Door engines and touch bars
25.		Emergency door valve operation
26.		Door timing: Front:_____sec. Rear:_____sec.
27.		Emergency hatch operation
28.		Heater/defroster operation
29.		Front vent control
30.	Clean:	A/C return air intake filter
31.		Other defects found

ITEM #		BODY INSPECTION
32.	Check:	And clean interior heating and ventilating screens
33.		Ventilators for operation and lubricate
34.		Accelerator and brake pedal for condition
		AIR SYSTEM
35.	Check:	Pressure drop (3# in one minute max.) with brakes applied
36.		Low air buzzer/light — 70 + 6 psi
37.		Compressor air build-up
38.		Air compressor governor — 100-120#
		AIR CONDITIONING
39.	Inspect:	Compressor & lines for oil (freon) leaks
40.	Clean:	Evaporator air filters
41.	Check:	Evaporator drains open
42.		
43.	Check:	Operation for cooling
44.	Inspect:	A/C blower mounts for cracks
45.		Freon supply
46.		Idle pulley and bearing
47.		Belt tension (100 psi)
48.		PTO seals
49.		Compressor oil level
50.		Valve caps for tightness — Replace if missing
51.	Inspect:	And test clutch
52.	Check:	For rubbing A/C lines from compressor
53.		Driver booster blower motor

DEFECTS & COMMENTS SECTION

ITEM #	DESCRIPTION OF DEFECTS	INITIAL WHEN REPAIRED

Phoenix Transit
City of Phoenix
Transit Operations -
Fleet Maintenance

METRO-A
P.M. Inspection

ON EACH ITEM SHOW:
"V" if OK
"X" if adjusted
"O" if repairs are necessary
(for each "O", give explanation under defects section)

UPPER VEHICLE INSPECTION (CONTINUED)

ITEM #		ELECTRICAL
54. ____	Inspect:	Battery cables, terminals, carrier
55. ____		Hydrometer readings should read 1.25-1.270
56. ____		Electric panel, wiring, connections
57. ____		Battery connections at terminal block
58. ____		Battery voltage using VAT-33
59.	Test:	Charging system using VAT-33
60. ____		Starter voltage drop_____(VAT-33)
61. ____	Inspect:	Voltage regulator
62. ____		Alternator and starter wiring and cables
63. ____		Warning buzzers, alarms & lights
		ENGINE COMPARTMENT
64. ____	Check:	Engine low idle (RPM)
65. ____		Engine fast idle
66. ____	Inspect:	For oil, air, coolant, fuel leaks, missing parts
67. ____		Engine governor and throttle linkage
68. ____		Fan blades, hub, dampener
69. ____		Pressure check cooling system and inspect hoses, hose connections, surge tank cap gaskets, water pump, water manifold
70. ____		Replace water filter
71. ____		Check coolant inhibitor

ITEM #		ENGINE COMPARTMENT
72. ____	Inspect:	Restriction indicator
73. ____		Air intake filter, replace if Donaldson gauge reads 18 psi or greater
74. ____		Air intake hoses & connections
75. ____		Tighten all clamps including rubber coupling at turbo charger
76. ____	Inspect:	Fuel lines and replace filter
77. ____		Transmission oil level
78. ____		Engine and transmission mounts
79. ____		Ground strap for wear and secure
80. ____		Wiring harnesses, breaks, frayed
81. ____		Power steering fluid level and replace filter
82. ____		Exhaust manifold for leaks
83. ____		Take oil sample
		ELECTRICAL—EXTERIOR & INTERIOR
84. ____	Inspect:	Horn operation
85. ____		Boarding and stepwell lights
86. ____		Interior lights
87. ____		Marker lights
88. ____		Turn signals and four-way flashers
89. ____		Stoplights operation
90. ____		Head, tail, back-up lights
91. ____		P.A. operation
92. ____		Passenger signal operation
93. ____		Engine compartment lights

DEFECTS & COMMENTS SECTION

ITEM #	DESCRIPTION OF DEFECTS	INITIAL WHEN REPAIRED

Phoenix Transit
City of Phoenix
Transit Operations -
Fleet Maintenance

METRO-A
P.M. Inspection

ON EACH ITEM SHOW:
"V" if OK
"X" if adjusted
"O" if repairs are necessary
(for each "O", give explanation under defects section)

LOWER VEHICLE INSPECTION

ITEM #		ENGINE & DRIVE LINE
94. ____	Inspect:	Fuel lines and connections
95. ____		Oil, air, coolant, fuel leaks
96. ____		Change engine oil and filters
97. ____		Change transmission oil and filters
98. ____		Clean transmission governor screen
99. ____	Inspect:	Driveline, U-joints, guards
100.		Differential oil level
101. ____		Transmission and differential leaks
102. ____		Transmission shift mechanism

		ELECTRICAL
103. ____	Inspect:	Wiring harnesses, for breaks, fraying
104. ____		Ensure electrical panels are reinstalled

		BRAKES
105. ____	Inspect:	Air lines, hoses, diaphragms for leaks, chafing
106. ____		Slack adjuster, brake drum, brake chamber
107. ____		Check anchor bolts for tightness
108. ____		Adjust brakes, inspect cam action, check lining thickness, 5/16" min.
109. ____		Drain air tanks and purge tank
110. ____		Test air system, check valve
111. ____		Check air dryer dump operation
12. ____		Inspect relay & quick release valves

ITEM #		CHASSIS
113. ____		Lube per chart (see back page)
114. ____		Check steering gear box mounting for tightness
115. ____	Inspect:	Steering gear for play, all joints secure
116. ____		King pins, tie rod ends, draglink, pitman arm
117. ____		Steering knuckle arms
118. ____		Tires, pressure, cuts, wear (4/32" min. front, 2/32 min. rear)
119. ____		Bellows, radius rods
120. ____		Exhaust system, muffler, tailpipe
121.		Shock absorbers
122. ____		Level valve height, refer to Manual pg.23-3 and pg. 133-3
123. ____		A-frame and engine cradle for cracks
124. ____		Torque axle flange nuts (90-113 ft. lbs.)
125. ____	Inspect:	Vehicle for damage and cracks
126. ____		Other defects found

DEFECTS & COMMENTS SECTION

ITEM #	DESCRIPTION OF DEFECTS	INITIAL WHEN REPAIRED

Phoenix Transit
City of Phoenix
Transit Operations -
Fleet Maintenance

METRO-A
P.M. Inspection

ON EACH ITEM SHOW:
"V" If OK
"X" If adjusted
"O" If repairs are necessary
(for each "O", give explanation under defects section)

DRIVE-AWAY INSPECTION

OBTAIN PARKING INSTRUCTIONS FROM FOREMAN PRIOR TO DRIVE AWAY INSPECTION

ITEM # **ROAD TEST**

127. _____ Test drive starting, power, noise, shifting, brakes, steering, speedometer
128. _____ Pullaway test, parking brake
129. _____ Rear door interlock

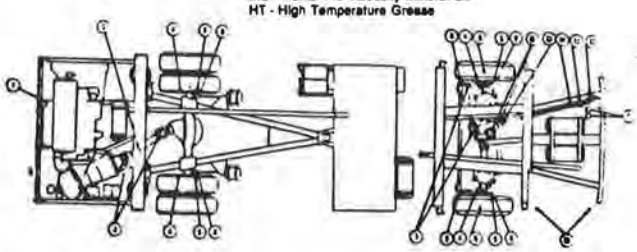
DEFECTS & COMMENTS SECTION

ITEM #		

LUBRICATION

	ITEM	REMARKS/LUBRICANT *	
1.	Air Throttle Control Cylinder	One Fitting - Rod End Pivot	/HT
2.	Drive Shaft U-Joints	Two Fittings - One Each Joint	/MO
3.	Drive Shaft Slip Joint	One Fitting	/MPG
4.	Brake Shoe Anchor Pins	Eight Fittings - Two Each Wheel	/MPG
5.	Brake Camshafts	Four Fittings - One Each Wheel	/MPG
6.	Slack Adjusters	Four Fittings - One Each Wheel	/MPG
7.	Steering Drag Link Ends	Two Fittings - One Each End	/MPG
8.	Steering Tie Rod Ends	Two Fittings - One Each End	/MPG
9.	Steering Knuckles	Four Fittings - Two Each Side	/MPG
10.	Entrance Door Lower Ball Sockets	Two Fittings - One Each Socket	/MPG
11.	Brake and Accelerator Treadles	Pivot Pin & Roller - Clean & Oil Lightly	/MPG
12.	Steering Transfer Box	Keep to Lower Fill Plug Level	/MPG
13.	Steering Shaft U-Joint	Two Fittings - One Each Joint	/MPG
14.	Steering Shaft Slip Joint	One Fitting	/MPG
15.	Power Steering Gear Input and Output Shafts	Two Fittings - One Each Shaft	/MPG

* Lubricant Code
MPG = Multi Purpose Grease
MO = SAE 140 Viscosity Mineral Oil
HT - High Temperature Grease



TO BE COMPLETED BY FOREMAN FOR APPROVAL OF SUPERVISOR

COACH DISPOSITION:

- ☐ Coach ready for service - no defects
- ☐ Coach available for full service - pending repairs
- ☐ Coach available for limited service - pending repairs
- ☐ Coach not available for service - pending repairs

Mechanic's Signature _____ Badge _____

QA's Signature _____ Badge # _____ Date _____

Foreman/Supervisor Signature _____ Date _____

APPENDIX G

JOB INSTRUCTION SHEETS FOR MECHANICS (MILWAUKEE COUNTY TRANSIT SYSTEM)

Note that the items on these job instruction sheets correspond to the items on the inspection check lists shown in Appendix F.

A MECHANIC

DIESEL MINOR INSPECTION

JOB INSTRUCTION SHEETS

A. CHASSIS

1. Brakes - Adjust and Observe (2 man Operation).
   a. Check for proper push rod throw. Adjust if necessary. 3/4" in front, 1 1/8" in rear, on all buses except 3100 series coaches.
   b. Observe brake shoe movement. Poor release may mean weak or broken return springs.
   c. Report if cam roller pins are coming out.
   d. Position of rollers on "S" cam; report when 3/4" from end of cam.
   e. Report loose pins or missing locks, tighten when possible.
   f. On 3000 and 3300 series and 3100 series equipped with antiskid connectors for tightness. Check sensor gap with gage.
   g. On 3000's check and clean drain slots in DD-3 brake chambers and lubricate with Lubriplate Aero (on even numbered cards ONLY).

A. CHASSIS (cont.)

2. Suspension System

   a. Check for air leaks and secure mounting of valves, bellows and supports.

3. Shock Absorbers

   a. Check for leaky or worn shocks; report if leaky or worn.

   b. Check for worn shock absorber bushings.

4. Air Leaks

   a. Check air equipment, lines, and tanks for air leaks.

5. Steering Linkages

   a. Check drag link for wear and broken or damaged dust seal.

   b. Turning wheel - check for roughness or excessive play.

   c. Check steering box for secure mounting and oil leaks.

   d. Check universal joints for wear or play.

   e. On 3000,3100 and 3300 series coaches, check P.S. lines for leaks. (BUS MUST BE RUNNING).

   f. On 3000, 3100 and 3300 series coaches, check for pressure relief before stops are hit. (BUS MUST BE RUNNING).

6. Interlocks
   a. Observe operation of interlocks when doors are opened and closed.
   b. Observe interlock linkage for weakness.
7. Minimum Brake Lining Thickness
   a. When lining nears 5/16" in thickness, record thickness in spaces provided on the inspection card.
8. Loose Bolts
   a. While inspecting bus, be on the lookout for loose bolts, missing cotter keys and damaged or missing lock wires.
   b. Check motor mounts for loose bolts, cracked members, etc.
9. Toe
   a. Front wheel toe to be checked as follows:
      (1) Raise the wheels and, while rotating the tire, make a wide mark near the center of the tread with chalk. Do this for both front tires.
      (2) Place the toe gauge in front of the wheels and adjust it so the pointers are near the center of the chalk mark on each wheel. The adjustable pointer must be set at "0".

A. CHASSIS (cont.)

9. Toe (cont.)

(3) Scribe a line in the chalk mark on each tire by holding the respective pointer securely in one position and against the tire while rotating the tire.

(4) Lower the bus.

(5) Place the toe gauge behind the front tires and align each pointer with each tire's scribe mark by adjusting the width of the toe gauge and then securely locking all thumb screws. Recheck the pointer for "0".

(6) Move the toe gauge again to the front of the bus. Set the stationary pointer on the left tire's scribe mark. ("Left" is driver's side)

Align the adjustable pointer with the right tire scribe mark. ("Right" is passenger side) by turning the pointer adjusting thumb screw.

(7) Rear the scale. I f the pointer has moved to the right, toe-out readings are indicated. If the pointer has moved to the left of zero, toe-in readings are indicated. Record the reading.

A. CHASSIS (cont.)

9. Toe (cont.)

(8) Correct toe-in should be:

(a) 3300 series 0 - 1/8"

(b) TDH - 5301 - 5303 1/8" $\pm$ 1/32"

(c) 3000 series 0 - 1/32"

(d) 3100 series 1/8" $\pm$ 1/16"

10. Air Box Drain Tubes

a. With engine running, check for flow of air from air box drain tubes.

(1) Report if tubes are clogged.

11. Pinion Shaft

a. Test end play by pushing shaft into rear end housing.

b. Test looseness by turning shaft. Report if more than 1" play.

c. Examine pinion oil seal for leaks.

12. Differential Gears

a. Check in following manner:

(1) Place wrench on a propeller shaft flange nut.

(2) With bus in neutral and hand brake off, turning the wrench counter-clockwise will cause the bus to move forward.

(3) Now turn clockwise moving the bus backward.

A. CHASSIS (cont.)

12. Differential Gears (cont.)

(4) The amount of play between moving forward and reverse in the play between the tires and the driveshaft. Report if excessive.

B. ENGINE COMPARTMENT

1. Primary & Secondary Fuel Filter - Replacement (Odd Cards)

a. Open draincock on bottom and drain out water.

b. Remove and replace filters (Odd Cards Only).

2. Oil and Filter Replacement

a. Drain crankcase

b. Remove and replace oil filters, replace gaskets.

c. On 3300 series, drain oil and replace purifiner and fill flow filter. EVERY 4th CARD!

d. Fill with new oil.

(1) On 5301 and 5303 models, crankcase capacity is 28 quarts.

(2) On 3000's, crankcase capacity is 36 quarts.

(3) On 3300's, crankcase capacity is 32 quarts.

On 3100-3312, crankcase capacity is 38 quarts.

On 3225-3249, crankcase capacity is 38 quarts.

On 3219-3224, crankcase capacity is 26 quarts.

B. ENGINE COMPARTMENT (cont.)

3. Air Cleaners

a. With oil bath type, remove covers and screen filters.

(1) Clean in solvent and allow to drip dry.

(2) Fill coverbowl with oil up to "FULL" mark and re-install in bus.

(a) CAUTION must be taken not to overfill bowl.

(b) With dry type check restriction indicator. If flag-type indicator is red, check with manometer. If vacuum meets or exceeds 25" (20" on turbo-charged) report it.

(c) Check intake system, report any leaks, tighten loose clamps.

4. Oil Pressures

a. Oil pressure at idle should be a minimum of 4 PSI.

b. Minimum of 30 PSI @2100 R.P.M. for all buses.

5. Starter

a. Observe mounting for looseness; tighten loose bolts.

b. Observe cable connection. Report if hose is dirty, etc.

6. Solenoids

a. Emergency stop solenoid; test & reset manually.

B. ENGINE COMPARTMENT (cont.)

7. Alternator

   a. Visual inspection of terminals.

   b. Check output volts with voltmeter at the battery terminal connections.

8. Compressor

   a. Check for water and oil leaks

9. Radiator and Shutter

   a. Radiator

      (1) Check for leaks & excessive dirt.

      (2) Check anti-freeze concentrate - 20°F.

      (3) Check inhibiter conc. If the inhibiter is low, restore to an adequate level with Nacool 2000.

   b. Shutters

      (1) With engine not running and air off, shutters should be open.

      (2) With engine just started as air builds up, shutters should close.

      (3) If engine is at operating temperature, shutters should be open.

      (4) Add one TABLESPOON of Kysor Fluid shutter grease, (Lot Number 39-41-10) to shutter cylinder.

10. Hoses, Clamps, and Vent Cocks

   a. Check all hoses for leaks. Report hoses which are soft, spongy, bloated hard or brittle.

B. ENGINE COMPARTMENT (cont.)

10. Hoses, Clamps & Vent Cocks (cont.)

b. Tighten all hose clamps. If a leak is not stopped by tightening the hose clamp, report it.

c. Vent Cocks

(1) Check pressure relief valve surge tank by pushing button. Report defective valves.

11. Fan Operation

a. Check fan for misaligned or damaged blades.

b. Check operation of fluid fan.

(1) When operating temperature is low & the engine is running, the fan SHOULD NOT OPERATE.

(2) If operating temperature is up and engine is running, the fan SHOULD BE WORKING.

(3) Report if the fan is working when engine coolant is below operating temperature.

12. Ping Chamber - Drain

a. Some 5300 and ALL 3000 series buses have ping chambers.

(1) Open drain cock & allow all moisture & accumulation to drain out.

(2) Close valve.

B. ENGINE COMPARTMENT (cont.)

13. Transmission and Power Steering

    a. Check transmission fluid level; add fluid if needed and report.

    b. On 3000, 3100 and 3300 series coaches, check P.S. fluid. Add fluid if needed & report.

    c. On 3000 and 3300 series coaches, visually check that the air bellow under the transmission is inflated.

    d. Check condition of dipstick & tube. Report if it is defective.

14. Transmission Heat Exchanger

    a. Check for oil or water leaks (Visual)

15. Lubrication

    a. As per chart

16. Engine Idle

    a. Idle speed should be 500 to 550 R.P.M. for 53's and 3000 series coaches.

    b. 625 with A/C or RTS, and 3300 series coaches.

    c. Fast idle 3300 series 950 $\pm$ R.P.M.
       3100 series 900 $\pm$ R.P.M.
       3000 series 825 $\pm$ R.P.M.

17 Engine Stall

    a. With brakes on and transmission in forward position, the engine is accelerated to maximum.

B. ENGINE COMPARTMENT (cont.)

17. Engine Stall (cont.)

(1) Tachometer should show 1400 to 1500 R.P.M. on 5301 and 5300 models, 3000's - 1250 - 1300 R.P.M., 3100's - 1250 - 1300 R.P.M., 3300's 1250 - 1300 R.P.M.

(2) Do not hold stall speed more than 10 seconds.

18. Engine No-Load

a. With transmission in neutral, engine is accelerated to maximum.

(1) All buses - 2150 R.P.M. $\pm$ 50 R.P.M.

19. Water and Oil Leaks

a. Look for leaks around the transmission, engine, radiator and fluid lines.

(1) If any leak persists after tightening lines or clamps, report it.

C. FINISH FUNCTIONS

1. Tapley Reading

a. At a speed of 20 M.P.H., depress the brake pedal to the floor. The decelerometer should read above 60% on dry pavement. Report if it does not.

2. Anti-skid (3000,3300, and 3225 to 3249)

a. Report any false antiskid operations.

C. FINISH FUNCTIONS (cont.)

3. Check Shift

a. The shift to drive should be smooth. Report if shift is rough.

(1) Upshift: 1484 - 1863 $29^{\pm}$ MPH

1901 - 2030 $31^{\pm}$ MPH

(2) Downshift: 1484 - 1863 $23^{\pm}$ MPH

1901 - 2030 $25^{\pm}$

b. On 3000, 3100 and 3300 series coaches, check for rough up and down shifts and manual shifting.

4. Parking Brake Test

a. At a speed of 10 MPH, apply parking brake. The brake interlock should stop the bus within 1 1/2 bus lengths. Report if it doesn't.

5. Interlocks - Check

a. At a speed of 10 MPH, open the doors, The brake interlock should stop the bus within 1 1/2 bus lengths. Report if it does not.

6. Unusual Noises

a. Listen for excessive rattles or noises while driving the bus.

7. On 3001 - 30, and 3100 - 3149, check PA and adjust volume.

The leadman and helper are to check off the item numbers which will be checked by both, providing they EACH took part in the inspection of that item. Each are to check off the item numbers which pertain to them on the Inspection Card.

C MECHANIC

DIESEL MINOR INSPECTION

JOB INSTRUCTION SHEETS

A. PREPARATION

1. Get current inspection card and a blank inspection card for the next inspection due.
2. Check bus speedometer or hubodometer reading with dash tab and inspection card mileage to make sure bus is due for inspection.
3. Fill out a new dash tab and top portion of the next inspection card, adding 5,000 miles to the current speedometer reading to obtain the next inspection mileage.
4. Connect duct to exhaust pipe.

B. OPERATOR'S SEAT

1. Governor air pressures.
   a. Governor cut-in and cut-out pressures are:

		Cut-In	Cut-Out
(1)	All Buses	110 PSI	130 PSI

   (2) Report if more than 5 PSI variation.

   b. Compressor build up at curb idle.
   c. Compressor leak down 3 PSI/MAX.-MIN. with engine off and brake pedal down.

B. OPERATOR'S SEAT

2. Switches, warning lights and gauges.

   a. Check directional, oil, air generator, and all other warning lights and buzzers.

   NOTE: On buses with anti-skid warning lights, should stay on for about 5 seconds after ignition is turned on.

   b. Check run, emergency stop, heater, light, signal and all other switches.

   c. Check all dash, dome and door lights.

   d. Check the voltmeter gauges (if so equipped).

3. Accelerator and Brake Pedals.

   a. Check for binding or excessive play and worn pedal pads.

   b. Report excessive dirt and accumulation underneath pads.

   c. Lube brake pedal roller & pin with spray lube.

   d. Brake valve plunger with mine car.

4. Hand Brake (5301 and 5303 Coaches ONLY)

   a. Set in holding position. Handle should be near vertical. (5 or 6 notches).

5. Door Control Valve

   a. Operate in all positions, noting door operation.

      (1) Exit doors employ a green signal light to inform passengers that door is unlocked. Check to make sure light operates.

B. OPERATOR'S SEAT (cont.)

5. Door Control Valve (cont.)

(2) Check touch bars and/or treadle for proper operation.

(3) If equipped, check sensitive edges.

b. Listen for air leaks.

c. On 3000 series coaches, drain separator valve.

6. Accelerator and Brake Interlocks.

a. Accelerator interlock - with air on and doors open, should offer resistance to any attempt to press pedal down.

b. Brake interlock - 20 PSI air pressure is applied to service brakes on all four (4) wheels when doors are open. (50 PSI on rear brakes ONLY, On 3100 series coaches.)

7. Doors - Timing

a. Front door opening time is:
1.5 sec. on 5301, 5303, 3000, 3300
2.0 to 3.0 sec. on 3100 series.

b. Closing time on buses is 1.8 sec.: FRONT DOORS ONLY. 2.0 sec. on 3000,3100,3300 series.

c. On 3000, 3100, and 3300 series coaches, check for cushioning on opening.

B. OPERATOR'S SEAT

8. Windshield Wipers

   a. Wipers will not work when air pressure is less than 65 PSI.

   b. With air pressure up, and wet windshield, check wipers at full speed for:

      (1) Air leaks, operation speed (65-70 strokes per minute).

      (2) Full stroke and even operation. Report if stroke is incorrect.

   c. Check washers on 3000,3100, and 3300 series coaches, and fill reservoir.

   d. Check adjustment of blades (should not strike glazing rubber.) Report if necessary.

9. Transmission Control Lever

   a. On buses with VH transmissions, shift from neutral position to forward and reverse several times. Allow several seconds after lever is out of neutral notch before moving lever forward or reverse. Report excessive sticking or gear clashing.

   b. On buses with V730 transmissions, check to see that valve body detents correspond to respective selector positions.

B. OPERATOR'S SEAT (cont.)

10. Steering
    a. Test operation while moving bus.
        (1) Check for free play in wheels - 2" is Maximum.
        (2) Check for rough meshing in gears.
        (3) Check for security of column mounting.
        (4) On P.S. equipped buses, check for spongy action and noisy operation. Check for pressure relief by turning steering wheel lock to lock.
11. Transfer Cutter and Watch Hook
    a. Check mounting.
    b. Check transfer cutter operations.
    c. Check for chain and clip.
    d. Check for watch hook.
12. Mirrors
    a. Check for secure mounting.
13. Operator's Seat
    a. Check seat covering for worn or ripped covers.
    b. Test seat operation & adjustment.
    c. Check for secure mounting.
    d. Check seat belt operation if equipped.
    e. Lubricate driver's seat pedestal with spray lube.

C. BODY - INSIDE

1. Passenger Signal
   a. Test signal operation from several places on each side of the bus.
   b. Inspect signal cord for rough or frayed edges.
   c. Check for secure mounting of signal switch and all eyelets.
   d. Check all touch strips on 3100 series coaches.
   e. Check "STOP REQUESTED" sign on 3300 series coaches and Rehabs.
2. Doors - Front and Rear
   a. Front doors - report if adjustment is needed - actual time check done from operator's seat as stated in Item #7.
   b. Rear doors - timing if needed.
      (1) On 3000 series:

Opening Time:	1 to .15 sec.
Closing Time:	1.5 to 2.0, after release of touch bar.

      (2) On 3100 series:

Opening Time:	3.0 sec.
Closing Time:	3.0 sec.

      (3) On 3300 series:

Opening Time:	1.5 sec.
Closing Time:	2.0 to 3.0 sec.

C. BODY - INSIDE (cont.)

c. Sensitive Edges

(1) On 3100 and 3300 series buses, employ safety edges on exit doors. Report all dead edges.

(2) Check sensitivity of touch bars on 3000 and 3100 series.

d. Check treadle pads on 3300 series buses for dead spots.

3. Steps and Floor Covering

a. Check step treads for loose mounting and wear.

b. Check for worn or loose flooring.

c. Report if floors are excessively dirty.

4. Interior Lights

a. With all light switches on, check all dome, fare box, driver's central panel, and step-well lights. Report all burned out bulbs. Report all broken lenses.

5. Seats, Stanchions and Hand Holds

a. Seats - check for cut material, dirt, writing on seat backs and security of mounting.

b. Check stanchions, hand holds, and modesty panels. Check for firmness and security.

6. Windows

a. Check for faulty window seals.

b. Look for broken or badly scratched glass.

c. Check for broken locks.

d. Check ALL sliding windows.

C. BODY - INSIDE (cont.)

6. Windows (cont.)

   e. On 3000, 3100 and 3300 series coaches, check operation of emergency locks. They should only require 20 lbs. of pull. If more than that, lube with silicone grease.

   f. Check emergency door latch operation and emergency hatch operation (if so equipped).

7. Fire Extinguisher

   a. Check security of bracket.

   b. Check gauge - gauge should read "FULL-CHARGED".

8. Broom, Sand Bags, Ice Scraper & Thermometer

   a. Broom - report if it is missing.

   b. Sandbags - from November 17 to April 1, make sure ALL buses are equipped with sand bags and an ice scraper.

   c. Thermometer - report if it is missing.

9. Heater and Defroster Fans

   a. Test operation.

   b. Listen for unusual noises.

10. Destination and Run Number Signs

   a. Test operation: report if faulty.

   b. Report burned out light bulbs.

   c. On 3100 and 3300, check operation of rear route sign.

   d. Examine destination sign door locks & report if broken or mis-adjusted.

D. BODY - OUTSIDE

1. Outside Lights
   a. With lights on, check operation of head, tail stop, marker, and directional lights. Report burned out bulbs. Report broken lenses or reflectors.
2. Wiper Arms and Blades
   a. Test blades for full contact, & proper adjustment.
   b. Report faulty blades and broken or bent arms.
3. Advertising Signs
   a. Check for damaged sign frames.
   b. Check for neatness of signs. Report dirty or torn signs.
4. Body Inspection
   a. Report any collision damage.
   b. Check exhaust system. Report if repairs are necessary.
   c. Check condition of wheel fenders.
   d. Inspect bumpers for damage.
   e. Check license plate holders for secureness.
   f. Wipe off all lights and reflectors.
5. Compartment Doors and Hinges
   a. Open doors and lube locks.
   b. Inspect doors for damages.
   c. Report loose hinges & lubericate hinges with spray lube.

D. BODY - OUTSIDE (cont.)

6. Battery
   a. Check water level: note on inspection card whether it is dry, low, or O.K.
   b. Record on inspection card the high & low specific gravity readings.
   c. Examine battery cables for chaffing wear, & corrosion.
   d. Check both sides of the battery cable terminal block on the firewall for corrosion.
   e. Check for terminal looseness. Tighten if necessary.
   f. Report if battery tops & terminals need cleaning.
   g. Add water if necessary.
   h. Report broken or missing hold-downs.
7. Air Intake Ducts and Vents
   a. Inspect for accumulation of dust & dirt. Clean if necessary.
   b. During the winter months, check to make sure that the driver's air vent in front is sealed.
8. Static Ground Strap
   a. Check for proper length, report if replacement is needed.
   b. Check connection to body. Report if cleaning is needed.

E. CHASSIS

1. Tires - Wear & Inflation

   a. Check tire rims. Report any damage.

   b. Report unusual tire wear so front end alignment can be checked.

   c. Report damaged or worn tires so that they will be changed.

   d. Visual inspection of tire matching & placement. Report tires not properly matched.

      (1) Front tires worn to 4/32 inch or less and rear tires worn to 2/32 inch or less must be reported for removal. Do not mix General and Goodyear or radial & non-radial tires on front of buses. If so, report.

      (2) Variation of tire circumferences on same rear dual must not exceed 1/2". The larger tire mounted on the outside.

      (3) On side rear dual tire diameter must not exceed other side rear dual diameter by more than 1/2".

   e. Run out tires mounted only on inside rear dual wheels. (Mark with RED "R").

   f. Recapped tires can only be mounted on the rear.

E. CHASSIS (cont.)

1. Tires (cont.)

g. Inflation

(1) 5301 and 5303's: 90 PSI in front, 85 PSI in rear.

(2) On 3000: 90 PSI in front, 85 PSI in rear.

(3) On 3100: 100 PSI in front, 90 PSI in rear.

(4) On 3300: 115 PSI in front, 115 PSI in rear.

(5) If 15 lbs. or more variation is found, report for removal and inspection.

2. Wheel Nuts.

a. Inspect for loose wheel nuts.

b. Tighten all loose nuts, using torque wrench or "T" wrench.

375-425 Foot-Pound torque - Front

475-525 Foot-Pound torque - Rear

3. Wheel Housing Clearance

NOTE: Report if found out of adjustment.

a. On 5301 and 5303: Axle bumper to body bumper clearance in front is 3 1/4" minimum and 3 1/2" maximum. In rear, it is 3 3/8" minimum and 3 5/8" maximum.

b. On 3000's - front plate to plate is 13 1/2" and rear bag height of 8".

c. On 3000 series without wheelchair lift, it is 10 1/4" between plates.

E. CHASSIS (cont.)

3. Wheel Housing Clearance (cont.)

d. On 3100 series, 13" step height. Gauge Number J28717, 3/14" top axle and bumper stop.

e. 3300 series - Front plate to front plate is 10-3/4" ± 1/8" and rear plate to rear plate is 12-3/4" ± 3/8".

f. Check the kneeling height on the following:

1) 3000 series: 8-1/2 inches

2) 3100 series: 8 inches

3) 3300 series: 10-1/2 inches

NOTE: ± 1/2 inch is acceptable.

NOTE: Kneeling height is measured from the road to the entrance step height.

4. Lubrication

a. As per chart.

5. Rear Axle Flange Nuts

a. Inspect for looseness, reporting damaged or missing lock wires.

6. Drive Shaft

a. Check for loose "U" joints by moving shaft near joint.

1) Test for rotational looseness by turning.

2) Report excessive play.

3) Check yokes and report if not in same plane.

E. CHASSIS (cont.)

7. Radius Rods
   a. Look for loose bolts & worn rubber bushings
   b. On 3100 series coaches, torque the lower control arm mounting rod bolts to the underbody to 190 - 210 foot-pounds
8. Air Tanks
   a. Open drain cocks & allow ALL moisture & sludge to drain
   b. Check for secure mounting
   c. Check for proper drain cock operation
   d. On 3000, 3100 and 3300 series coaches, any accumulation of water is to be reported. (2 or 3 Teaspoons is acceptable)
   e. On 3000, 3100 and 3300 series, check air dryer purge
9. Change heater filters on 5300, 3000 and 3300 coaches
10. CLEAN the defroster filters on the 3100 coaches. Spray the filters with R.P. Filter Adhesive, Lot # 39-43-008 BEFORE REPOSITIONING THE FILTER BACK INTO PLACE.
    Change defroster filters on 3000 and 3300 series coaches
11. Radio Check: Check the following items:
    a. Make sure the driver can send a message to the dispatcher
    b. Make sure the driver can receive a message from the dispatcher

E. CHASSIS (cont.)

11. Radio Check: (cont.)

c. Make sure that the silent alarm system works.

d. Make sure that the radio will turn off COMPLETELY.

On 3001 - 3030 and 3100 - 3149 series coaches check operation of PA system.

The lead man and helper are to check off the item numbers which will be checked by both, providing they each took part in the inspection of that item. Each are to check off the item numbers which pertain to them on the Inspection Card.