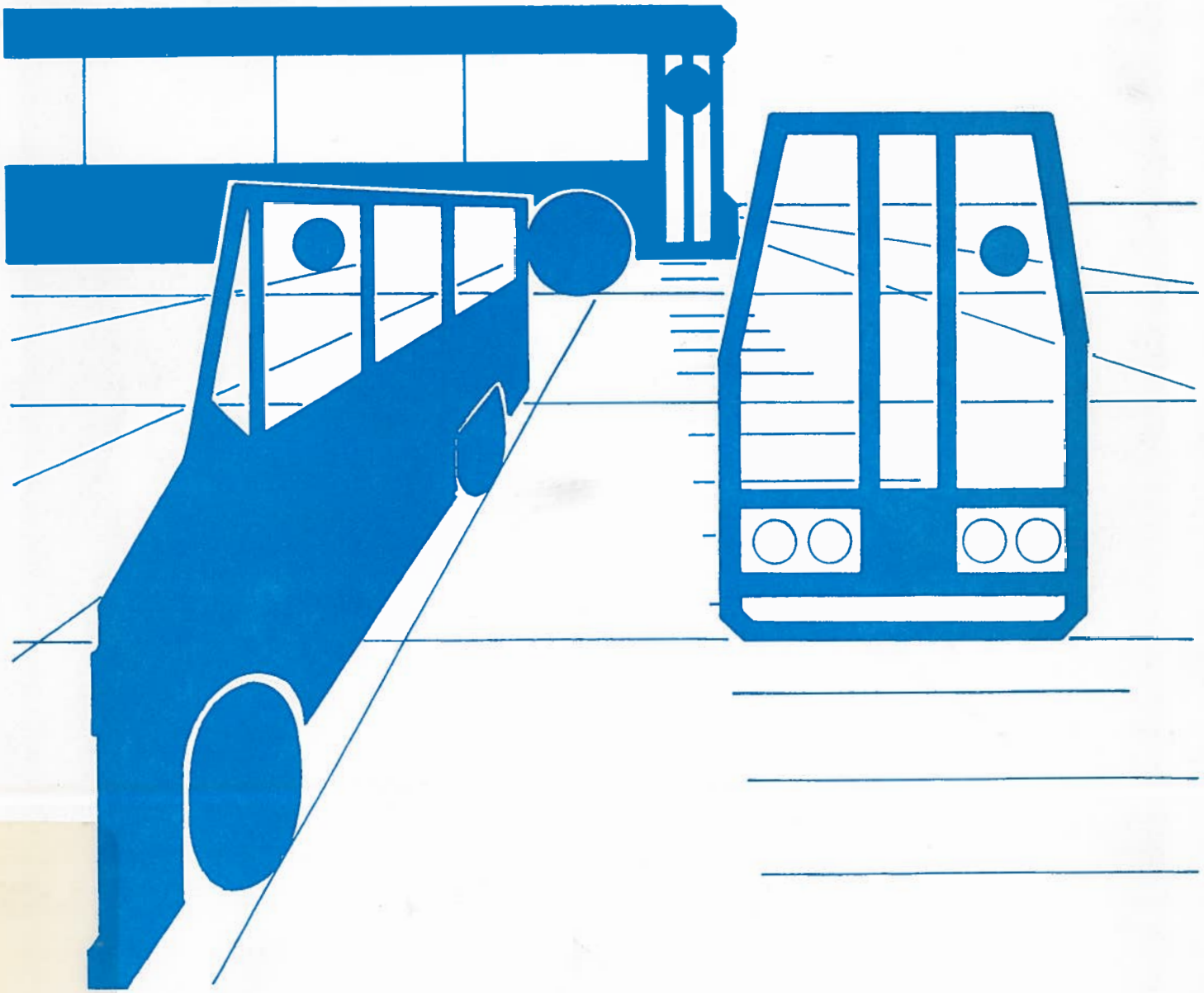
DESCRIPTIONS OF TRANSIT MAINTENANCE MANAGEMENT INFORMATION SYSTEMS

U.S. Department of Transportation
Urban Mass Transportation Administration

October 1984



UMTA Technical Assistance Program

T ge

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
UMTA-MA-06-0039-84-2		

4. Title and Subtitle	5. Report Date
Descriptions of Transit Maintenance Management Information Systems	6. Performing Organization Code
	8. Performing Organization Report No.
7. Author(s)	
George Anagnostopoulos and Maximilian Etschmaier	
9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
U.S. Department of Transportation Transportation Systems Center, DTS-62 Kendall Square Cambridge, MA 02142	URT-41
	11. Contract or Grant No. URT-41
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
U.S. Department of Transportation **Urban Mass Transportation Administration** **400 Seventh Street, S.W.** **Washington, D. C. 20590**	Technical Report on Maintenance Mgt. Systems
	14. Sponsoring Agency Code URT-41

15. Supplementary Notes

16. Abstract

This report presents descriptions of ten transit maintenance management systems for mini and microcomputers.

17. Key Words	18. Distribution Statement
Maintenance	**Available to the Public through the National Technical Information Service, Springfield, Virginia 22161.**

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	**Unclassified**		

BUS TRANSIT MAINTENANCE MANAGEMENT INFORMATION SYSTEMS (MMIS)

BY

George Anagnostopoulos
Maximilian M. Etschmaier

Transportation Systems Center
U.S. Department of Transportation
Cambridge, MA

for

Office of Methods and Support
Urban Mass Transportation Administration
U.S. Department of Transportation
Washington, DC

PREFACE

This assessment was conducted under PPA UM-17 as part of the Operations and Planning System Support program under sponsorship of UMTA's Office of Technical Assistance, Methods Division, Granville E. Paules, Chief. This assessment report compiles information on the status and capabilities of Maintenance Management Information Systems (MMIS) that are operational or near operational on primarily microcomputers and minicomputers. The objective is to make this information available to transit authorities to facilitate their selection of a MMIS.

An endeavor like this would not be possible without the full cooperation of the developers of these MMISs. The authors are indebted to these developers for their cooperation in making the necessary information available. Also, valuable comments were provided by Ronald Jensen-Fisher, the UMTA Program Manager.

FOREWORD

The Urban Mass Transportation Administration has undertaken the sponsorship of Federal involvement in and the stimulation of private development and exchange of a wide range of transit management aids. This effort has evolved under the general label Operations and Planning Support (OPS), a collection of technical support activities involving research and review, development and demonstration, and information dissemination. This document is one of several which provides background and summarizes the activities conducted as part of the OPS program. These documents provide information on the availability and use of management tools, and on concepts and proposed designs of new tools to encourage critique and feedback from the transit industry and other interested parties.

A large portion of the work in the OPS program is devoted to the application of computer-based tools that can support work of individual departments within a transit agency. Examples include operations analysis and planning, vehicle driver scheduling, maintenance management, financial/budget analysis including capital asset and cash flow management. Many transit agencies are already using computerized systems for such activities as payroll, accounting, maintenance and scheduling. Tools which are identified or developed through Federal activities will complement or supplement many of these existing capabilities. Though the tools may be usable on computer installations of any size, initial development is emphasizing microcomputer implementations. Inexpensive systems centered on microcomputers offer many advantages to decentralized, departmentally-oriented operations. However, these systems retain the potential to share an agency's data and information through a variety of communications interfaces. Thus, information produced through the individual units may be brought together and organized as additional sources of management information.

Technological breakthroughs continue to extend the computing power and data-handling capabilities of these desk-top systems. Very powerful systems are now within the financial reach of even the smallest transit properties, and these same systems can extend computing power to each appropriate organizational element in the larger properties.

Further information on the OPS program can be obtained from:

Mr. Gran Paules
Chief, Methods Division
Office of Methods and Support
UMTA URT-41
US Department of Transportation
400 Seventh Street, S.W.
Washington, DC 20590
(202) 426-9271

Informational requests related to the Transportation Systems Center's specific activities may be directed to:

Mr. Donald Ward
Chief, Planning Methods Division
Transportation Systems Center
US Department of Transportation
Cambridge, MA 02142
(617) 494-2465

TABLE OF CONTENTS

1. INTRODUCTION

The need to improve management information systems for the transit industry became evident in the mid 70's when it was recognized that important and relevant information was often not available to help management establish goals and objectives, develop plans, and monitor performance. With recognition of the importance of timely, relevant, management information, significant development of Management Information Systems (MISs) was initiated of which maintenance is one element.

Maintenance Management Information Systems (MMISs) were primarily developed for minicomputers because of the low availability and high cost of mainframe computers. The introduction of the microcomputer made computational capability far less expensive and more affordable than minis and mainframes. The purchase of microcomputers by many transit authorities has led to a rapid increase in the number of microcomputer-based Maintenance Management Information Systems.

This report presents a brief description and assessment of ten MMIS. Only MMIS that are either operational or near operational on micro- or minicomputers were considered for this assessment. An attempt was made to include all known and available MMIS that met these requirements.

The objective of this assessment is to provide selection information to potential users of MMIS. Both summary and detailed information is given so that a more detailed investigation could be conducted after a preliminary selection is made from the data.

While all MMIS' are designed to support management needs, they have different capabilities in supporting the full range of maintenance magement functions:

- Cost Accounting, which includes the tracking of resource expenditures (e.g., labor and materials cost) attributable to each vehicle or vehicle fleet.
- Work Order Processing, which includes the recording of a comprehensive description of each repair action, as well as tracking the status of open (i.e., unassigned) work orders.
- Status Tracking, which includes the documentation of vehicle and component assets and repair histories.
- Materials Processing, which includes inventory control, purchasing, requisitioning, and tracking usage patterns.
- Preventive Maintenance (PM) Scheduling, which includes the projection of inspection date, and supports the planned allocation of labor and materials resources.
- Failure Monitoring, which includes the documentaion of component failures for each vehicle, and can be used to support quality control or the projection of labor and materials needs.

- o Maintenance Resource Planning, which includes the capability to support on-going maintenance management decisions.

Each of the ten MMIS's described in this document addresses one or more of the above capabilities. These capabilities are summarized from information obtained from the vendors; while every attempt was made to describe fairly each system, there are some differences in information content.

The remainder of this report is divided into three sections:

- o Current State of MMIS briefly discusses the development state of MMIS, and provides a summary of the assessment.

- o Overview of the MMIS's Reviewed presents a comparative summary of the ten systems' capabilities, and provides a brief summary of each system.

- o MMIS Descriptions provide detailed information on each systems's development and availability status, functional capabilities, principal inputs and outputs, and examples of reports.

The information used in this report was derived from information supplied by the developers of these MMISs. Each MMIS is listed by developer and system name in alphabetical order because of the similarity between names. The use o developer names is not intended to be an endorsement of the system.

2. THE CURRENT STATE OF MAINTENANCE MANAGEMENT INFORMATION SYSTEMS IN URBAN TRANSIT

The current MMISs are an outgrowth of MIS development that was oriented toward financial control. Financial controls ask if resources were spent according to the plan, but do not necessarily ask how resources should have been spent in the first place. Asking how resources are spent is not unimportant; it simply is not the complete question. Deciding how resources are best used is the essence of an integrated management system that properly relates all components, and provides the necessary communication between all components of the system. Therefore, in general MMIS development has completed the first and most important development phase, i.e., financial control of maintenance consistent with finacial control of the transit authority. The remaining development that is needed is to provide maintenance managers with a support system to assist them in allocating their resources in best way possible.

Maintenance of transit vehicles, as maintenance of most types of equipment, is a sensitive task that can only be performed economically in a narrow band of options. Deviations from this band invariably leads to high cost, poor vehicle condition, or both. Thus, a MMIS is needed that can control the many variables and account for sensitivities of the maintenance system. It should be designed from the overall system viewpoint, and it should reflect all of the necessary functions in an integrated system and assure that all components seek to work together. The alternative is a system that compartmentalizes and subordinates functional components for the purpose of organizational control. A MMIS should also provide operational decision support to the maintenance manager.

Most of the MMIS's investigated are more or less automations of the American Trucking Association Inc. - Vehicle Maintenance Reporting Standards. They are primarily work order systems that emphasize maintenance cost accounting. Simple file management systems are used primarily to store and manipulate data. The exceptions to this are the Fleet Controller and CPMU/V which uses sophisticated network and relational data base management systems, respectively. VEMM also uses a data base management system that was developed by Modeling Systems Inc. Data base management systems allow the flexibility to make extensive inquiries of the data base, and to reformat reports easily.

Table 2-1 compares the functional capabilities of each MMIS assessed. The functional capabilities are heirarchically listed by prime function and then by detailed function. The type of function is shown in the far left hand column. Each system has an "X" placed next to the functional capability the developers indicated. Comparisons can thus be made by examining the functional capabilities of each system. With a few exceptions in planning, only those functional capabilities are included that exist in any of the systems. That is, Table 2-1 represents a composite of all systems.

An examination of the functional capabilities of the MMIS's in Table 2-1 indicates that the systems are designed for overall finance reporting with some work order processing as the primary input source. Hercules and the Fleet Maintenance System are categorized primarily as file management systems. CPMU/V, Fleet Controller, and VEMM use data base management systems. TRANS-PAC, Micro EMIS, and MMM are primarily categorized as cost accounting systems.

With the exception of the Western Transit Maintenance Consortium - Transit Maintenance System, none of the MMIS's incorporate planning and failure monitoring components. However, the planning and failure monitoring components of the Transit Maintenance Management System have not yet been implemented. Therefore, none of the current MMIS's are structured as decision support systems that can assist in determining how resources should best be allocated.

Decision Support Systems are needed to help investigate the following questions:

- How much maintenance should be performed?
- When should equipment be rehabilitated?
- When should equipment be replaced?

To determine the correct level of maintenance and rehabilitation, information is required that is generally not collected. An important function of a MMIS is to collect this data and also assist in determining a budget.

A summary of each of the MMISs follows.

MMIS FUNCTIONAL CAPABILITIES

		AIA - VMRS	CTG - Hercules	DDS - Fleet Maint. Syst	Facts Corp. CPMU/V	Fleet Tech Intl Fleet Controller	Modeling Syst Inc VEMM	MTD - TRANS PAC	PTI MICRO EMIS	Western Transit Maint Corp - Transit Maint Mgt	VISTA
Planning	o Long Term Response Planning									X	
	o Capital Expenditures										
	o Rebuild										
	o Forecasting and Budgeting										
	o Effectiveness measures										
	o How well; how much										
Failure Monitoring	o Availability - spares ratio									X	
	o Dependability									X	X
	o Road call rate									X	
Preventive Maintenance Scheduling and Monitoring	o Vehicle Scheduling	X	X	X		X	X	X	X	X	X
	o Personnel Scheduling									X	
	o Component and Spares Scheduling									X	
	o Facility and Support Equipment Scheduling			X						X	

Table 2-1

MMIS FUNCTIONAL CAPABILITIES (continued)

		ATA - VMRS	CTG - Hercules	DDS - Fleet Maint. Syst	Facts Corp. CPMU/V	Fleet Tech Intl Fleet Controller	Modeling Syst Inc VFMM	MTD - TRANS PAC	PTI MICRO EMIS	Western Transit Maint Corp - Transit Maint Mgt	VISTA
Work Order Processing	o Work Order Control	X	X	X	X	X	X	X	X	X	X
	o Labor Costs	X	X	X	X	X	X	X	X	X	X
	o Parts and Supplies Costs	X	X	X	X	X	X	X	X	X	X
	o Preventive Maintenance Costs		X						X		
	o Outside Maint & Repair	X	X								
	o Maint Cost Reporting				X			X	X	X	X
	o Accidents - Expense or Credits	X		X					X		
Materials Management	o Inventory Transactions	X						X		X	X
	o Usage Reporting	X	X				X	X		X	X
	o Stock Status	X					X	X		X	X
	o Reorder Processing						X	X		X	X
	o Vendor History						X	X		X	
	o Physical Inventory							X		X	X
	o Inventory Costing							X		X	
	o Special Requirements										
	o Warranty	X	X	X					X	X	X
	o Campaigns									X	
	o Fuel & Oil Reports	X	X	X	X	X	X	X	X	X	X
	o Issues							X			
	o Quantity, Location	X		X	X		X		X	X	X
	o Vehicle, Mileage			X	X			X	X	X	X

Table 2-1

MMIS FUNCTIONAL CAPABILITIES (continued)

		ATA - VMRS	CTG - Hercules	DDS - Fleet Maint. Syst	Facts Corp. CPMO/V	Fleet Tech Intl Fleet Controller	Modeling Syst Inc VEMM	MID - TRANS PAC	PII MICRO EMIS	Western Transit Maint Corp - Transit Maint Mgt	VISTA
	o Purchases & Receipts	X					X	X	X	X	X
	o Inventory Status	X					X	X	X		X
	o Fuel Reconciliation								X		
Status Tracking and Reporting	o Consumables and mileage Monitoring	X	X	X	X	X		X		X	X
	o Fuel & Oil	X	X	X	X	X	X	X	X	X	X
	o Oil Analysis			X							
	o Tires		X				X	X			
	o Batteries & supplies						X				
	o Standing Costs	X									
	o Administrative Overhead	X			X	X					
	o Interest	X			X						
	o Depreciation	X			X						
	o Vehicle History	X	X	X	X	X	X	X	X	X	X
	o Personnel History					X		X	X		
	o Fleet Inventory	X		X		X	X		X	X	
	o Facilities Inventory	X								X	
	o Road Calls			X		X		X		X	X
	o Component Rebuild History			X		X					X
	o Inspections		X	X					X		X
	o License Renewal		X								
	o Route Characteristics									X	
Management Reporting	o System Performance	X	X	X	X	X		X	X	X	X
	o Cost Summary	X	X	X	X	X		X	X	X	X
	o Project				X					X	
	o Special	X		X	X					X	

Table 2-1

3. OVERVIEW OF THE MMIS SYSTEMS REVIEWED

This section provides a brief summary of ten operational MMISs:

- 3.1 American Trucking Association, Inc. - Vehicle Maintenance Reporting Standards
- 3.2 Computer Task Group Inc. - Hercules Vehicle Maintenance Reporting System
- 3.3 DDS, Incorporated - Fleet Maintenance System
- 3.4 Facts Corporation, CPMU/V
- 3.5 Fleet Tech International - Fleet Controller
- 3.6 MTD Project Services - TRANS-PAC
- 3.7 Modeling Systems, Inc. - Vehicle Maintenance Monitoring System
- 3.8 Public Technology, Inc. - Equipment Management Information System
- 3.9 Western Transit Maintenance Consortium - Transit Maintenance Management System
- 3.10 Vista Systems Inc. - Maintenance and Materials Management System

The capabilities of these ten systems are summarized in Table 2-1. Each individual system is further elaborated upon in the remainder of this section.

3.1 AMERICAN TRUCKING ASSOCIATION, INC. VEHICLE MAINTENANCE REPORTING STANDARDS

The American Trucking Association (ATA) Vehicle Maintenance Reporting Standards (VMRS) system represents a reporting standard for equipment and maintenance data of trucking companies. Around this standard, manual as well as computer-based maintenance management information systems can be, and have been, developed. VMRS is based on a set of data codes that have by and large been standardized for the entire trucking industry. These codes describe the vehicle by its major components, assemblies, or parts; by its physical characteristics; by the states, malfunctions, and the maintenance performed; and by the mechanics and facilities performing maintenance.

The system also provides means of identifying and accounting for costs, directly and indirectly. These costs are divided into:

- Running costs that include mileage, fuel and oil usage, tires, batteries and supplies;
- Standing costs including interest, depreciation, administrative overhead, licenses, and insurance; and
- Maintenance and repair costs that also include facility overhead, parts and supplies, labor, and outside maintenance and repair.

Cost information is assembled into equipment histories and into management information reports.

Although VMRS was primarily designed as a manual system that could be automated, it provides a framework for understanding many maintenance management information system functions. Many of the MMIS developers have either adopted the entire data structure and coding system or have adapted parts of this truck system to suit needs more specifically defined for transit bus maintenance.

Comparison of VMRS with the MMIS functional capabilities indicated in Table 2-1 show a lack of planning and failure monitoring functions. This indicates that the system was designed primarily to satisfy financial reporting needs of the maintenance manager.

3.2 COMPUTER TASK GROUP, INC. HERCULES VEHICLE MAINTENANCE REPORTING SYSTEM

The HERCULES Vehicle Maintenance Reporting System was developed by the Computer Task Group Inc. (CTG) for management of truck fleets. It is an automation of the ATA VMRS system for use on an Apple II plus personal computer. The system was designed to collect, analyze, and report running costs for power units, trailers, and refrigeration units. With some change of standard screen formats, it could also be used for buses. Hercules was designed to maintain life-to-date records for all vehicles and vehicle types in the fleet including: repair orders, fuel and oil purchases, and preventive maintenance information. It also has the capability to analyze this data and prepare analytical reports including running costs. The system can produce the following types of reports and analyses:

1. Analyze component failures.
2. Measure vehicle performance.
3. Compile maintenance histories.
4. Determine cost-per-mile or hour of operation.
5. Schedule preventive maintenance a year in advance.
6. Identify rework problems.
7. Identify costs in high-cost maintenance areas.
8. Evaluate vehicle life-to-date and period-to-date statistics.
9. Insure timely warranty recovery.
10. Track license renewals and inspection deadlines.
11. Determine the most cost-effective vehicle makes, models, or engine and transmission types.

Hercules uses a system of codes to store and track information. These may either be user defined or the ATA Codes may be used as a default option.

Preliminary observation and comparison of the functional capabilities of Hercules shown in Table 2-1 indicates that the system is essentially a computerization of the ATA VMRS system. As such, it is a work order system that is capable of accumulating and totaling data. Some changes in formats are necessary to make the system compatible with buses. A file management system is used to store and manipulate the data base, which is entered on Repair Orders. Without significant reprogramming, the system does not have the flexibility to generate reports other than those already in the system . The system is easy to use, but limited to the ATA VMRS reports. Furthermore, it can analyze approximately only 130 vehicles at a time.

3.3 DDS, INCORPORATED
FLEET MAINTENANCE SYSTEM

The DDS Fleet Maintenance System (FMS) automates all fleet maintenance records and vehicle history information, and automatically issues timely instructions for all necessary maintenance activities. The system also generates a variety of management reports: daily, monthly, and as required. The objective of FMS is to improve operational planning, reduce downtime, optimize manpower, and increase vehicle life. It maintains a history of each vehicle in the fleet according to predefined maintenance activities, and produces repair orders and management reports. The Repair Orders detail not only what is to be done to a vehicle, but include a description of the procedures for each maintenance item. Preventive maintenance schedules are entered into the system and repair orders are issued when the recommended time or mileage limit is reached.

When time or mileage is entered after fueling, PM Work Orders (WO) are initiated according to the PM schedule established for each vehicle . The work order provides a means for easy tracking of each maintenance activity performed on any vehicle in the fleet. Each WO contains a Specific and Standard Maintenance Procedure and all information needed by a mechanic to properly complete the job. When the work has been completed, signed off, and closed out, the vehicle history is automatically updated. In addition to the PM Work Orders, a Road Call WO, Accident WO, Foreman Request WO, Unit or Component Rebuild WO, and Service WO can also be initiated.

The system can generate Vehicle Inventory and Status Reports; daily, monthly, and yearly Consumables Reports; daily Not Probed Reports that signal active vehicles which did not have their farebox cleared; Monthly Road Call Reports; Oil Analysis Reports; California Highway Patrol Inspection Reports; Component History Reports; Series PM Recommendation Reports; and Activity Dictionary Reports that provide the coding system for activities.

Preliminary observations of FMS indicate that the system was designed primarily as a work order system and a consumables monitoring system that emphasizes PM scheduling. An examination of the functional capabilities shown in Table 2-1 indicates that vehicle history and maintenance cost reports are not available, but monthly road call reports and an oil analysis report are included. Materials management, with the exception of fuel and oils, planning, and failure monitoring functions, are not available. Overall cost summary reports are also not available.

FMS is designed to use an enhanced version of the UNIX operating system and an extensive set of utilities. UNIX supports a multi-user and multi-tasking environment. The UNIX File Management System offers flexibility to create a variety of data structures that can be easily formatted. The system operates on any Motorola 68000 processor and provides virtual 16 megaBytes of processing capability. Multiple 16-bit peripherals and special function I/O (Input/Output) processors provide support for the multi-user and multi-tasking environment. Winchester disk and diskette support allows for flexibility in configuration and up to 300 megaBytes of on-line storage. FMS could support small to modestly large size vehicle fleets (approximately 1000 vehicles).

3.4 FACTS CORPORATION, THE CPMU/V

CPMU/V is a fleet management and cost analysis software system developed by The Facts Corporation for general analysis and control of rolling stock in single or multiple units. The system provides cost accounting, cost control, daily control of operations, general purpose fleet management information, vehicle efficiency and performance information and vehicle repair histories. It also includes functions for evaluation of lease or purchase options, and for determining capital investment payback.

CPMU/V is one of the many applications available from the applications generating language, CPMU. The programs and algorithms of CPMU provide for comparative analysis of variables. The CPMU/V system is designed to operate on a variety of microcomputers such as the Apple II, TRS-80/II, Northstar, or the IBM Personal Computer. The system requires either the CP/M or MP/M operating systems (Version 1.4 or 2.X) and dBASE II. dBASE II is a relational data base management system that facilitates manipulation of fields, records, and files to manage data as desired. The minimum disk storage required is 378K Bytes, either on a hard disk or distributed on floppies.

The CPMU/V system is a menu driven system that has a file maintenance, report generating, and inquiry system. The file maintenance system contains the following files:

- Vehicle Files;
- Repair Order Files that describe vehicle repairs including part numbers of parts used for each task, the unit price, the reason for failure, the I.D. of the employee performing the task, time, and actual labor cost;
- Fuel Files that contain amount and cost of fuel used by each vehicle;
- Expense Files that include date, cost, and type of vehicle expenses; Mileage Files; and
- Code Files that contain coded descriptions of each repair and expense category monitored. The codes are based on the American Trucking Association VMRS codes.

The system provides the following reports:

- Management Reports,
- Master User Defined Reports,
- Master Cost Summary Reports,
- Master Fuel Usage Reports, and
- Master Cost Analysis by Code Reports.

The Master Cost Summary Reports provide the total cost and the average cost per mile or vehicle for any set of vehicles selected. The selection capability makes comparisons easy to perform. Master Fuel Usage Reports contain mileage, fuel usage, and miles per gallon of each vehicle and the totals and averages of all selected vehicles. The Master-Cost-Analysis-by-Code Reports provide a summary, by vehicle, for each labor, part, or expense code, and the cost-per-mile and total cost over month-to-date, year-to-date, and term-to-date periods. Since the set of codes can represent assemblies, subassemblies, components, and parts, these costs, when compared to other sets

of codes, provide a means of comparative analysis of components and structural elements. The Management Reports provide a versatile "user friendly" report selection capability.

Unlike the Master Reports, which report on all vehicles, the Management Reports generate reports on only those vehicles specified. This capability provides considerable flexibility in performing comparative analysis.

The Master User Defined Reports allow the user to format a report in any desired way. In addition to the exception reporting and reformatting capability, the system also has an easy to use query function.

Preliminary observations of this system indicate that the system was designed for overall financial reporting and for management and control of a vehicle fleet. Preventive maintenance scheduling is not included in the data structure. A comparison of the functional capabilities shown in Table 2-1 indicates an orientation to financial and management reporting with a work order processing capability. The capability for comparative analysis that is built into the data structure can be a useful tool for managing a fleet. The system uses dBASE II, which gives it added flexibility to query the data base and structure for a wide variety of comparative analyses and reports. dBASE II is "user friendly" and does not require programming skill to use the query capability.

3.5 FLEET TECHNOLOGIES INTERNATIONAL FLEET CONTROLLER

The Fleet Controller fleet management system performs the following functions:

- maintains vehicle histories,
- processes repair order information,
- tracks fuel and fluid consumption,
  major component rebuild histories,
  and vehicles and vehicle usage,
- schedules preventive maintenance,
- monitors mechanic seniority levels,
  average labor rates,
  and road calls,
- produces cost reports.

The system uses the American Trucking Association VMRS coding system, but translates the codes into understandable English descriptions for report generation. It was was designed for operation on the IBM Personal Computer, but can operate on any system which uses a Z-80, 8080, 8085, 8086, Z8000, or PDP-11 processor and supports the network data base management system, MDBS.

Preliminary observations indicate that the system is designed for overall finance reporting with the added capability for scheduling PM inspections. Labor costs are based on average costs per division. Specific parts are not recorded; instead only major components are considered. Rebuilt components, however, can be tracked.

A comparison of the functional capabilities shown in Table 2-1 suggests that the data structure is oriented primarily towards financial reporting with the capability for process work orders added on. However, this system uses MDBS, which allows interface with electronic spread sheets for budgeting. It also has considerable flexibility to query the data base and to structure a wide variety of additional reports. The disadvantage of MDBS is that some degree of programming skill is required to use it.

3.6 MTD PROJECT SERVICES
TRANS-PAC

TRANS-PAC was developed by MTD Project Services Company, a subsidiary of MDS Qantel, Inc., for small to medium sized transit authorities. Much of the development was done in collaboration with Arthur Andersen & Co., which was involved in Project FARE (Financial Accounting and Reporting Elements), an UMTA funded, transit industry sponsored effort to define a uniform external reporting system. The objective of Project FARE was to specify key financial and operating data, which could be uniformly reported to allow for aggregate industry analyses and provide a basis for meaningful comparisons between transit systems. In addition to describing this system for external reporting, the FARE Task Report (Reference 2) also recognized an urgent need to improve the internal management information system. In response to this need, UMTA sponsored an extension of Project FARE, which resulted in the framework for many of the current management information systems. TRANS-PAC is one of these systems.

TRANS-PAC is designed to meet all operational needs of transit authorities with between 20 and 500 vehicles. In its smallest configuration it is operational on a Quantel System 20 minicomputer. In addition to vehicle maintenance and inventory control, the system provides other operational, administrative, and Section 15 reporting functions including the following:

- Revenue and ridership reporting
- Payroll;
- Personnel and operator attendance records processing;
- Processing of claims and safety records;
- Accounting and financial reporting;
- Accounts payable;
- Accounts receivable;
- Fixed asset accounting;
- Section 15 passenger trip sampling, and level B and C reporting;
- Generation of user-defined reports.

TRANS-PAC uses its own coding system that is a simplification of the ATA VMRS codes. In addition to vehicle maintenance reporting, it has an inventory control system that is directly tied into the accounting and maintenance. The inquiry capability provides flexibility to measure system performance and generate exception reports.

The primary functions provided by the Vehicle Maintenance component of TRANS-PAC are: cost accumulation for labor, parts, and overhead, by vehicle; tire control; and monitoring of fuel and oil usage. TRANS-PAC produces a large number of standard reports, including Vehicle Maintenance Schedules, Inspection Due Master Listings, and monthly Mileage Variance Reports. In addition, the Report Generator allows other desired reports to be produced.

The purpose of the Inventory Control System is the processing and tracking of inventory. This system processes purchases, receipts, issues and adjustments to inventory; compares physical inventory to book inventory; and provides historical usage reports. It automatically interfaces to the General Ledger and to the Vehicle Maintenance System.

Preliminary observations of the Vehicle Maintenance component indicates the system was designed for, and from the perspective of, Finance and Administration (refer to Table 2-1) to track how resources are used. Absent from this system is the capability of maintenance to plan how resources should best be allocated. Moreover, the organizational structure reflected in the MMIS places Finance and Administration between Operations and Maintenance makes communication difficult between Operations and Maintenance.

3.7 MODELING SYSTEMS, INC. VEHICLE MAINTENANCE MONITOR

The Vehicle Maintenance Monitor (VEMM) was designed by Modeling Systems, Inc. (MSI) as a maintenance management information system that enters, retrieves, and reports vehicle maintenance costs and parts inventory. It also tracks maintenance schedules for each vehicle in the fleet and accounts for all parts and labor. The system in its smallest multi-user configuration operates on a DEC PDP 11/23 with 128K RAM (Random Access Memory), which can handle about 150 vehicles. If used with a VAX 11/750 or 780, it can handle fleets of vehicles greater than 1500. The system may also be used on the DEC Personal Computer in a single user configuration.

The VEMM data structure supports a variety of preestablished maintenance and inventory reports. If other reports are desired, VEMM may also be used with ISDATA, a generalized data base management system developed by MSI. ISDATA makes formatting or reformatting of any reports or files easy. MSI markets turnkey systems using Digital Equipment Corporations' micro and minicomputer equipment.

The system provides the following functions:

- Equipment Identification
- Preventive Maintenance and Repair Scheduling
- Work Order Processing
- Parts Inventory Control
- Purchasing Control
- Receiving Control
- Fuel Usage Management
- Tire and Battery Usage Management
- Operational and Management Reporting

Included in the Vehicle Maintenance function is Preventive Maintenance Scheduling that provides automated notification of when preventive maintenance is due on vehicles and equipment. The Work Order Processing function, in addition to accounting for all parts and labor costs, tracks out-of-service time.

Comparison of the functional capabilities indicated in table 2-1 shows that VEMM is basically a work order processor, but includes vehicle status tracking and inventory control functions. It was designed to operate exclusively on DEC hardware, including the DEC personal computer. Although VEMM is based on a data base management system, the data structure indicates an orientation to an accounting system. The system appears to be easy to use.

3.8 PUBLIC TECHNOLOGY INC. MICRO EMIS

MICRO EMIS (Micro[computer-based] Equipment Management Information System) is a turnkey fleet management system developed by Public Technology Inc. (PTI) to maintain an equipment inventory, track all repair activity and fuel transactions, schedule and monitor preventive maintenance, and produce a variety of management reports summarizing fleet cost and activities. It can also be used to bill sub-organizational units or agencies for operating and maintenance costs. MICRO EMIS operates on an Apple II microcomputer. With this computer it is capable of handling fleets of up to 500 vehicles.

MICRO EMIS is based on PTI's mainframe Equipment Management Information System that was developed jointly by local government representatives, the American Public Works Association (APWA), and PTI. PTI is a non-profit corporation that is the applied science and technical arm of the National League of Cities and the International City Management Association.

With MICRO EMIS it is possible to maintain a detailed history for each vehicle in the fleet, to schedule all preventive maintenance inspections, to record and review the repair history of any vehicle, and to trace and reconcile all fuel disbursements and usage by pumps and by vehicle. MICRO EMIS prepares monthly summaries of fleet operations, and identifies costly and inefficient vehicles through exception reporting. It generates inventory, fuel, repairs, billing, and management reports. The Repairs Report includes preventive maintenance scheduling. A Department Billing Report containing direct billing and rental charges for the month is also produced.

A number of management reports are produced that include: Equipment/Organization Performance, Fleet Summary Report, Equipment Exception Condition Report, Cost versus Billed, and Fuel Type and Pump Reconciliations.

MICRO EMIS is an interactive menu driven system that was designed for use by individuals without training in data processing. It has internal procedures to help prevent entry of inaccurate data.

Preliminary observations indicates that MICRO EMIS is a file management system primarily designed to facilitate the accounting process. In addition, the following features are provided: work order processs system provides primary input data, a detailed history of each vehicle is maintained, and preventive maintenance inspections are scheduled. Although exception reporting is included, no query capability exists. The system, however, does appear easy to use.

3.9 WESTERN TRANSIT MAINTENANCE CONSORTIUM TRANSIT MAINTENANCE MANAGEMENT SYSTEM

The Transit Maintenance Management System, developed by the Western Transit Maintenance Consortium, was designed for fleet maintenance and inventory control of medium size authorities. The need for improved management and control of maintenance forced the focus on: specific performance goals, labor productivity, effective preventive maintenance methods, efficient use of inventories, better quality control, and reducing the cost of performing effective maintenance. The system is operable on minicomputers, easily transferable, and economically implementable at each authority.

Six western transit authorities formed a consortium in mid-1980 to jointly develop a maintenance and inventory system consistent with these requirements. The consortium includes:

- Denver Regional Transit District (RTD)
- Orange County Transit District (OCTD)
- Sacramento Regional Transit District (RT)
- Santa Clara County Transit District (SCCTD)
- Municipality of Metropolitan Seattle (METRO)

A sixth member, the San Diego Transit Corporation, contributed significantly to the user design phase of the project, but decided not to participate in the later project phases because of computer requirements and software development priorities.

A consortium approach was adopted because it afforded an opportunity to pool maintenance expertise, address common needs, provide a forum for exchanging ideas, and share one-time development costs. To date, only the Inventory System is implemented at Orange County Transit District. Implementation of the Work Order System is nearing completion at Seattle METRO.

The system is designed to provide seven major functions:

- Preventive Maintenance
- Work Order
- Inventory Management
- Status Tracking
- Failure Monitoring
- Planning
- Management Reporting

These functions are integrated and provide a comprehensive monitoring, control, and reporting system. On-line processing and inquiry are important system features. In addition, timely analysis, exception, and summary reporting are provided throughout all functions. Both the on-line interactive and reporting features are designed for ease of use.

The Preventive Maintenance module will process and report usage, mileage, and consumption information, and will provide notification of all inspections and preventive maintenance events due on vehicles, components, and support equipment.

The Work Order Processing function will provide processing for the majority of maintenance-related activities including: trouble calls, driver defects, vehicle defects, inspections, and general work orders. On-line vehicle, component and support equipment status and history will be provided within this module.

The Inventory Management module will provide perpetual inventory balances on a "real-time" basis. Inventory costs will be determined by a method of moving average cost. Reorder processing will trigger suggested requisitions, which will be sent to the purchasing department. Open purchase requisitions and purchase orders will be tracked. In addition, the cycle of component rebuilt items will be tracked from component change-out through unit repairs. Rebuilding costs will be accumulated and averaged into the finished inventory.

The Failure Monitoring function consolidates vehicle breakdown information and uses this information to highlight problem areas in analysis reports. For example, specific vehicles and sub-fleets requiring excessive maintenance can be identified.

The Status Tracking function addresses vehicle availability and location of vehicles in a fleet. Route characteristics will also be maintained in this module to match the best suited sub-fleet to each route. This information combined with the status of the sub-fleets and vehicles will assist the transit managers in assigning individual vehicles to a route.

The planning module will provide managers assistance in short-term work scheduling. A prioritized work order backlog will be maintained. Reporting will be based on this work order backlog and preventive maintenance projections. These reports will also include information regarding the associated work requirements. In addition, a sub-module will be provided to assist in budget preparation, It will be based on projected or historical resource requirements. By varying assumptions, a long-term "what-if" analysis may be performed.

The Management Reporting function will be used to measure performance at the authority, division, or sub-fleet level. Parameter defined performance indicators will be used to measure actual against planned performance. Management reports will be generated on an exception basis.

Although the Transit Maintenance Management System was designed for medium to large size authorities, and operates on minicomputers, it was included in this assessment to provide a perspective of a system designed with long range planning capability. This long range planning function provides a decision support capability to examine how resources should best be allocated, and to specifically examine the issues previously discussed. A capability to perform failure analysis is implicit in long range planning.

3.10 VISTA SYSTEMS, INC.
MAINTENANCE AND MATERIALS MANAGEMENT SYSTEM (MMM)

VISTA's Maintenance and Materials Management (MMM) system automates information processing for equipment maintenance, parts inventory management and procurement. Although it is focussed on vehicle maintenance, it can also be used for any other type of equipment or facilities.

MMM is fully interactive and uses simple commands and menus. Information is entered via interactive screens and can be retrieved in the form of on-line screen displays or in the form of printed reports. MMM satisfies requirements for standard financial, historical, and trend reporting and provides information to assist the maintenance manager and the inventory clerk in their job functions. Many of the basic data can be defined by the user and modified as necessary. This is accomplished through user-defined files which specify stock items, equipment configurations, maintenance activity codes, and preventive maintenance programs. From a software point of view there are no limitations on the fleet sizes or number of stock items which can be handled by the system. The system is only limited by the available disk storage.

MMM is divided into a Vehicle Maintenance Module and an Inventory Module. The maintenance module is designed to satisfy the information needs of the maintenance shops. It tracks and reports maintenance history; accumulates and reports labor and parts costs; analyzes and reports defects by component, vehicle and fleet; accumulates and reports consumables histories; and projects future maintenance events. The user develops and maintains master files of equipment configurations and stock items as well as a code book for component, defect, problem, and repair action codes. The user also specifies the preventive maintenance program.

The Inventory Control Module is a self-contained set of programs which monitor and report materials movements and assist in the purchasing function. It can be integrated with VISTA's Financial Management System for expense distribution on either a FIFO or an average pricing basis. It interfaces with the Vehicle Maintenance Module, receiving materials movements information and providing materals cost information.

MMM was developed for use on any Prime or Digital Equipment Corporation's VAX system line. It can also be down-loaded to any UNIX based micro system. It is based on a VISTA developed file management system that can interface with a relational data base management system that will allow additional queries.

MMM was developed by VISTA with the consultation of maintenance managers from a number of transit companies. It is currently being implemented at the Capital District Transit Authority of Albany, NY.

REFERENCES

1. Vehicle Maintenance Reporting Standards Handbook, American Trucking Association, Inc., revised December 1982.

2. A Program for Improving Transit Industry Management Information Systems, Volume I, Information Systems Improvement Plan Summary; and Volume III, Systems Design Reference Manual, UMTA-IT-06-0094-77-5, Arthur Anderson & Co., Washington, DC, September 1976.

APPENDIX

DETAILED DESCRIPTIONS

OF THE

MAINTENANCE MANAGEMENT INFORMATION SYSTEMS

INTRODUCTION

This appendix provides a detailed description of each MMIS to allow the reader to investigate the details of selected systems, after the summary has served to focus the investigation.

Included in these descriptions are:

- An introduction that provides some background information about the system and indicates the status of development.

- A description of the functional capabilities of the system, including the principal inputs and the output reports.

- A description of the hardware.

The functional capabilities and the possible output reports vary widely between the systems described. Recognizing their importance in determining the suitability of some system for a reader's application, examples of many output reports are included in each system's description.

A.1 VEHICLE MAINTENANCE REPORTING STANDARDS (VMRS)

AMERICAN TRUCKING ASSOCIATION, INC.

VMRS is different from the other maintenance management information systems presented in this report. It represents a reporting standard around which manual as well as computerized systems have been developed. In fact, two of the systems described in this report follow the VMRS standard. Also, ATA provides access to VMRS as a service bureau. The discussion of VMRS for these reasons follows a format different from the discussion of the other systems in this report. It is designed to provide an understanding of the maintenance management information system functions.

A.1 VMRS

1. INTRODUCTION

In 1968 the Cost Control Methods Study Group of the Regular Common Carrier Conference (RCCC) Maintenance Committee developed a requirement for a uniform maintenance management information system for the motor carrier industry. The purpose was to overcome the then existing lack of vehicle maintenance reporting standards which did not permit one-to-one comparisons between motor carriers, or sharing of maintenance information with vehicle suppliers or with the user representation. It was almost impossible to compile meaningful industry-wide statistics, because maintenance measurements, such as intervals between inspections and overhauls, component life, cost per mile, and normal service expectations, had no standard definitions. As the main reason, differences in operating procedures and a lack of standardized forms for collecting maintenance data were identified.

The ATA Management Systems Committee and the ATA National Accounting and Finance Council were requested to join the Study Group, so that maintenance, systems, and accounting aspects would be represented. The following four steps were considered necessary for the development of a vehicle maintenance reporting standard.

- Identification of vehicle maintenance data needed by various levels of motor carrier management.
- Development of definitions of terms and data classifications with sufficient information content.
- Development of data codes for data classifications.
- Development of a work order form.

The data codes and forms were to be designed so that they could be used by all carriers, irrespective of whether they were using manual or automated procedures for data processing.

The result of this effort is the ATA Vehicle Maintenance Reporting Standards System (VMRS), a complete maintenance management information system that can be implemented manually, or on a computer. A full description of VMRS is contained in reference A.1-1. In implementing a computerized VMRS one has a choice between developing ones own software, purchasing software from a number of independent suppliers (The HERCULES System, described in this report, is one example), or use a data processing service offered by ATA. VMRS data codes have become the standard for the trucking industry and are used for the following purposes:

- To describe the vehicle by its major components, assemblies, or parts and by its physical characteristics.
- For a component, assembly or part, to indicate the current state, existing or past malfunctions, and the maintenance performed.
- For each past maintenance action, to indicate by whom, and at what facility it was performed.
- To directly identify and account for costs.

2. SYSTEM DESCRIPTION

An overview over VMRS is shown in Figure A.1-1. Information pertaining to vehicles is grouped into one of three categories:

- o Standing Data
  The data elements and costs which are independent of whether or not the vehicle is running.
- o Running Data
  The data elements and costs related to the operation of the vehicle.
- o Maintenance and Repair Data
  The data elements related to the time and cost incurred in keeping the vehicles in operating condition.

The following functions of VMRS can be identified:

- Identification and classification
  - o of cargo carrying motor vehicles and their components,
  - o of operating conditions affecting the maintenance needs of vehicles, and
  - o of conditions and performance of maintenance.

- Standard codes for identification, classification and processing into useful maintenance information of the following:

  - o Activity (vehicle work assignment),
  - o Reason for Repair,
  - o Work Accomplished (maintenance work performed),
  - o Repair Class (timing of repairs),
  - o Repair Site,
  - o Part Failure,
  - o Vehicle Type,
  - o Vehicle Components,
  - o Indirect Labor.

  Several coding levels for vehicle components are provided, so that each individual motor carrier can select the level appropriate for his method of recordkeeping. As a result, carriers will have interfleet comparability of information to the coding level selected.

A.1 VMRS

The following standard forms are used for recording data:

- Vehicle Master Record,
- Power Unit Record,
- Records of Trailers, Containers and Converter Dollies,
- Vehicle Control Card,
- Driver's Vehicle Condition Report,
- Repair Order,
- Repair Order Log,
- Time Card,
- Direct Labor,
- Indirect Labor.

The fact that the codes are compatible with the I.C.C. accounting codes makes it easy to integrate VMRS into company-wide accounting systems.

A.1 VMRS

Input Data

The VMRS system was designed to be operated by individuals without clerical training. The basic input data are obtained from mechanics and as few reports as possible are used. To the extent possible, data are captured at their origin and then distributed to various users. Multiple input of the same information is avoided.

The input data for VMRS are divided into two groups, data which identify equipment, and data which document work performed. The VMRS Vehicle Master Record Form shown in Figure A.1-2 is the system source document for identification of equipment. It contains the following categories of information:

- Identification of the vehicle and its major components by serial number and by major characteristics
- Manufacturers of the vehicle and major components
- Purchase information
- Cost and depreciation schedule
- Ownership.

The VMRS Repair Order Form is the source document for information on maintenance work performed on individual equipment (see Figure A.1-3). It is subdivided into the following categories:

- Date when the work was performed
- Equipment identification - Fleet I.D.
- Accumulated service (miles or hours) of the equipment
- Reason for work
- Nature of work performed
- Facility at which the work was performed
- Identification and failure code for parts or components which were repaired, replaced or serviced
- Identity of employee performing the work
- Cost of labor and parts
- Information about outside repair

A.1 VMRS

The input data sources are shown in Figure A.1-4. The integration of maintenance data with fuel and oil data for the development of maintenance management information is shown in Figure A.1-5. The following information is contained in maintenance and fuel oil files.

Maintenance

- o Vehicle Fleet I.D. No.
- o Data and mileage maintenance performed
- o Location where work performed
- o Parts used
- o Parts cost
- o Labor hours
- o Labor cost

Fuel and Oil

- o Vehicle Fleet I.D. No.
- o Data and mileage fuel or oil added
- o Location where fuel added
- o Quantity added
- o Cost of fuel or oil added

Output Reports

The Vehicle Fleet I.D. Number, which is common to both files, permits the development of reports containing data elements from each file. Because of the ability to identify and record the foregoing categories of data it is possible to:

- Classify expenses by activity
- Classify expenses by type
- Report performance costs by
  - o Individual units of equipment
  - o Groups of like equipment
  - o Groups of unlike equipment in like service or at the same location
- Report equipment utilization by groupings, location, type and activity
- Report facility utilization
- Report direct labor utilization
- Report indirect labor utilization
- Identify rework
- Identify warranty work and claims
- Control inventories by identifying spare parts required to support maintenance operations by
  - o Equipment groups
  - o Locations
  - o Manufacturer's I.D.
  - o Source of supply
  - o Cost
  - o Utilization factor
- Identify obsolescent spare parts

In addition to this information, other types of information can be generated from the source data. The following are examples of this type of information:

- Operations
  - o Equipment utilization at specific locations
  - o Identification of equipment for special functions
  - o Identification of the need for training drivers in relation to equipment component failures
  - o Data for licensing
  - o Claims analysis, to identify types of equipment with high rates of damage to freight

- Sales
  - o Identification of unprofitable shippers resulting from freight which causes damage to equipment at a cost in excess of the net revenue received.

- Safety
  - o Analysis of characteristics of vehicles involved in accidents
  - o Component life history
  - o Identification of component and parts manufacturers
  - o Cause of parts failures
  - o Record of inspections, PM's, maintenance

- Accounting
  - o Information for ICC reporting
  - o Equipment costs for financial reporting
  - o Equipment costs for tax purposes
  - o Valuation of equipment and supporting spare parts inventories

- Personnel
  - o Staffing requirements at specific locations

Due to the many vehicle maintenance variables which can be identified, measured and compared, a large variety of reports can be generated. The variables include individual vehicle units, locations of maintenance activities, causes of vehicle failures, and the separate characteristics and reliabilities of the systems, assemblies and parts which make up the vehicle. The reports have to be evaluated according to the following criteria: content, detail, frame of reference, aids to analysis, readability, schedule, and economy.

The reports of VMRS are divided into the following two types:

- Maintenance Facility-Oriented Reports
  Vehicle inventories, data reliability control, fleet maintenance utilization analysis, and indirect cost control.

- Vehicle Reports
  Maintenance costs, running costs, and vehicle maintenance utilization analysis.

Some examples of vehicle maintenance reports are given to indicate how some motor carriers have approached maintenance management reporting.

An example of a weekly vehicle maintenance cost report prepared on a minicomputer is shown in Figure A.1-6. This report presents the maintenance costs of each vehicle by major vehicle component group and by the location at which the work was performed. It includes vehicle identification, a system description, labor hours, labor cost, parts cost, and total cost for all major component work and for preventive maintenance tasks performed during the period. An indication of whether the work was performed at a company facility, in the field, at a company terminal facility, or at an outside maintenance shop is also provided. The objective of this type of report is to identify needs for further investigation or for other management action. A drawback of this report is that the user has to mentally associate make, model, year, and special equipment with the vehicle identification number or refer to other reports for this information. In addition, the vehicle list type report becomes quite long in a large fleet and requires considerable time to analyze.

Figure A.1-7 shows a monthly report that includes a frame of reference via year-to-date and life-to-date maintenance expense, and mileage utilization for each vehicle. This report is more difficult to read than Figure A.1-6.

A.1 VMRS

Figure A.1-8 shows a weekly report which presents maintenance cost information as a function of utilization data. It includes vehicle running costs as well as maintenance and repair costs. Collisions, road failures and exceptions are also reported. The frequency and cost of collisions permits the separation of activities that are beyond the control of maintenance.

A vehicle maintenance analysis report for more specialized maintenance control purposes is shown in Figure A.1-9. Frequency of failure and maintenance cost of specific components are given to determine the components which are producing the greatest costs, or, alternatively, the components which require increased levels of maintenance. The component records are based on the VMRS codes. A more detailed explanation of the codes is given in the VMRS Handbook (Reference A.1-2). Each entry is vehicle based with mileage utilization and periods of interest. Below this, the following information is shown:

- o Number of occurrences of maintenance in the current period and costs per group or system
- o Number of occurences of maintenance in the previous years, and costs per group or system
- o Number of occurrences of maintenance in the vehicle life to date, and costs per group or system
- o Cost per mile, cost per group, or system in the previous year
- o Cost per mile, cost per group, or system over the life of the system.

Figure A.1-9, which presents cost for these different time frames by thirty different cost centers, illustrates the complexities of vehicle maintenance reporting.

A number of other reports are illustrated in Figures A.1-10 to A.1-18.

- Unit History Summary (Figure A.1-10)
  Provides a list of vehicles which exceeded minimum standards in the areas of cost per mile, miles per gallon of fuel, or miles per quart of oil, for any or all of the established periods.

- Vehicle Maintenance by Component Groups Report (Figure A.1-11)
  Shows for each VMRS component group code the number of occurrences of maintenance, and, on a per mile basis, the cost of labor, parts, and the total maintenance cost, for the current period and for the life to date of all vehicles collectively. This report indicates which component groups of the vehicles reported require the most frequent and the most costly maintenance.

- Vehicle Maintenance by Component Systems Report (Figure A.1-12)
  Provides a further breakdown of the component groups into component systems. This report may be used for more detailed analysis of component groups experiencing greater frequency of failure, or requiring greater levels of maintenance.

- Report on Vehicle Maintenance and Repair by Component Group and Reason (Figure A.1-13)
  Provides a matrix of fleet maintenance occurrences and cost by reason for repairs, or by other VMRS coded characteristics, such as repair class, repair site, and work accomplished.

- Maintenance Facility Summary Analysis (Figure A.1-14)
  Provides a summary of the following four reports:
  o vehicle group and system by reason for repair,
  o repair class,
  o repair site, and
  o work accomplished
  Also provided are parts and labor breakdown. This report may be used to control the cost and performance of the maintenance facility.

- Maintenance Facility Trend Analysis (Figure A.1-15)
  Provides a summary, for the current period, for the preceeding year and for each of the preceeding eleven periods, of work performed at a maintenance facility . By comparing these monthly figures, the effects of winter weather, other unusual monthly variations, or trends in maintenance frequency and cost can be identified.

- Maintenance Trend Analysis by Vehicle Activity and Type (Figure A.1-16)
  Shows information on the frequency of various maintenance activities over the course of the preceeding twelve periods and allows an analysis of trends in the rate of occurrence of these activities.

- Maintenance Facility Rework Analysis (Figure A.1-17)
  This is an example of a report on one particular category of work performed at a maintenance facility. Although this case reports rework, similar reports for road calls, driver complaints, or other categories of maintenance causes and effects can be prepared.

- Vehicle Inventory Report Detail (Figure A.1-18)
  This is a list of all vehicles in the fleet. It includes identification, descriptive information, and location. This data is derived from the vehicle master record for each unit.

In summary, Figures A.1-5, -6, -7 and 9 are examples of the vehicle oriented maintenance reports. These reports present basic maintenance cost information. Reports presented in Figures A.1-8, -10, -11, 12 -13, and -14 are component oriented. They support analyses of component life expectencies, and causes of failure and their associated cost to make component replacement and specification decisions. Figures A.1-14 and -15 support analyses of the effect of time and use on maintenance costs. Figure A.1-12 is a component oriented report that focuses on one aspect, such as rework. Vehicle history and fleet inventory type reports are shown in Figures A.1-10 and -18 respectively.

A.1 VMRS

2.3 THE VMRS CODES

A listing of the VMRS vehicle codes is reproduced in Table A.1-1. Since these codes were developed for truck fleets, it is natural that some changes are required to make them applicable to transit bus systems. The required changes are relatively minor in nature and concern mostly the addition of the passenger compartment and equipment for passenger service.

3. Hardware

VMRS has been implemented on a number of minicomputers at service bureaus, but has not been implemented on any micro's.

4. References

A.1-1 Vehicle Maintenance Reporting Standards Handbook, American Trucking Association, Inc., revised December 1982.

SYSTEMS ELEMENTS OF EQUIPMENT CONTROL

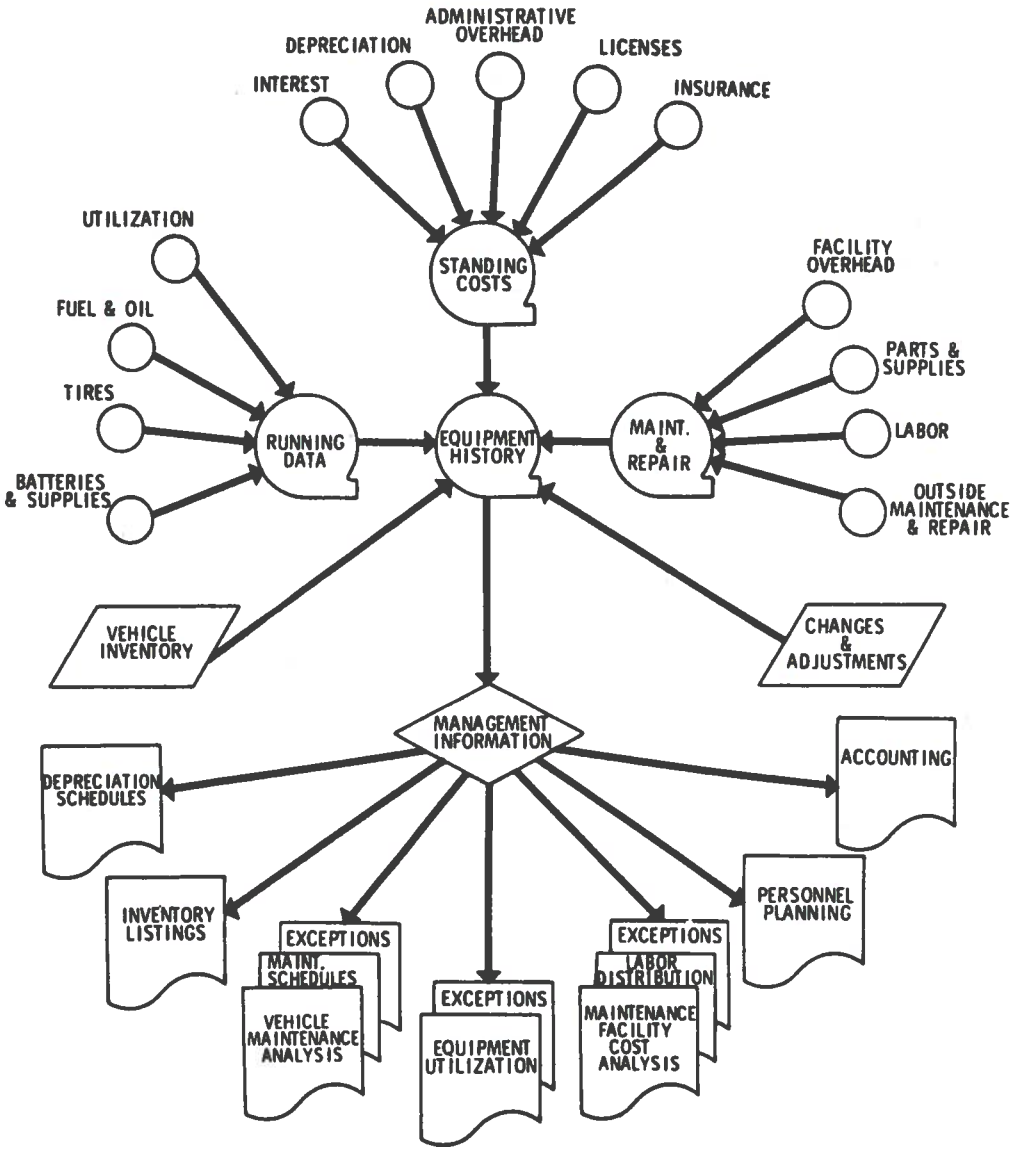


Figure A.1-1

FORM 1 (REV 10-76) **VEHICLE MASTER RECORD — POWER UNITS**

COMPANY NAME ____________________ 1

NOTE: CHECK PROGRAM CONTROL **A** WHEN PREPARING FIRST VMR.

CHECK PROGRAM CONTROL **E** WHEN MAKING ADDITIONS, CHANGES, OR CORRECTIONS ON SUBSEQUENT VMR'S.

DATA ENTRY: IF COLUMN NUMBER IS SHOWN WITH ARROW AT LEFT, AS ◄1-4), RECORD DATA STARTING IN FIRST (LEFT) COLUMN OF BLOCK

IF COLUMN NUMBER IS SHOWN WITH ARROW AT RIGHT, AS (5-7►, RECORD DATA TO END IN LAST (RIGHT) COLUMN OF BLOCK

IDENTIFICATION NUMBER

COMPANY SCAC CODE 2 | FLEET GROUP 1 | FLEET I D NO 4 | CHECK DIGIT 5 | ACTIVITY CODE 6 (15-16►) | PROGRAM CONTROL (CHECK ONE) 7: ☐ A ☐ E | TEMP OR OLD FLEET I D NO. 8 (◄8-21)

YEAR 1 (24-27►)	MAKE 2 (◄28-32)	MODEL 3 (◄35-42)	CHASSIS SERIAL 4 (◄43-59)	TYPE CODE 5 (◄60-66)	OWNERSHIP - CHECK ONE 6: ☐ 1-OWNED ☐ 2-LEASED ☐ 3-RENTED ☐ 4-OTHER (79)	A 80
DESCRIPTION 1 (◄24-38)	CAPACITY 2 (39-44►)	WEIGHT 3 (49-54►)	WHEEL BASE 4 (55-58►)			B 80
PURCHASED FROM 1 (◄24-38)	PURCHASE PRICE 2 (39-44►)	CHECK IF PRICE IS (CHECK ONE) 3: ☐ ACTUAL - 1 (45) ☐ ESTIMATE - 2 (46)				
DATE IN SERVICE 4: MO (47-48►) DAY (49-50►) YEAR (51-52►)	IDENTIFY IF VEH IS (CHECK ONE) 5: ☐ NEW - 1 (53) ☐ USED - 2 (54)	BEGINNING: MILES 6 (55-60►) HOURS 7 (61-64►)	VEHICLE ESTIMATED LIFE (NEW): MILES 8 (65-70►) HOURS 9 (71-74►) MONTHS 10 (75-77►)			C 80
DEPRECIATION PERIOD: MONTHS 1 (24-26►) YEARS 2 (27-28►)	DEPRECIATION RATE: MONTHLY 3 (29-33►) ANNUAL 4 (34-39►)	LEASE OR RENTAL RATE: HOURS 5 (40-44►) DAY 6 (46-48►) WEEK 7 (49-51►) MONTH 8 (52-55►)				D 80
BODY	DESCRIPTION 1 (◄24-43)	MODEL OR SERIES 2 (◄44-53)	MATERIAL 3 (◄54-63)	SLEEPER (CHECK ONE) 4: 1 YES (64) 2 NO (65)	BODY CODE 5 (◄73-79)	E 80
ENGINE MAIN	MAKE 1 (◄24-28)	MODEL 2 (◄33-42)	SERIAL 3 (◄43-56)	TYPE 4 (◄57-60); H P 5 (63-65►); CU IN 6 (66-68►); CYL 7 (69-70►); FUEL CODE 8 (71-72►); ENGINE CODE 9 (◄73-79)	F 80
ENGINE AUX.	MAKE 1 (◄24-28)	MODEL 2 (◄33-42)	SERIAL 3 (◄43-56)	TYPE 4 (◄57-60); H P 5 (61-65►); CU IN 6 (66-68►); CYL 7 (69-70►); FUEL CODE 8 (71-72►); AUX ENG CODE 9 (◄73-79)	G 80
TRANS. MAIN	MAKE 1 (◄24-28)	MODEL 2 (◄33-42)	TYPE 3 (◄43-56)	NO SPEEDS 4: FWD REV 5 (68-69►, 70-71►); P T O (CHECK ONE) 6: 1 YES 2 NO (72); TRANS CODE MAIN 7 (◄73-79)	H 80
TRANS. AUX.	MAKE 1 (◄24-28)	MODEL 2 (◄33-42)	TYPE 3 (◄43-56)	SPEED 4 (68-69►); TRANS CODE - AUX 5 (◄73-79)		J 80
AXLES	NO 1 (24-25►); DRIVEN 2 (26-27►)	AXLE FRONT: CAPACITY 3 (28-31►)	TIRES — FRONT: NO 4 (34-35►) SIZE 5 (◄36-45)	REAR: NO 6 (46-47►) SIZE 7 (◄48-57)		K 80
REAR AXLE	MAKE 1 (◄24-28)	MODEL 2 (◄33-42)	TYPE 3 (◄43-53)	SET UP 4 (54-55►); SPEEDS 5 (56)	RATIO 6, 7 (57-58►, ◄59, 62-63►, ◄64-66); WEIGHT RATING 8 (67-72►); AXLE CODE 9 (◄73-79)	L 80
OTHER EQUIP.	MAKE 1 (◄24-28)	MODEL 2 (◄33-42)	SERIAL 3 (◄43-56)	DESCRIPTION/TYPE 4 (◄57-67); SYS 5 (◄68-69); ASSY 6 (◄70-72); PART 7 (◄71-75); 8 (76-79►)	M 80
P.M. SCHED.	INTERVAL (CHECK ONE): ☐ 1 - MILES ☐ 2 - HOURS ☐ 3 - DAYS ☐ 4 - OTHER (24)	A: CODE 2 (25-27►) INTERVAL 3 (28-32►)	B: CODE 4 (31-35►) INTERVAL 5 (36-40►)	C: CODE 6 (41-43►) INTERVAL 7 (44-48►); D: CODE 8 (49-51►) INTERVAL 9 (52-57►)	FUEL CAPACITY 10 (60-62►); OIL CAPACITY 11 (63-65►)	N 80
ATA LOC 1 (24-26►)	COST CENTER 2 (27-31►)	REP FAC. 3 (36-38►)	LICENSE: LOC 4 (◄39-40) NUMBER 5 (◄41-47)	6 (48)	VEHICLE APPROPRIATE BOX: A B C D E F G H J K L M N P 7; DATE 8: MO DAY YR (70-71►, 72-73►, 74-75►)	P

MAIN OFFICE ONLY: CONTROL NUMBER 9 (76-79►) 80

SUBMITTED BY ____________________ DATE ____________________ CHECKED BY ____________________

Figure A.1-2

FORM 6 (REV. 1-80)

REPAIR ORDER

COMPANY CODE	FACILITY CODE	IDENTIFICATION NO. FLEET	VEHICLE
A.T.A.T	17	118	8306

FACILITY IDENTIFICATION: COWPENS

COMPANY NAME: ATA TRANSPORT

DATE: 07 (MONTH) 29 (DAY) 80 (YEAR)

REPAIR ORDER NO.: G-319878

METER READING (NO 10THS): 271459

ACTIVITY CODE ✓ (CHECK ONE)
- ☑ 1. PREDOMINATELY LINE HAUL
- ☐ 2. PREDOMINATELY P & D
- ☐ 3. OTHER

REASON FOR REPAIR ✓ (CHECK ONE)

MAINTENANCE
- ☐ 01 BREAKDOWN
- ☐ 02 CONSUMPTION - FUEL
- ☐ 03 CONSUMPTION - OIL
- ☑ 04 DRIVER'S REPORT
- ENTER REPORT NO. HERE: E217216
- ☐ 05 INSPECT. ROUTINE
- ☐ 06 LUBRICATION
- ☐ 07 PRE-DELIVERY
- ☐ 08 PM
- ☐ 09 REWORK
- ☐ 10 ROAD CALL
- ☐ 11 ROUTINE

REPAIR—MANAGEMENT DECISION
- ☐ 21 CAPITAL IMPROVEMENT
- ☐ 22 CONVERSION
- ☐ 23 MODIFICATION
- ☐ 24 SPECIAL STUDY

REPAIR—OUTSIDE INFLUENCE
- ☐ 31 ACCIDENT NON REPORTED
- ☐ 32 ACCIDENT REPORTED
- ☐ 33 MANUFACTURER RECALL
- ☐ 34 STATUTORY INSPECTION
- ☐ 35 STAT. MODIF.
- ☐ 36 THEFT
- ☐ 37 VANDALISM
- ☐ 38 WARRANTY
- ☐ 39 NATURAL CAUSES

REPAIR CLASS ✓ (CHECK ONE)
- ☑ 1 SCHEDULED
- ☐ 2 NON SCHEDULED
- ☐ 3 EMERGENCY

REPAIR SITE ✓ (CHECK ONE)
- ☑ 1 FACILITY
- ☐ 2 FIELD
- ☐ 3 TERMINAL
- ☐ 4 OUTSIDE COMPANY

IF THIS IS A CONTINUATION RO ☐ ✓ (CHECK HERE) ORIGINAL REPAIR ORDER NO.

PROMISED: 7-30-80 ☐ A.M. ☐ P.M.

WRITTEN BY: D. Morgan

ENTER PARTS INFORMATION HERE

SYS.	ASSY.	PART	PART NUMBER	QTY.	UNIT PRICE	FAIL. CODE
11	001	003	14-C-1699 R	2	1 03	
15	003	047	R-IH-901386	1	32 80	44
15	004	022	72194-3-A-76	1	37 15	18
53	999	016	30# oil	2	75	07

INSTRUCTIONS

check rough idle

check play in steering

ENTER LABOR INFORMATION HERE

MO.	DAY	EMPLOY. NO.	SYS.	ASSY.	WORK ACC.	ACTUAL TIME	STD. TIME
7	30	41	44		01	0 9	
7	30	41	11		01	1 0	
7	30	41	15		03	1 7	
7	30	41	45		07	0 2	

METER RESET / REPLACEMENT (NO TENTHS)
- ENTER OLD METER READING
- ENTER RESET/REPL. METER READING
- ENTER EST. UTILIZATION, NO READING

INSPECTED BY: Jaque Sable

DATE INSPECTED: 7 (MONTH) 30 (DAY) 80 (YEAR)

VENDOR NOTIFICATION
1. ALL STATEMENTS MUST CONTAIN THIS PURCHASE ORDER NO. & VEHICLE I.D. NUMBER.
2. NET PRICE OF PARTS AND LABOR MUST INCLUDE ALL TAX APPLICABLE.
3. COMPANY RETAIN THIS COPY FOR FURTHER PROCESSING.

VENDOR

INVOICE NUMBER

ENTER OUTSIDE REPAIR INFORMATION HERE

MO.	DAY	SYS.	ASSY.	PART	WORK ACC.	PARTS $	LABOR $

Figure A.1-3

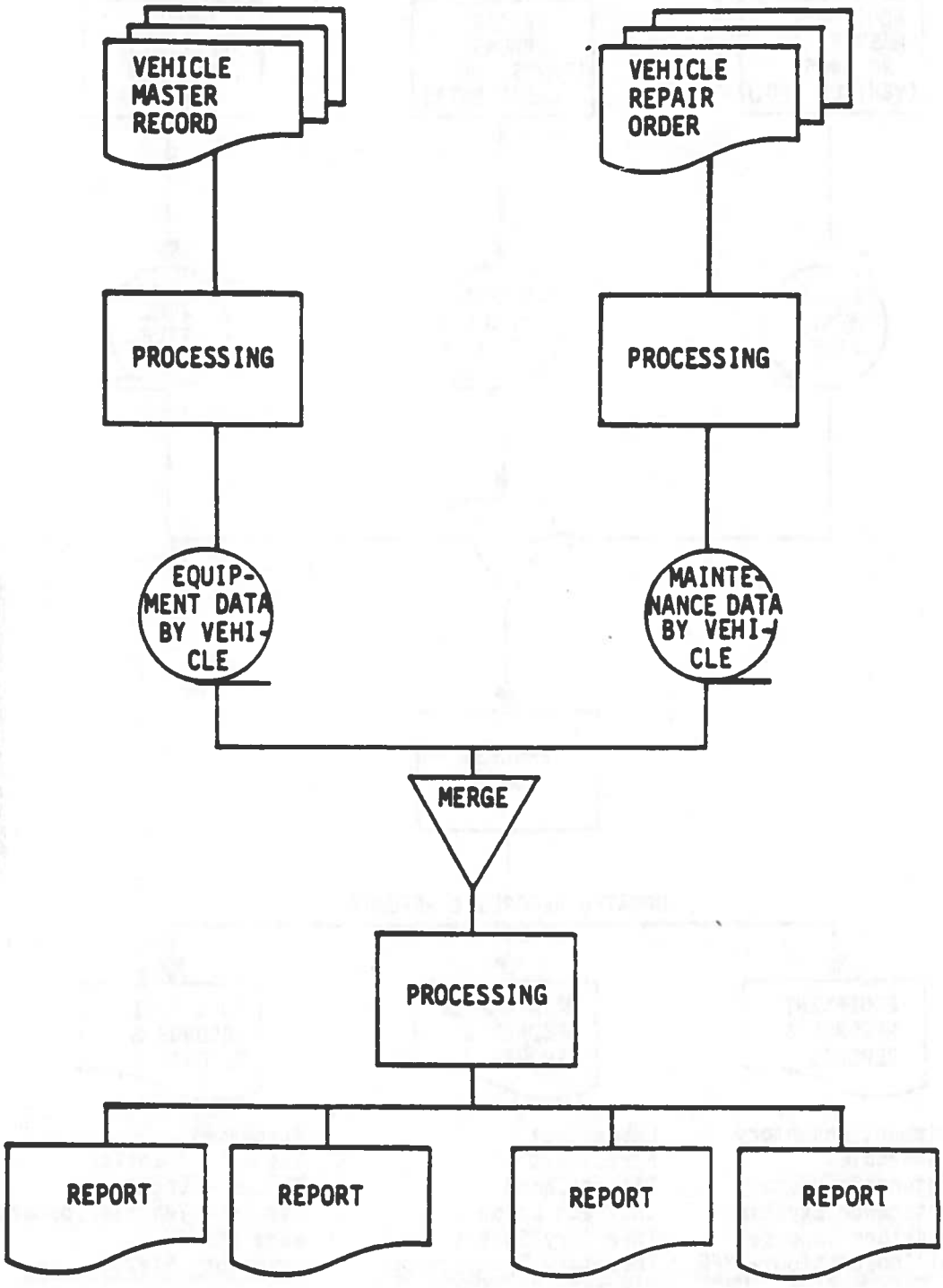


Figure A.1-4

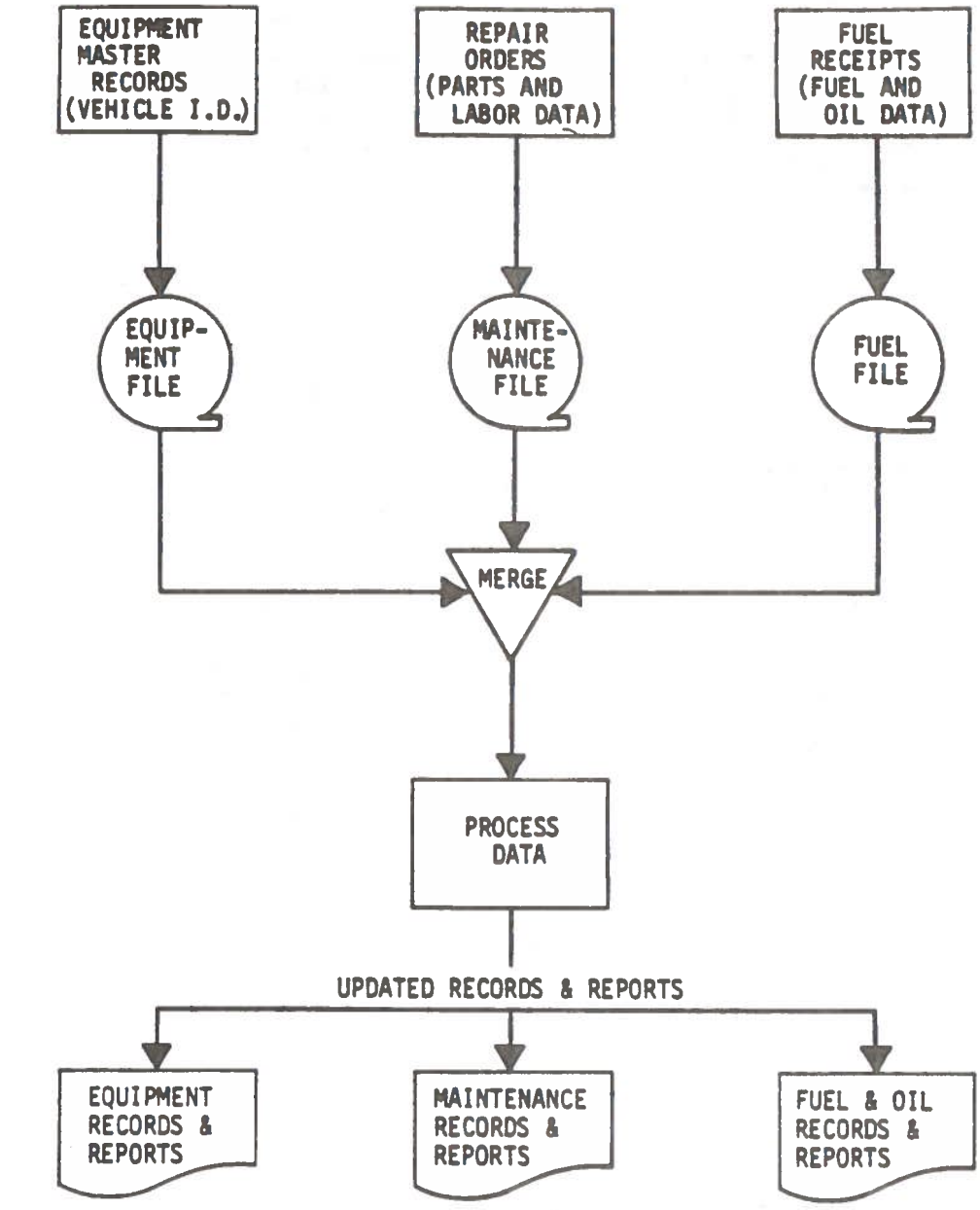


Figure A.1-5

WEEKLY MAINTENANCE COST REPORT WK END 02/22/ PRINTED 02/25/ PAGE 12

VEH ID	SYS	DESCRIPTION		LABOR HRS	LABOR AMT	PARTS AMT	TOTAL	
047	17	TIRES		.0	5.50	14.45	19.95	
047	30	ELECTRICAL		1.8	9.04	38.50	47.54	
047	P1	PREV. MAINT. 1		.8	3.56		3.56	
047	FACILITY		51.10	2.6	18.10	52.95	71.05	TOTAL
047	FIELD		.00					
047	TERMINAL		.00					
047	OUTSIDE		19.95					
048	00	COOLING-CAB-GUAGES		3.4	13.76	52.77	66.53	
048	10	CHASSIS		4.8	23.49		23.49	
048	13	BRAKES		8.1	39.63	13.10	52.73	
048	40	ENGINE		1.2	6.43		6.43	
048	P1	PREV. MAINT. 1		1.0	4.89		4.89	
048	FACILITY		130.58	18.5	88.20	65.87	154.07	TOTAL
048	FIELD		23.49					
048	TERMINAL		.00					
048	OUTSIDE		.00					
049	10	CHASSIS		19.9	80.88	284.97	365.85	
049	20	DRIVE LINE		39.1	174.47	174.75	349.22	
049	P1	PREV. MAINT. 1		.3	1.11		1.11	
049	FACILITY		716.18	59.3	256.46	459.72	716.18	TOTAL
049	FIELD		.00					
049	TERMINAL		.00					
049	OUTSIDE		.00					
063	P1	PREV. MAINT. 1		.3	1.61		1.61	
063	FACILITY		1.61	.3	1.61	.00	1.61	TOTAL
063	FIELD		.00					
063	TERMINAL		.00					
063	OUTSIDE		.00					
113	P1	PREV. MAINT. 1		.5	2.68		2.68	
113	FACILITY		2.68	.5	2.68	.00	2.68	TOTAL
113	FIELD		.00					
113	TERMINAL		.00					
113	OUTSIDE		.00					
115	P1	PREV. MAINT. 1		.5	1.85		1.85	
115	FACILITY		1.85	.5	1.85	.00	1.85	TOTAL
115	FIELD		.00					
115	TERMINAL		.00					
115	OUTSIDE		.00					

Figure A.1-6

NOVEMBER 1976 — MOTOR FREIGHT INC. EQUIPMENT EXPENSE REPORT — PAGE 2

EQUIP NO.	INVENTORY EXPENSE	DIREC EXPENSE	OUTSIDE EXPENSE	LABOR HRS	LABOR EXPENSE	TOTAL EXPENSE	YTD EXPENSE	LIFE EXPENSE	YTD MILES	LIFE MILES	YTD MI COST	LIFE MI COST
170							1,232.16	11,455.52	26915	233763	.046	.049
172	2,099.17	133.80	480.52	74.19	630.62	3,344.11	5,248.17	10,683.47	29640	103576	.177	.103
173	26.50			4.03	34.26	60.76	1,025.20	4,122.05	32046	98309	.032	.042
174			41.80			41.80	542.37	3,138.27	12832	57527	.042	.055
175	294.18	507.89		61.96	526.66	1,328.73	8,813.90	15,912.57	59034	260457	.149	.061
176	47.30	423.50	388.45	5.28	44.89	904.13	7,393.09	16,785.35	86436	281406	.086	.060
177	151.57	19.36		15.36	130.56	301.49	1,477.36	9,292.62	23547	133437	.063	.070
178	401.91	132.32	113.25	59.91	509.24	1,156.72	5,140.17	10,738.25	71049	199355	.072	.054
179	303.75		241.77	26.21	222.79	768.31	7,741.65	14,450.12	56639	164641	.137	.088
180	175.39	1,065.28		31.29	265.97	1,506.64	5,133.80	15,397.92	55551	155830	.092	.099
181	11.75			3.00	25.50	37.25	9,784.45	15,627.36	73412	175860	.133	.089
182	7.23			2.53	21.51	28.74	6,716.78	16,050.02	46426	146898	.145	.109
183	10.08	1.25		4.89	41.57	52.90	4,914.91	14,560.67	79442	164901	.062	.088
184	295.81		136.07	52.05	442.43	874.31	12,563.17	19,297.34	56814	213493	.221	.090
185							974.86	2,376.40	14705	43217	.066	.055
186	18.45			3.16	26.86	45.31	952.24	2,658.42	32809	68640	.029	.039
187	563.84	2.40	13.85	29.31	249.14	829.23	1,370.86	2,323.69	21587	42677	.064	.054
188							615.18	1,412.13	20840	42455	.030	.033
189	90.42		10.00	26.81	227.89	328.31	818.94	2,708.42	11737	21582	.070	.125
190	170.32	3.12		41.41	351.99	525.43	999.20	2,764.24	17810	32902	.056	.084
191				7.23	61.46	97.05	2,087.06	2,932.50	9179	16450	.227	.178
192				1.73	14.71	30.21	1,872.62	3,120.77	18371	35533	.102	.088
193	70.05			5.55	47.18	231.23	2,275.34	3,177.75	47666	52394	.048	.061
194							3,199.02	3,545.21	36379	36379	.088	.097
195				1.59	13.52	13.52	3,062.08	3,523.26	57469	58202	.053	.061
196	15.45	.449		15.82	134.47	167.41	3,545.99	3,652.31	65420	68544	.054	.053
197	5.82		143.61	8.39	71.32	220.75	2,706.52	3,803.14	60994	61717	.044	.062
212								470.51				
213								452.69				
214				3.04	25.84	25.84	2,000.51	3,155.76				
216								312.25				
217							505.23	1,576.24				
218	248.50	95.80		9.66	82.11	426.41	652.56	2,443.38				
220								363.22				
221							600.30	2,279.04				
222				.60	5.10	5.10	585.56	1,717.07				
223				3.23	27.46	27.46	891.21	1,555.45				
224							324.18	965.83				
225							517.84	760.95				
226	6.66	54.82		3.74	31.79	93.27	297.01	1,466.25				
227				1.12	9.52	9.52	806.67	1,360.30				
228	4.28			1.44	12.24	16.52	255.69	1,329.91				
229							557.52	1,224.50				
230				1.87	15.90	15.90	423.35	893.44				
231			54.00			54.00	756.76	1,315.67				
232			25.00	.90	7.65	32.65	293.69	1,086.26				
233				1.54	13.09	13.09	339.69	702.39				
234							364.34	2,710.57				
235							216.56	3,082.17				
236	4.28			.33	2.81	7.09	384.64	1,002.31				
237	2.65			2.49	21.17	23.82	279.75	861.82				
238	11.87			2.84	24.14	36.01	217.62	1,014.20				

WEEKLY MAINTENANCE REPORT
WEEK ENDING 6/30/

PAGE# 22

TRACTOR# 534 1968 GMC

	MILEAGE	GALLONS	FUEL	REPAIRS	TIRES	COLLISION	RD. FAIL	R/F	TOTAL	MESSAGES
WEEKLY	650	94	24	15					39	
Y-T-D	21,262	3,992	998	1,091					2,089	
Y-T-D CPM		5.3	.047	.051					.098	
L-T-D	391,188	86,198	21,550	19,587	2,589				43,726	
L-T-D CPM		4.5	.055	.050	.007				.112	

TRACTOR# 535 1968 GMC

	MILEAGE	GALLONS	FUEL	REPAIRS	TIRES	COLLISION	RD. FAIL	R/F	TOTAL	MESSAGES
WEEKLY	313	65	16	24					40	
Y-T-D	11,454	3,098	775	2,051			260	5	3,086	
Y-T-D CPM		3.7	.068	.179			.023		.269	FUEL USAGE UNDER 4.0 MPG
L-T-D	383,455	85,765	21,441	20,651	2,604		260	5	44,956	
L-T-D CPM		4.5	.056	.054	.007		.001		.117	

TRACTOR# 536 1968 GMC

	MILEAGE	GALLONS	FUEL	REPAIRS	TIRES	COLLISION	RD. FAIL	R/F	TOTAL	MESSAGES
WEEKLY	267									217,366 MILES OVERDUE FOR A-SERV
Y-T-D	24,454	4,703	1,176	2,199			42	2	3,417	
Y-T-D CPM		5.2	.048	.090			.002		.140	
L-T-D	449,766	99,217	24,804	23,465	2,977		42	2	51,288	
L-T-D CPM		4.5	.055	.052	.007				.114	

TERM. TOTALS

	MILEAGE	GALLONS	FUEL	REPAIRS	TIRES	COLLISION	RD. FAIL	R/F	TOTAL
WEEKLY	15,829	3,410	854	656			63	2	1,573
Y-T-D	546,584	127,781	31,949	73,102	5,447		2,392	68	112,890
Y-T-D CPM		4.3	.058	.134	.010		.004		.207
L-T-D	9,608,376	2,032,409	508,106	599,695	62,620	234	3,543	951	1,174,198
L-T-D CPM		4.7	.053	.062	.007				.122

Figure A.1-8

REPORT - VEHICLE MAINTENANCE ANALYSIS. PERIOD - JUNE 19XX.

	MAINTENANCE																										TOTAL	REPAIRS	
	AC-CAR-INSTR.			CHASSIS						DRIVE TRAIN					ELECTRICAL				ENGINE										
	01 A.C.	02 CAB	03 INSTR	11-12 AXLES DEAD	13 BRAKES	14 FRAME	15 STEER	16 SUSP	17-18 TIRES WHEELS	21-22 AXLES DRIVEN	23 CLUTCH	24 DRIVE SHAFT	25 PTO	26-27 TRANS MAIN	28 TRANS AUX.	31 CHASS	32 CHASS	33 IGNI-TION	34 LIGHTS	41 AIR INTAKE	42 COOL-ING	43 EX-HAUST	44 FUEL	46 POWER PLANT	50 ACCESS	99 BODY SPEC.	PM		MAT. DEGID.	OUTSIDE INFLUENCE
69-0662 19XX XXXXX TYPE CODE - 224626 UTILIZATION - LAST PERIOD 6,997 PREVIOUS 12 PERIODS 69,326 LIFE 27 PERIODS 123,617																													
PRD RPR		1	1	2						1						3			3		1		1				1	5	1	
$ COST		49	11	28						19						28			41		44		697				13	932	30	
12 PRDS	2	6	12	4				2	2	2	2			1	1	2	3	3	9	3	2	4	3				4	41	2	3
$ COST	106	279	147	197				134	17	177	71			103	14	55	45	72	130	49	59	32	815				78	2578	92	244
27 PRDS	5	10	29	7			1	5	7	2	6			2	3	9	4	6	26	5	3	12	3				11	88	2	5
$ COST	176	364	302	271			87	301	82	177	176			148	106	206	99	101	419	103	168	149	1163				241	4839	92	479
CPM CTS																													
12 PRDS	.0014	.0041	.0021	.0029				.0019	.0003	.0024	.0011			.0014	.0082	.0006	.0007	.0010	.0018	.0007	.0009	.0005	.0118				.0011	.0483	.0013	.0036
27 PRDS	.0011	.0030	.0024	.0022			.0007	.0024	.0007	.0014	.0014			.0012	.0008	.0017	.0008	.0008	.0034	.0008	.0013	.0012	.0095				.0019	.0993	.0007	.0038
69-7048 19XX XXXXX TYPE CODE - 224626 UTILIZATION - LAST PERIOD 5,179 PREVIOUS 12 PERIODS 37,426 LIFE 14 PERIODS 46,257																													
PRD RPR		1						2										1	2			1					4		1
$ COST		12						47										3	9			11					82		104
12 PRDS		11		3				12	2	6				10				5	21	1		6	3			3	48	1	1
$ COST		139		34				231	10	130				98				28	106	12		82	419			41	1329	54	196
14 PRDS	1	11		4				12	2	7				12				7	21	2		6	3			3	95	2	2
$ COST	69	139		49				231	10	149				128				45	106	31		81	419			41	1498	98	144
CPM CTS																													
12 PRDS		.0038		.0009				.0062	.0003	.0035				.0028				.0007	.0029	.0003		.0022	.0115			.0011	.0395	.0019	.0028
14 PRDS	.0015	.0032		.0011				.0050	.0002	.0032				.0028				.0009	.0023	.0004		.0017	.0092			.0009	.0326	.0021	.0033
69-4001 19XX XXXXX TYPE CODE - 224626 UTILIZATION - LAST PERIOD 3,048 PREVIOUS 9 PERIODS 24,321 LIFE 9 PERIODS 24,321																													
PRD RPR				1												1			2							1	3		
$ COST				14												11			7							10	42		
9 PRDS		7		1												3			4	1			2	1		8	21	1	2
$ COST		326		18												21			39	7			598	9		86	1104	67	93
9 PRDS		7		1												3			4	1			2	1		8	21	1	
$ COST		326		18												21			39	7			598	9		86	1104	67	93
CPM CTS																													
9 PRDS		.0136		.0008												.0009			.0016	.0030			.0025	.0004		.0035	.0461	.0028	.0038
9 PRDS		.0136		.0008												.0009			.0016	.0030			.0025	.0004		.0035	.0461	.0028	.0038

Figure A.1-9

PAGE 2 UNIT HISTORY SUMMARY MONTH ENDING 12/11/ REPORT EQ 08

	-CURRENT MONTH-						-PREVIOUS 3 MONTHS-							-LIFE TO DATE-						
		MAINTENANCE		OPERATION		FUEL	OIL*		MAINTENANCE		OPERATION		FUEL	OIL*		MAINTENANCE			OPERATION	FUEL	OIL
UNIT	MILES	COST	CPM	COST	CPM	MPG	MPQ*	MILES	COST	CPM	COST	CPM	MPG	MPQ*	MILES	COST	CPM	COST	CPM	MPG	MPQ
2035	2098	783	.3735	212	.1015	5.0	174	4196	1567	.3735	425	.1015	5.0	174	36586	4617	.1262	3892	.1064	4.6	435
2036	427	19	.0445	48	.1145	4.4	427	854	38	.0445	97	.1145	4.4	427	12690	1944	.1532	1740	.1372	3.6	437
2037	2155	165	.0767	203	.0945	5.3	307	4310	330	.0767	407	.0945	5.3	307	42670	1428	.0335	4077	.0956	5.5	609
2038			.0000		.0000	.0				.0000		.0000	.0		8712	589	.0677	1177	.1352	3.7	363
2039	1335	59	.0443	136	.1020	5.0	166	2670	118	.0443	272	.1020	5.0	166	22130	1218	.0551	2643	.1194	4.1	491
2040	2003	87	.0438	270	.1349	4.8	400	4006	175	.0438	540	.1349	4.8	400	36549	1345	.0368	4239	.1160	5.1	562
2041	1405	35	.0253	208	.1483	4.3	117	2810	71	.0253	416	.1483	4.3	117	10401	3001	.2886	1039	.0999	6.1	281
2042	2324	404	.1740	244	.1052	4.8	232	4648	808	.1740	488	.1052	4.8	232	43635	5439	.1247	4201	.0963	5.2	214
2043	1308	79	.0607	164	.1259	4.0	130	2616	158	.0607	329	.1259	4.0	130	24313	3337	.1373	2986	.1228	4.4	517
2044	498	52	.1063	163	.3283	6.1	498	996	105	.1063	326	.3283	6.1	498	9719	522	.0538	1390	.1431	4.9	571
2045	1215		.0000	103	.0852	5.9	303	2430		.0000	206	.0852	5.9	303	20439	4128	.2020	1725	.0844	5.7	757
2046	1304	21	.0161	103	.0796	6.2	1304	2608	42	.0161	207	.0796	6.2	1304	19410	2582	.1331	2032	.1047	5.1	1078
2047		17	.0000	8	.0000	.0			35	.0000	16	.0000	.0		27920	3694	.1323	2053	.0735	6.7	1116
2048	1838		.0000	202	.1100	4.5	612	3676		.0000	404	.1100	4.5	612	30920	3441	.1113	3004	.0972	5.1	300
2049	107		.0000	51	.4783	4.1	107	214		.0000	102	.4783	4.1	107	3505	162	.0463	525	.1499	4.6	438
GRP 102	18017	1725	.0958	2121	.1177	4.9	240	36034	3451	.0958	4243	.1177	4.9	240	349599	37454	.1071	36728	.1051	5.0	435
2050			.0000		.0000	.0				.0000		.0000	.0		10244	1966	.1920	1423	.1390	3.4	1280
2051	*****		.0000		.0000	.0	*****			.0000		.0000	.0		16831	1402	.0833	1727	.1026	5.3	765
2052	1642		.0000	159	.0974	5.1	410	3284		.0000	319	.0974	5.1	410	52350	2240	.0428	2698	.0515	9.4	951
2053	1346	66	.0492	130	.0967	5.2	336	2692	132	.0492	260	.0967	5.2	336	25039	1952	.0780	2437	.0973	5.0	1251
2054	460	20	.0435	53	.1168	4.3	230	920	40	.0435	107	.1168	4.3	230	13486	849	.0630	1633	.1212	5.0	199
2055	1078	74	.0688	113	.1056	4.7	269	2156	148	.0688	227	.1056	4.7	269	16397	1936	.1181	1935	.1180	4.6	712
2056	1310	35	.0268	142	.1087	4.6	1310	2620	70	.0268	284	.1087	4.6	1310	31554	2730	.0865	3312	.1050	4.6	1168
2057	1475	86	.0588	143	.0973	5.1	368	2950	173	.0588	287	.0973	5.1	368	27368	2445	.0893	3169	.1158	4.2	156
2058	989	100	51.0169	100	.1017	4.9	329	1978	201	11.0169	201	.1017	4.9	329	18375	4884	.2658	3104	.1690	4.1	1020
2059	449	49	.1110	44	.0990	5.0	449	898	99	.1110	88	.0990	5.0	449	12232	1110	.0908	1700	.1390	4.3	260
GRP 103	9749	1337	.1372	888	.0912	5.5	423	19498	2675	.1372	1777	.0912	5.5	423	223876	21518	.0961	23143	.1034	5.1	482

Figure A.1-10

REPORT 2.

VEHICLE MAINTENANCE BY COMPONENT GROUPS - COST PER MILE. 2ND QTR., 1977.

LINE HAUL POWER UNITS REPORTED THIS PERIOD.

		NUMBER OF FLEETS / VEHS	< - - - - MILES - - - - > TOTAL	AVG	THIS PERIOD	MAINTENANCE - THIS PERIOD FRQNCY	LABOR HOURS	LABOR $	PARTS $	TOTAL $	MAINTENANCE - LIFE TO DATE FRQNCY	LABOR HOURS	LABOR $	PARTS $	TOTAL $
	LINE HAUL POWER UNITS	21/ 2,752	117,525 M	43 M	57,972 M										
0	A/C, CAB, INSTR.					8,013	.0002	.0016	.0010	.0026	15,831	.0002	.0019	.0011	.0030
1	CHASSIS					15,699	.0005	.0049	.0039	.0082	26,911	.0005	.0042	.0038	.0080
2	DRIVE TRAIN					6,554	0003	.0026	0035	.0061	11,511	0003	.0028	0036	.0064
3	ELECTRICAL					12,254	.0003	.0029	.0019	.0043	23,693	.0003	.0027	.0022	.0048
4	ENGINE					13,972	.0008	.0060	.0066	.0139	26,749	.0008	.0078	.0075	.0153
5	ACCESSORIES					5,201	.0001	.0010	.0004	.0016	10,034	.0001	.0011	.0007	.0018
6	SPECIAL BODIES					115	.0000	.0000	.0000	.0000	198	.0000	.0000	.0000	.0000
7	BODIES + VESSELS					151	.0000	.0000	.0000	.0000	205	.0000	.0000	.0000	.0000
8	HEAT. + REFRIG.					10	.0000	.0000	.0000	.0000	18	.0000	.0000	.0000	.0000
9	PRO. TRANS. SYS.					315	.0000	.0001	.0001	.0001	507	.0000	.0001	.0001	.0001
	P. M.					8,261	.0004	.0036	.0016	.0053	14,481	.0004	.0037	.0016	.0053
	GRP. UNSPECIFIED					248	.0000	.0001	.0000	.0001	454	.0000	.0001	.0000	.0001
	TOTAL MAINTENANCE					70,793	0026	.0226	0192	.0417	130,592	0026	.0249	0206	.0498

Figure A.1-11

REPORT 3.

VEHICLE MAINTENANCE BY COMPONENT SYSTEMS - COST PER MILE. 2ND QTR., 1977.

LINE HAUL POWER UNITS REPORTED THIS PERIOD.

	NUMBER OF FLEETS / VEHS	MILES TOTAL	MILES AVG	MILES THIS PERIOD	MAINTENANCE - THIS PERIOD FRQNCY	LABOR HOURS	LABOR $	PARTS $	TOTAL $	MAINTENANCE - LIFE TO DATE FRQNCY	LABOR HOURS	LABOR $	PARTS $	TOTAL $
LINE HAUL POWER UNITS	21/ 2,752	117,525 M	43 M	57,972 M										
01 A/C, HEAT, VENT.					991	.00003	.00019	.00013	.00032	2,545	.00004	.00033	.00019	.00053
02 CAB AND SHEET METAL					6,007	.00015	.00124	.00079	.00197	11,195	.00016	.00138	.00075	.00213
03 INSTRS. AND GAUGES					1,065	.00002	.00020	.00014	.00034	2,091	.00003	.00023	.00015	.00038
SYSTEM UNSPECIFIED					0	.00000	.00000	.00000	.00000	0	.00000	.00000	.00000	.00000
00 A/C, CAB, INSTR.					8,013	.00020	.00143	.00101	.00263	15,831	.00022	.00194	.00109	.00304
11 AXLES FRONT, N.D.					297	.00001	.00011	.00007	.00018	542	.00001	.00011	.00008	.00019
12 AXLES REAR, N.D.					106	.00000	.00003	.00002	.00005	197	.00000	.00003	.00002	.00005
13 BRAKES					5,827	.00020	.00144	.00139	.00303	10,746	.00021	.00178	.00142	.00321
14 FRAME					707	.00003	.00022	.00004	.00026	1,154	.00002	.00019	.00004	.00024
15 STEERING					2,033	.00007	.00057	.00042	.00099	3,246	.00006	.00051	.00033	.00084
16 SUSPENSION					1,491	.00007	.00060	.00088	.00148	2,522	.00006	.00057	.00082	.00139
17 TIRES					2,912	.00006	.00051	.00047	.00098	4,414	.00005	.00042	.00050	.00093
18 WHEELS, RIMS ETC.					1,802	.00007	.00059	.00057	.00115	2,993	.00006	.00053	.00057	.00110
19 AUTO LUBRICATOR					524	.00001	.00010	.00002	.00012	897	.00001	.00008	.00002	.00010
SYSTEM UNSPECIFIED					0	.00000	.00000	.00000	.00000	0	.00000	.00000	.00000	.00000
10 CHASSIS					15,699	.00052	.00437	.00388	.00824	26,911	.00048	.00422	.00380	.00805
21 AXLE DRIVEN, FRNT					104	.00001	.00006	.00004	.00010	196	.00001	.00005	.00004	.00009
22 AXLE DRIVEN, REAR					1,412	.00009	.00075	.00122	.00197	2,459	.00009	.00077	.00129	.00207
23 CLUTCH					2,079	.00008	.00063	.00065	.00128	3,747	.00009	.00075	.00073	.00148
24 DRIVE SHAFTS					979	.00003	.00026	.00035	.00060	1,452	.00003	.00029	.00031	.00055
25 POWER TAKE OFF					89	.00000	.00003	.00004	.00007	119	.00000	.00002	.00003	.00005
26 TRANS., MAIN STD.					1,630	.00009	.00077	.00112	.00189	2,988	.00009	.00081	.00109	.00190
27 TRANS., MAIN AUTO.					0	.00000	.00000	.00000	.00000	0	.00000	.00000	.00000	.00000
28 TRANS., AUXILIARY					259	.00001	.00012	.00011	.00022	550	.00002	.00019	.00014	.00027
SYSTEM UNSPECIFIED					0	.00000	.00000	.00000	.00000	0	.00000	.00000	.00000	.00000
20 DRIVE TRAIN					6,554	.00031	.00242	.00353	.00613	11,511	.00033	.00278	.00363	.00641
31 CHARGING SYSTEM					1,936	.00006	.00049	.00063	.00112	3,942	.00007	.00060	.00072	.00132
32 CRANKING SYSTEM					2,024	.00007	.00056	.00092	.00148	3,941	.00007	.00061	.00101	.00162
33 IGNITION SYSTEM					442	.00001	.00011	.00007	.00018	834	.00001	.00011	.00008	.00019
34 LIGHTING SYSTEM					7,852	.00015	.00121	.00031	.00153	14,976	.00015	.00134	.00034	.00168
SYSTEM UNSPECIFIED					0	.00000	.00000	.00000	.00000	0	.00000	.00000	.00000	.00000
30 ELECTRICAL					12,254	.00029	.00237	.00193	.00431	23,693	.00030	.00266	.00215	.00481

REPORT 4.

VEHICLE MAINTENANCE AND REPAIR BY COMPONENT GROUP / REASON - COST PER MILE. 2ND QTR., 1977.

LINE HAUL POWER UNITS REPORTED THIS PERIOD.

	0 AC/CAB/INSTR. SPEC.		1 CHASSIS BODY		2 DRIVE TRAIN BODIES		3 ELECTRICAL VSLS.		4 ENGINE HEAT.		5 ACCESSORIES REFG.		6 P.M. PRD.		7 UNSPECIFIED TRF.		8 TOTAL SYS.	
	FRQNCY	C.P.M $	FRQNCY	C.P.M $	FRQNCY	C.P.M $	FRQNCY	C.P.M $	FRQNCY	C.P.M $	FRQNCY	C.P.M $	FRQNCY	C.P.M $	FRQNCY	C.P.M $	FRQNCY	C.P.M $
FLEETS - 21 VEHICLES - 2,752 MILES -- TOTAL =117,525 M AVG. - 43 M THIS PERIOD - 57,972 M																		
MAINTENANCE																		
01 BREAKDOWN	158	.00011	727	.00049	322	.00090	605	.00041	625	.00213	103	.00009						
	10	.00000	7	.00000	0	.00000	18	.00001	23	.00002	88	.00004	2,486	.00415				
02 CONSUM. - FUEL	1	.00000	4	.00000	1	.00000	2	.00000	8	.00003	1	.00000						
	0	.00000	0	.00000	0	.00000	0	.00000	1	.00000	0	.00000	18	.00003				
03 CONSUM. - OIL	3	.00000	4	.00000	5	.00002	3	.00000	15	.00017	1	.00000						
	1	.00000	1	.00000	0	.00000	0	.00000	1	.00000	0	.00000	34	.00019				
04 DRIVERS REPORT	5,654	.00172	11,038	.00461	4,664	.00360	8,644	.00279	9,911	.00495	3,420	.00102						
	75	.00001	109	.00003	3	.00000	231	.00010	1,196	.00052	42	.00002	45,189	.02137				
05 INSPECT - RTN.	584	.00029	1,223	.00084	349	.00041	673	.00026	851	.00097	268	.00008						
	1	.00000	8	.00000	3	.00000	13	.00000	718	.00034	1	.00000	4,492	.00314				
06 LUBRICATION	168	.00006	274	.00027	164	.00012	302	.00012	195	.00027	186	.00006						
	1	.00000	1	.00000	0	.00000	0	.00000	461	.00023	1	.00000	1,753	.00113				
07 PRE-DELIVERY	13	.00001	36	.00002	5	.00002	13	.00000	14	.00000	65	.00009						
	0	.00000	0	.00000	0	.00000	1	.00001	50	.00002	1	.00000	198	.00017				
08 PREV. MAINT	1,035	.00037	1,673	.00128	770	.00060	1,938	.00048	1,575	.00133	799	.00029						
	21	.00000	10	.00001	4	.00000	21	.00001	5,712	.00409	2	.00000	13,060	.00841				
09 REWORK	33	.00001	71	.00008	52	.00006	54	.00002	107	.00032	18	.00001						
	0	.00000	0	.00000	0	.00000	0	.00000	5	.00000	0	.00000	340	.00050				
10 ROAD CALL	122	.00004	388	.00022	129	.00015	359	.00017	431	.00073	31	.00001						
	5	.00000	1	.00000	0	.00000	12	.00000	11	.00000	111	.00007	1,595	.00139				
11 ROUTINE	105	.00005	242	.00042	69	.00010	140	.00005	165	.00028	100	.00004						
	1	.00000	1	.00000	0	.00000	14	.00000	82	.00004	1	.00000	920	.00098				
MAINTENANCE	7,874	.00261	15,680	.00823	6,527	.00598	12,233	.00430	13,897	.01318	5,192	.00159						
	115	.00001	138	.00004	10	.00000	310	.00013	8,260	.00526	247	.00013	70,485	.04146				
REPAIRS, MGT. DEC.																		
21 CAPITAL IMPROV.	103	.00011	52	.00001	5	.00003	149	.00005	158	.00036	154	.00010						
	0	.00000	2	.00000	0	.00000	4	.00005	6	.00000	0	.00000	633	.00071				
22 CONVERSION	5	.00001	3	.00000	0	.00000	3	.00000	8	.00000	14	.00000						
	0	.00000	0	.00000	0	.00000	1	.00000	0	.00000	0	.00000	34	.00001				
23 MODIFICATION	14	.00003	31	.00001	5	.00001	4	.00000	24	.00004	46	.00002						
	3	.00000	16	.00001	0	.00000	0	.00000	5	.00000	0	.00000	150	.00012				
24 SPECIAL STUDY	0	.00000	28	.00000	0	.00000	1	.00000	5	.00001	2	.00001						
	0	.00000	0	.00000	0	.00000	0	.00000	0	.00000	0	.00000	36	.00002				
REPAIRS, MGT. DEC.	124	.00015	114	.00002	10	.00004	157	.00005	195	.00041	216	.00013						
	3	.00000	18	.00001	0	.00000	5	.00005	11	.00000	0	.00000	853	.00086				

Figure A.1-13

REPORT - MAINTENANCE FACILITY SUMMARY ANALYSIS.

COMPANY -
FACILITY -

PERIOD - JUNE 19XX.

	MAINTENANCE																											TOTAL	REPAIRS	
	AC-CAB-INSTR.			CHASSIS						DRIVE TRAIN						ELECTRICAL				ENGINE										
	01 A.C.	02 CAB	08 INSTR	11-12 AXLES DEAD	13 BRAKES	14 FRAME	15 STEER	16 SUSP.	17-18 TIRES WHEELS	21-22 AXLES DRIVEN	23 CLUTCH	24 DRIVE SHAFT	25 PTO	26-27 TRANS MAIN	28 TRANS AUX	31 CHARG	32 CRANK	33 IGNITION	34 LIGHTS	41 AIR INTAKE	42 COOLING	43 EXHAUST	44 FUEL	45 POWER PLANT	50 ACCESS	60 BODY SPEC.	PM		MGT DECIS	OUTSIDE INFLUENCE
REPAIR SUMMARY																														
MAINTENANCE	7	5	15	3	11		1	3	6	12	22	2		4		7	17	10	26	4	8	5	7	14	18		46	253		
$	580	1482	150	730	642		115	410	625	1239	1750	180		673		476	148	352	274	394	477	371	683	8942	810		2350	23853		
REP - MGT DEC.		2			4	1				2				1		1		1		1			2	1				16		
$		768			314	180				184				142		47		41		116			192	2068				4052		
REP - OUT INF.		1			3		1		1	4						5	5	7	12		1	2	5	1				48		
$		400			249		95		285	442						327	72	217	106		83	229	365	735				3605		
TOTAL	7	8	15	3	18	1	2	3	7	18	22	2		5		13	22	18	38	5	9	7	14	16	18		46	317	16	48
$	580	2650	150	730	1205	180	210	410	910	1865	1750	180		815		850	220	610	380	510	560	600	1240	11745	810		2350	31510	4052	3605
PARTS $	360	825	30	410	590		85	150	280	805	690	40				225	115	180	65	190	310	180	740	5870	480		180	10088	1603	1109
LABOR $	220	1825	120	320	420		125	105	630	980	1060	140				625	105	430	315	320	170	345	390	4555	330		2170	10755	2449	2496
OUTSIDE $					195	180		155		80				815							80	75	110	1320				3010		
CO. LABOR HRS	25	203	13	36	47		14	12	70	109	118	16				69	12	48	35	36	19	38	43	506	37		241	1198	272	277
REPAIR CLASS																														
SCHEDULED	6	6		3	13	1	2		6	12	18	2		5		3	18	8	4	4	6	6	10	13	1		46	173	15	5
$	480	1820		730	780	180	210		625	1146	1350	180		815		217	176	240	49	394	360	496	884	9542	45		2350	18716	3864	489
NON-SCHEDULED	1	1	15		4			3		6						7	4	4	30	1	2	1	3	2	17		-	69	1	31
$	100	430	150		376			410		719						428	44	160	297	116	117	104	246	1468	765			3636	188	2106
EMERGENCY		1			1				1		4					3		6	4		1		1	1				11		12
$		400			49				285		400					205		210	34		83		110	735				1501		1010
REPAIR SITE																														
FACILITY	7	8	13	3	15		2	1	3	17	19	2				8	22	10	17	5	6	6	10	12	18		46	202	16	32
FIELD									2		1					3		4	2				1					2		11
TERMINAL			2						2		1					2		4	19		1		1					30		2
OUTSIDE COMP					3	1		2		1	1			5							2	1	2	4				19		3
WORK ACCOMP.																														
ADJUST	3				12			2			6					3	18	9			4		8	8				53	8	12
CLEAN																							2					1	1	
EXCH. NEW			5						4		7								33	2	2	4	1	1	12			66	4	1
EXCH. REBUILT									1	1	4							1					2	1				1		9
EXCH. USED																														
INSPECT					1						1	1					1		1		1			2				5	2	1
LUBRICATE				1						8																		9		
OVERHAUL	3			2	2		2			1		1		2		3								1				13		4
P.M. - A																											24	24		
P.M. - B																											12	12		
P.M. - C																											8	8		
P.M. - D																											2	2		
REPAIR	1	8	10		3	1		1	2	6	4			2		6	3	8	4	3	2	3	1	3	6			57	1	21
TOWING																														
WORK INCOMP.														1		1												2		

Figure A.1-14

REPORT - MAINTENANCE FACILITY TREND ANALYSIS. COMPANY - FACILITY - PERIOD - JUNE 19XX.

ACCOUNTING PERIOD	7	8	9	10	11	12	1	2	3	4	5	6	TOTAL CURRENT YEAR	TOTAL PREVIOUS YEAR
TOTAL MAINTENANCE.														
NO. UNITS REPAIRED	117	115	120	135	133	134	135	135	128	112	115	108	153	170
NO. REPAIR ORDERS	560	510	490	501	525	518	502	475	450	360	392	317	5600	6981
AVG. R. O. / UNIT	4.8	4.4	4.1	3.7	3.9	3.9	3.7	3.5	3.5	3.2	3.5	2.9	36.6	41.1
COMPANY $	39810	37820	35100	34200	34200	33800	33500	33100	32700	32500	30600	28500	405830	437500
OUTSIDE $			350	2150	1250	2400	4300	1800	3250	2710	3850	3010	25070	38200
TOTAL VEH. MAINT. $	39810	37820	35450	36350	35450	36200	37800	34900	35950	35210	34450	31510	430900	475700
CREDITS - WARRANTY $	110		350			210	180		450	50	1250	850	3450	100
CREDITS - ACCIDENT $				1800	1500	140	1250	800			760	1105	7355	3200
COMPANY MAINTENANCE.														
NO. UNITS REPAIRED	117	115	109	121	112	114	125	133	110	108	101	92	153	170
NO. REPAIR ORDERS	560	510	479	486	504	494	491	473	430	356	375	295	5453	6561
PARTS $	23800	24600	21400	21500	20800	19900	18400	15550	13700	13000	13300	12800	218750	153000
LABOR $	15910	13220	13700	12700	13400	13900	15100	17550	19000	19500	17300	15700	187080	284500
TOTAL $	39810	37820	35100	34200	34200	33800	33500	33100	32700	32500	30600	28500	405830	437500
$ % PARTS	59.8	65.1	61.0	62.9	60.8	58.9	54.9	46.8	41.9	40.0	43.4	45.0	54.1	35.1
$ % LABOR	40.0	35.0	39.0	37.1	39.1	41.1	45.0	52.8	58.1	60.0	56.5	55.0	46.2	65.1
AVG. COST/UNIT	341	329	322	283	305	297	248	245	255	301	303	310	2654	2882
AVG. PART $/UNIT	204	214	196	178	186	173	136	115	107	121	132	139	1430	1002
AVG. LABOR $/UNIT	137	115	126	105	119	124	112	130	148	180	171	171	1224	1880
AVG. LABOR HRS./UNIT	15.2	12.8	14.0	11.7	13.2	13.8	12.5	14.5	16.5	20.0	19.0	19.0	136	209
OUTSIDE MAINTENANCE.														
NO. UNITS REPAIRED			11	14	21	20	10	2	18	4	14	16	78	101
NO. REPAIR ORDERS			11	15	21	24	11	2	20	4	17	22	147	420
PARTS $			70	1290	575	1200	2020	935	2140	1670	2520	1780	14200	21550
LABOR $			280	860	675	1200	2280	865	1110	1040	1330	1230	10870	16650
TOTAL $			350	2150	1250	2400	4300	1800	3250	2710	3850	3010	25070	38200
$ % PARTS			20.0	60.0	46.0	50.0	47.0	52.0	66.0	63.0	65.5	59.0	56.6	61.5
$ % LABOR			80.0	40.0	54.0	50.0	53.0	48.0	34.0	37.0	34.5	41.0	43.4	38.5
AVG. COST/UNIT			32	154	60	120	430	900	181	678	275	188	322	427
AVG. PARTS $/UNIT			6	92	27	60	202	468	119	427	180	111	182	262
AVG. LABOR $/UNIT			26	62	33	60	228	432	62	251	95	77	140	165

Figure A.1-15

TRUCKING COMPANY, INC. PAGE 1

MAINTENANCE TREND ANALYSIS BY VEHICLE ACTIVITY AND TYPE 04/01/77

ACTIVITY AND TYPE - LH-TRCT

LINE		PERIOD 02	PERIOD 01	PERIOD 12	PERIOD 11	PERIOD 10	PERIOD 09	PERIOD 08	PERIOD 07	PERIOD 06	PERIOD 05	PERIOD 04	PERIOD 03	PER AVG	COMP TARGET
01	NUMBER OF VEHICLES. . .	81	81	65	65	65	65	65	65	65	65	65	65	68	
02	AVG VEH AGE IN MONTHS .	42	41	50	49	48	47	46	45	44	43	42	41	44	
03	AVG LIFE MI/VEH-ADD 000 .	205	201	246	242	238	233	228	223	218	212	206	201	220	
04	AVG MILES/VEH/PERIOD. . .	4026	3429	4055	4772	4925	4848	5297	4697	6349	5730	5124	3865	4719	
05	TOTAL MI-ALL VEH-ADD 000.	326	278	264	310	320	315	344	305	413	372	333	251	319	
06	DOWNTIME HRS PER VEHICLE.	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	
07	LABOR HRS PER VEHICLE . .	5.74	9.22	7.45	8.50	9.38	9.67	7.50	7.48	11.19	5.74	8.60	5.24	8.00	
08	% LABOR HRS TO DOWN HRS .	0	0	0	0	0	0	0	0	0	0	0	0	0	
09	REPAIR ORDERS PER VEHICLE	2.02	1.47	2.31	2.14	2.00	2.52	2.49	2.31	2.63	2.17	2.38	1.89	2.28	
10	SYSTEMS PER REPAIR ORDER.	1.26	1.41	1.32	1.37	1.28	1.38	1.31	1.32	1.45	1.23	1.27	1.41	1.34	
11	MILES PER REPAIR ORDER. .	1988	1389	1757	2232	2462	1922	2125	2055	2413	2641	2149	2042	2072	
12	COMPANY MECH HRS/REPAIR .	2.58	3.28	2.65	3.43	3.05	3.34	2.92	2.86	4.03	2.35	2.12	2.86	2.98	
13	MILES PER COMPANY MECH HR	761	449	709	681	897	620	860	822	632	1181	1098	813	755	
14	MILES PER TOTAL LABOR HR.	702	372	544	562	525	501	697	596	568	999	596	738	590	
15	PARTS $ PER REPAIR ORDER.	36.47	61.28	48.57	60.27	81.08	60.50	43.52	78.45	75.67	41.41	46.36	40.16	56.32	
16	MILES PER PART $.	55	23	36	37	30	32	49	26	32	64	46	51	37	
17	MILES PER MAINTENANCE $.	25	12	18	18	16	16	23	15	17	33	21	26	19	
18	TOTAL MAINT $ C.P.M. . .	.040	.085	.056	.054	.064	.062	.043	.065	.058	.030	.048	.039	.053	
19	COMPANY LABOR $ C.P.M. .	.019	.033	.021	.022	.016	.024	.017	.018	.023	.012	.013	.017	.019	
20	OUTSIDE LABOR $ C.P.M. .	.003	.008	.008	.006	.015	.007	.005	.008	.003	.003	.013	.002	.007	
21	TOTAL LABOR $ C.P.M. . .	.022	.041	.029	.027	.031	.031	.022	.026	.026	.014	.026	.019	.026	
22	COMPANY PARTS $ C.P.M. .	.017	.039	.024	.021	.011	.021	.014	.020	.025	.013	.012	.019	.019	
23	OUTSIDE PARTS $ C.P.M. .	.002	.006	.003	.006	.022	.011	.006	.018	.006	.002	.010	.000	.008	
24	TOTAL PARTS $ C.P.M. . .	.019	.044	.028	.027	.033	.031	.020	.039	.031	.016	.022	.020	.027	
25	% LABOR $ TO MAINT $. . .	54	48	51	50	48	49	52	41	46	48	52	50	49	
26	% PARTS $ TO MAINT $. . .	46	52	49	50	52	51	48	59	54	52	45	50	51	
27	P.M.'S PER VEHICLE. . . .	.69	.73	.71	.86	.71	1.02	.85	.66	1.02	.89	.80	.68	.78	
28	MILES PER P.M.	5843	4707	5730	5539	6959	4775	6260	7130	6255	6422	6405	5704	6044	
29	MILES PER P.M.'S	94	72	78	75	136	77	98	115	133	106	102	132	94	
30	LABOR HRS PER P.M. . . .	2.72	2.46	3.37	2.80	2.62	2.50	2.66	2.39	2.62	2.42	2.51	2.66	2.66	
31	PARTS $ PER P.M.	22.08	44.10	28.74	33.22	26.90	25.61	24.78	26.66	24.01	26.61	27.72	24.03	25.98	
32	AVG COST PER P.M.	62.06	65.55	73.83	74.32	65.35	62.31	63.86	61.82	62.48	50.33	62.70	61.17	64.62	
33	% P.M.'S TO MAINTENANCE $	27	16	23	25	15	21	24	13	17	31	21	19	20	
34	B'DOWN/R'CALL PER VEHICLE	.00	.01	.02	.00	.02	.00	.00	.00	.00	.00	.02	.03	.01	
35	MILES PER B'DOWN/R'CALL .	0	277709	203574	0	320118	0	0	0	0	0	333041	125606	638633	
36	AVG $ PER B'DOWN/R'CALL .	.00	53.48	100.00	.00	134.50	.00	.00	.00	.00	.00	27.88	22.23	60.05	
37	% B'DOWN-R'CALL $/MAINT $	0	0	1	0	1	0	0	0	0	0	0	0	0	
38	AVG LABOR $ PER VEHICLE .	87	141	116	130	152	149	117	124	164	83	134	75	123	
39	AVG PARTS $ PER VEHICLE .	74	151	112	129	162	153	108	181	200	90	111	76	128	
40	AVG TOTAL $ PER VEHICLE .	161	292	228	259	314	302	225	305	368	173	245	151	251	
41	PART $ PER COMP MECH HOUR	13.09	17.29	17.20	13.97	9.89	12.77	12.41	16.57	15.97	15.68	12.81	15.82	14.61	
42	PART $ PER COMP LAB $ . .	.89	1.18	1.17	.95	.67	.87	.84	1.13	1.09	1.13	.92	1.13	1.00	
43	PART $ PER OUTSIDE LAB $.	.61	.66	.43	1.14	1.51	1.55	1.21	2.17	1.98	.89	.74	.09	1.17	
44	LABOR RATE (COMP)$ PER HR	14.69	14.69	14.69	14.69	14.69	14.69	14.69	14.69	14.55	13.93	13.94	13.94	14.55	

Figure A.1-16

REPORT - MAINTENANCE FACILITY REWORK ANALYSIS. COMPANY - FACILITY - PERIOD - JUNE 19XX.

	AC-CAB-INSTR.			CHASSIS						DRIVE TRAIN						ELECTRICAL			ENGINE								TOTAL	REPAIRS	
	01 A.C.	02 CAB	09 INSTR	11-12 AXLES DEAD	13 BRAKES	14 FRAME	15 STEER	16 SUSP.	17-19 TIRES WHEELS	21-22 AXLES DRIVEN	23 CLUTCH	24 DRIVE SHAFT	25 PTO	26-27 TRANS MAIN	28 TRANS AUX.	31 CHARG	32 CRANK	33 IGNI-TION	34 LIGHTS	41 AIR IN-TAKE	42 COOL-ING	43 EX-HAUST	44 FUEL	45 POWER PLANT	80 ACCESS	90 BODY SPEC.	PM		MGT. DECIS.	OUTSIDE INFLUENCE
UNITS REPAIRED					6			2				4				1	3			7			2				19		
NO. R. O.					6			3				5				1	9			9			3				33		
AVG. R.O./UNIT					1.0			1.5				1.3				1.0	1.7			1.3			1.5				1.7		
PARTS COST $					47			62				246				10	49			61			97				572		
LABOR COST $					99			81				153				9	108			72			162				684		
TOTAL COST $					146			143				399				19	157			133			259				1,256		
LABOR HOURS					11			9				17				1	12			8			18				76		
PARTS $ / R.O.					8			21				49				10	10			7			32				18		
LABOR $ / R.O.					17			27				51				9	22			8			54				21		
TOTAL $ / R.O.					24			48				80				19	31			15			86				39		
LABOR HRS./RO					1.8			3.0				3.4				1.0	2.4			0.9			6.0				2.4		

Figure A.1-17

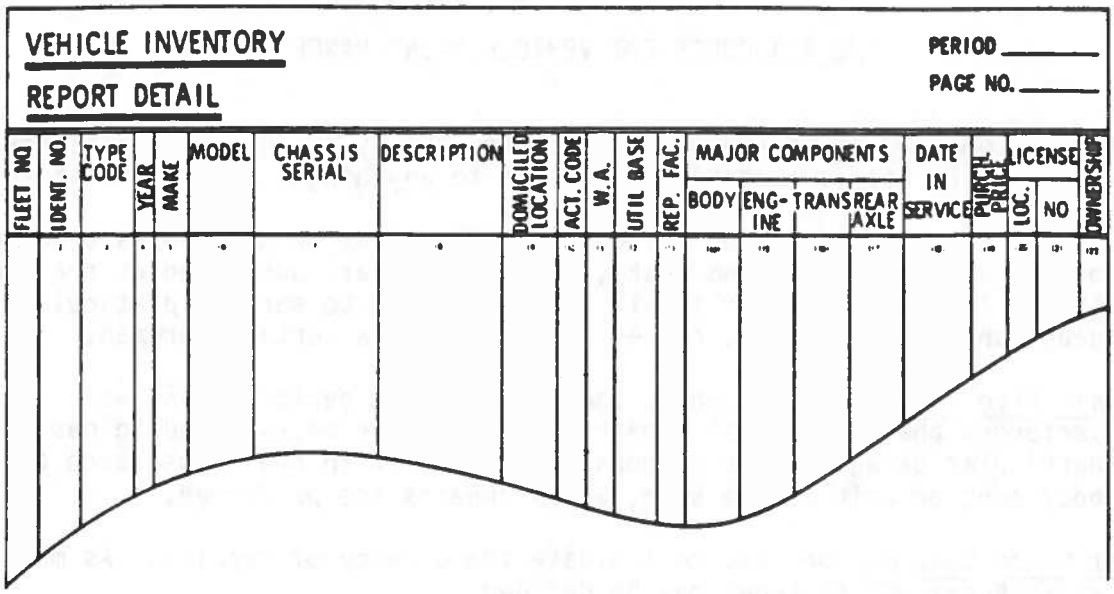

VEHICLE INVENTORY
REPORT DETAIL
PERIOD
PAGE NO.
FLEET NO.
IDENT. NO.
TYPE CODE
YEAR
MAKE
MODEL
CHASSIS SERIAL
DESCRIPTION
DOMICILED LOCATION
ACT. CODE
W.A.
UTIL BASE
REP. FAC.
MAJOR COMPONENTS
BODY
ENG-INE
TRANS
REAR AXLE
DATE IN SERVICE
PURCH. PRICE
LICENSE
LOC.
NO
OWNERSHIP

Figure A.1-18

A.1 VMRS
Table A.1-1

THE ATA CODES FOR VEHICLE MAINTENANCE

The Location Code indicates where a particular unit is based or where it makes most of its trips. Location may refer to anything a user wants it to refer to.

As many as 12 Fleet Codes may be assigned. A fleet may be defined as a group of units of the same kind (make, model, and year) purchased at the same time. It may also refer to all units assigned to serve a particular geographic area, garage, route, or managed by a certain foreman.

The Repair Site Code indicates where the repairs were performed and who performed them. Up to 12 Repair Site Codes may be assigned to describe particular garages, repair shops, or areas within the shops, such as body shop or unit change shop, where repairs are performed.

A Repair Class Code may be used to indicate the urgency of repairs. As many as 12 Repair Class Codes may be defined.

Three major Reasons-for-Repair Codes categories are used by ATA. The codes beginning with "0" and "1" refer to repairs made as part of normal unit operations; codes beginning with "2" refer to repairs made in response to management decisions; and codes beginning with "3" refer to repairs made necessary by an outside influence.

The Activity Code describes the units' primary work activity, e.g. urban, suburban, linehaul, or tripper. As many as 30 Activity Codes may be defined.

The Preventive Maintenance (PM) Code describe a program or procedure to prevent unscheduled overhaul unavailability of equipment caused by a component failure. PM procedures include inspections, tests, adjustments, replenishment of fluids and lubricants, and cleaning and replacement of filters and emission control devices. PM does not include any repairs. Specific functions to be performed under a PM procedure are specified by fleet management and the manufacturers by PM schedules (A, B, C, and D).

Fuel Codes may either be user defined or the default ATA Codes may be applied. The system will accept up to 12 different Fuel Codes. The ATA Codes are defined as follows:

1. Gasoline
2. Diesel
3. Liquid Propane Gas (LPG)
4. Liquid Natural Gas. (LNG)
5. Turbine Gas
6. Steam
7. Electric
8. Other

0 Non-applicable

The non-applicable category is for units which do not use fuel.

Table A.1-1 (continued)

The Component Codes

(0X) Air Conditioning, Cab and Instrumentation Systems
- 01 Air Conditioning, Heating and Ventilation
- 02 Cab and Sheet Metal
- 03 Instruments, Gauges, Warning Devices, Meters
- 04 Aerodynamic Devices

(1X) Chassis Systems
- 11 Axles Front - Non-Driven (Front)
- 12 Axles Front - Non-Driven (Rear)
- 13 Brakes
- 14 Frame
- 15 Steering
- 16 Suspension
- 17 Tires
- 18 Wheels
- 19 Automatic Chassis Lubricator

(2X) Drive Train System
- 21 Axles Driven - Front Steering
- 22 Axles Driven - Rear
- 22 Clutch
- 24 Drive Shaft(s)
- 25 Power Take Off
- 26 Transmission - Main - Manual
- 27 Transmission - Main - Automatic
- 28 Transmission - Auxiliary and Transfer Case
- 29 Transmission - Main - Manual (auxiliary section)

(3X) Electrical Systems
- 31 Charging
- 32 Cranking
- 33 Ignition
- 34 Lighting

(4X) Engine/Motor Systems
- 41 Air intake
- 42 Cooling
- 43 Exhaust
- 44 Fuel
- 45 Power plant
- 46 Electric propulsion

Table A.1-1 (continued)

(5x) Accessories systems
- 51 General accessories
- 52 Electrical accessories
- 53 Expendable items
- 54 Horn and mounting
- 55 Cargo Handling, Restraints, and Lifts
- 56 Radio Equipment
- 57 Spare Wheel Mounting
- 58 Winches
- 59 Vehicle Coupling

(6X) Special Applications
- 65 Hydraulic Systems

(7X) Trailer and Container Bodies and Vessel Systems
- 71 Body (Except Bulk Carrier Body)
- 72 Rear Door
- 73 Tank Vessel - Inner Shell
- 74 Tank Vessel - Outer Jacket
- 75 Manholes
- 76 Rings and Bolsters
- 77 Trailer Frame
- 78 Trim and Miscellaneous Hardware
- 79 Safety

(8X) Heating and Refrigeration Systems
- 81 Heating Unit
- 82 Refrigeration - Mechanical
- 83 Refrigeration - Nitrogen
- 84 Refrigeration - Cold Plates

(9X) Product Transfer Systems
- 91 Blower
- 92 Compressor
- 93 Engine (Auxiliary)
- 94 Lines
- 95 Manifold
- 96 Power Shaft
- 97 Pump
- 98 Valves - Regular
- 99 Safety Devices, Instruments and Gauges

Clearly, a number of these codes are not applicable to transit busses. In particular, (7X), Trailer and Container Bodies and Vessel Systems, and (9X), Product Transfer Systems must either be changed completely or be eliminated. Produce Transfer Systems using blowers, compressors and pumps are not used on buses. Components for items such as tank vessels, manholes, rings, and bolsters, trailer frame, included in (7X), Trailer and Container Bodies and Vessel Systems are also not applicable to buses. In addition, other items, such as aerodynamic devices, auxiliary transmissions, winches, cargo handling, restraints, lifts, vehicle coupling, and nitrogen refrigeration codes, are also not applicable.

A.2 COMPUTER TASK GROUP INC.

HERCULES VEHICLE MAINTENANCE REPORTING SYSTEM

1. Introduction
2. Description of the System
3. Hardware
4. References

A.2 Hercules

1. Introduction

The Hercules Vehicle Maintenance Reporting System is an automation of the ATA VMRS system described in Section A.1. It was developed by the Computer Task Group Inc. (CTG) for use on an Apple II plus personal computer. It is designed to collect, analyze, and report running costs for power units, trailers, and refrigeration units of truck fleets. With some change of screen formats it can also be used for buses. Hercules is designed to maintain life-to-date records for all vehicles and vehicle types in the fleet, including repair orders, fuel and oil purchases, and preventive maintenance information. It also analyzes this data and prepares analytical reports, including a running cost analysis. The following reports and analyses can be produced:

1. Analysis of component failures
2. Measurements of vehicle performance
3. Compilations of maintenance histories
4. Calculation of cost per mile or per hour of operation
5. Preventive maintenance schedules for up to a year into the future
6. Identification of rework problems
7. Identification of high-cost maintenance areas
8. Evaluation of vehicle life-to-date and period-to-date statistics
9. Monitoring of timely cost recovery under warranty programs
10. Monitoring license renewals and inspection deadlines
11. Identification of the most cost-effective vehicle makes or models, or engine and transmission types

A.2 Hercules

2. Description of the System

The Hercules system was designed for use on an Apple II plus microcomputer. It is menu driven. As shown is Figure A.2-1, it has the following eight options which can be called up from the main menu:

1. System Utilities Menu
2. System Set-Up Menu
3. Unit ID Menu
4. Repair Order Menu
5. Preventive Maintenance Menu
6. Fuel Oil Purchase Menu
7. Analysis Menu
8. End of Day/End of Period Menu

The System Utilities Menu activates system housekeeping tasks. The Preventive Maintenance, Unit ID, System Set-Up, and Fuel/Oil menus are used to create unit files. The Repair Orders and End of Period menus are used to create a repair order file. The Analysis Menu option is used to perform analyses and to produce output reports.

The system Set-Up Menu provides the capability to initially set-up system codes, to add, change, or delete previously defined system codes, or to print or display existing code definitions. Establishing or changing the definition of the vehicle units is done by selection from the Unit ID Menu. The possibilities include changing the description of a vehicle and changing an assigned identification number.

The Preventive Maintenance Menu is used to create a schedule of preventive maintenance (PM) for individual units or for the entire fleet. Fuel and oil purchases are recorded by selecting from the Fuel/Oil Menu. Repair orders are created, changed, or reviewed by selecting from the Repair Order Menu. The Analysis Menu permits analyses of repair orders, fuel and oil consumption, cost of component repairs, and operating costs of a variety of units by mile or hours of operation.

The Systems Utilities Menu

The System Utilities Menu activates the routine maintenance or housekeeping tasks which are necessary for proper operation of Hercules. Selecting this option will allow a user to initialize data diskettes, change system parameters, display diskette labels, restore the system in the event of information loss, or check for information loss.

When diskettes are initialized, the program will request designation of system parameters. These are characteristics of the system which can be defined to meet the requirements of a specific hardware system and a specific user. The established system parameters will be contained on Vehicle Diskettes, and all diskettes within a specific Volume will function according to the parameters included on that Vehicle Diskette.

A.2 Hercules

The System Set-Up Menu

This menu allows a user to define, change, delete, or display the codes upon which the Hercules system is based. The system will store and analyze information in terms of nine series of codes. Each of the nine codes included allows the user to designate unit maintenance and repair categories in accordance with the company's reporting requirements. Four of these codes apply to units, specifying unit location, fleet, activity, and fuel type. Four others provide details about repair orders including repair site, repair class, reason for repair, and components replaced or repaired. The last code, Preventive Maintenance, allows specification of ten different preventive maintenance schedules.

A user must define Location, Fleet and Preventive Maintenance codes, since these codes are specific to a company's operations. The remaining codes may either be assigned, or the American Trucking Association (ATA), Vehicle Maintenance Reporting Standards (VMRS) may be selected as the default. Some modification to the ATA codes are needed to use these for buses.

The Location Code indicates where a particular unit is based or where it makes most of its trips. As many as 12 Location Codes may be selected. Location may refer to anything a user wants it to refer to. In the transit environment they could e.g. be used to identify bus garages, routes, or geographical areas.

As many as 12 Fleet Codes may be assigned. A fleet may be defined as a group of units of the same kind (make, model, and year) purchased at the same time. It may also refer to all units assigned to serve a particular geographic area, garage, route, or managed by a certain foreman.

The Repair Site Code indicates where the repairs were performed and who performed them. Up to 12 Repair Site Codes may be assigned to describe particular garages, repair shops, or areas within the shops, such as body shop or unit change shop, where repairs are performed.

A Repair Class Code may be used to indicate the urgency of repairs. As many as 12 Repair Class Codes may be defined.

The system will accept up to 30 Reason-for-Repair Codes. Three major Reasons-for-Repair Codes categories are used by ATA. The ATA Reason-for-Repair Codes beginning with "0" and "1" refer to repairs made as part of normal unit operations; codes beginning with "2" refer to repairs made in response to management decisions; and codes beginning with "3" refer to repairs made necessary by an outside influence.

The Activity Code describes the units' primary work activity, e.g. urban, suburban, linehaul, or tripper. As many as 30 Activity Codes may be defined.

A.2 Hercules

The Component Code is used during the entry of repair orders to designate the part which was replaced or repaired. The system only accepts two kinds of Component Codes, "TI" and "PM". These refer to TIres and Preventive Maintenance. These Component Codes are not part of the ATA VMRS system, but have been added to allow a user to isolate preventive maintenance and tire costs for each unit.

The Preventive Maintenance (PM) Code permits a definition of up to ten different preventive Maintenance schedules numbered 0 through 9 for ten different types of units. Each of these schedules includes eight PM operations and their descriptions. The PM operation codes are defined by alphabetic characters A through H. A PM operation code may be called for by either mileage or a time interval in days, or both, which ever occurrs first. An example of this for PM Code [0] is as follows.

Operation Code	Description	Meter Interval	Day Interval
A	[OIL CHANGE]	[5000]	[ ]
B	[LUBRICATION]	[6000]	[ ]
C	[TUNE-UP]	[10000]	[180]
D	[TIRE ROTATION]	[12000]	[ ]
E	[INSPECTION]	[12000]	[ ]
F	[INSPECTION]	[24000]	[ ]
G	[INSPECTION]	[48000]	[180]
H	[REGISTRATION RENEWAL]	[ ]	[ ]

The remaining two-digit Component Codes are set up in accordance with the ATA VMRS foremat. The first number of the Component Code refers to one of ten major system categories; the second number defines specific parts within those systems.

Fuel Codes may either be user defined or the default ATA Codes may be applied. The system will accept up to 12 different Fuel Codes. The ATA Codes are defined as follows;

1. Gasoline
2. Diesel
3. Liquid Propane Gas (LPG)
4. Liquid Natural Gas. (LNG)
5. Turbine Gas
6. Steam
7. Electric
8. Other

0 Non-applicable

The non-applicable category is for units which do not use fuel.

A.2 Hercules

The Unit Identification Menu

Hercules uses three types of Unit Identification: one for Power Units, the second for Refrigeration Units, and the third for Trailers. Power Units can include trucks, tractors, buses, service vehicles, automobiles, terminal equipment, engineering and construction vehicles, and material handling equipment.

The unit identification information may be organized in forms prior to entry into the system. Copies of the forms are shown in Figures A.2-2, A.2-3, and A.2-4.

A.2 Hercules

The Repair Order Menu

The Hercules system allows selection of one of four options from the Repair Order (R.O.) Menu:

- Repair Order Entry
  For entry or adjustment of repair orders
- Repair Order Inquiry
  Review one or more already entered R.O. by period or by amount of work involved
- Update Major Repair Orders
- Repair Order Log
  Request a display or print listing of current, last period, or Major R.O.s.

The system will transfer newly entered Repair Order information to the Unit ID file, so that each Unit ID record will contain up-to-date R.O. information. However, the system will update the files only when the user returns to the Repair Order Menu.

As many as 99 Detail Lines for each Repair Order Entry may be made. The system will store up to 2400 records and will display the number used and the number remaining in the upper left hand corner of the screen. R.O. totals are accumulated for service performed inside and outside the organization.

Hercules allows either direct entry of data into the computer or manual preparation of data by shop foremen or supervisors and data entry into the computer by a clerk at some later time. The Repair Order form, shown in Figure A.2-5, is designed to help prepare all information for the second alternative. Header and Detail correspond to two separate screens for data entry.

A.2 Hercules

The Preventive Maintenance Menu

The Preventive Maintenance (PM) Menu is used to display the PM schedule for a specific Unit ID number, and to display or print a PM Planning Report for all units in the fleet. The first option, PM Schedule by Unit, is selected when one wants to know when a specific unit is due for PM, or when one wants to change the due-date for some PM event. The second option, PM Planning Report, is selected when one wants to to list all the units which are overdue for certain types of PM. This report may also be requested for power, trailer, or refrigeration units alone. The system allows designation of a "Lead Time" for PM operations. This permits display of the units for which PM will become due shortly (within the lead time specified), in addition to the ones for which PM is currently overdue. Lead Time may be specified in terms of hours of operation, mileage, or days.

A.2 Hercules

The Analysis Menu

The Analysis Menu is used when one wishes to:

- Compare Repair Order activity by Location, Fleet, Activity, Repair Class, Repair Site, Reason for Repair, or PM Code;
- Know the Fuel/Oil Consumption rates and costs for each Unit in the fleet;
- Know the Components Repaired and the cost of these Repairs by Unit; and
- Know running costs for each unit.

The Repair Order Analysis Menu may be used to compare ROs according to:

- Location Code
- Fleet Code
- Activity Code
- Reason for Repair Code
- Repair Class Code
- Repair Site Code
- Preventive Maintenance Code

The Fuel/Oil Analysis Menu can be used to compare fuel/oil consumption for selected units according to:

- Make Code
- Fleet Code
- Location Code
- Activity Code
- Meter Interval
- Engine Make
- Fuel Code
- Transmission Make
- Power Axle Make
- PM Code
- Compressor Make
- Generator Make
- Evaporator Make

A.2 Hercules

An analysis of component repair costs can be obtained from the Component Repair Cost Analysis Menu for selected units according to:

- Make Code
- Fleet Code
- Location Code
- Activity Code
- Meter Interval
- Engine Make
- Fuel Code
- Transmission Make
- Power Axle Make
- PM Code
- Compressor Make
- Generator Make
- Evaporator Make
- Brake Type

The Cost Analysis Menu is used to compare running costs for selected units in terms of:

- Miles (Hours) per Gallon of Fuel
- Fuel Cost per Mile (Hour)
- Miles (Hours) per Quart of Oil
- Oil Cost per Mile (Hour)
- Component Cost per Mile (Hour)
- PM Cost per Mile (Hour)
- Tire Cost per Mile (Hour)
- Total Cost per Mile (Hour)

Each analysis may be made for either a Period-To-Date or Life-To-Date time frame. The listing of the unit with the highest running costs is presented first.

A.2 Hercules

3. Hardware

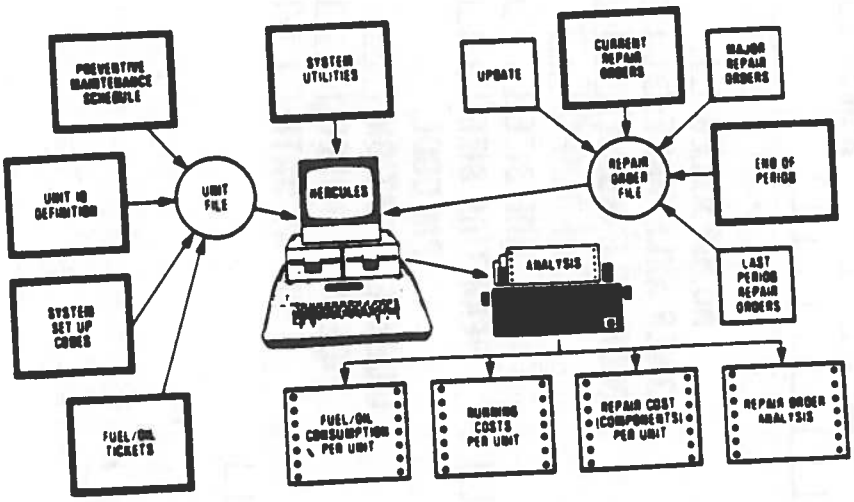
The Hercules system was designed for use on an Apple II plus computer with 64KB RAM (Random Access Memory). Two disk drives, an 80-column display, and a compatible printer completes the list of necessary hardware.

A minimum of 15 140K Byte, single sided, single density diskettes are needed to operate Hercules. Three of the diskettes are System Diskettes. The remaining 12 diskettes are use to store data and are refered to as a "Volume". A Volume is consists of four production data diskettes, each with two back up copies to insure that data is not lost. Data are divided amongst the four diskettes as follows: The "Vehicle Data Diskette" stores information about each vehicle in the fleet. The "Current R.O. Data Diskette" store the current repair orders. Data for the last period will be stored on the "Last Period R.O. Diskette". Any repair order considered to be major will be stored on the "Major R.O. Diskette".

The 12 data diskettes of a volume will contain space for approximately 130 vehicles, 2500 repair order records, and 250 fuel or oil entries. More vehicles may be added by adding additional Volumes. Separate Volumes could e.g. be created for vehicles of each type, or for vehicles assigned to one garage. However, Hercules treats the information stored on one Volume as totally separate from the information stored on another one, and will only prepare reports for individual Volumes. It will not process reports by consolidating the information from multiple Volumes.

4. References

A.2-1 HERCULES Vehicle Maintenance Reporting System User's Guide, Computer Task Group Inc., 1982.



Hercules Vehicle Maintenance Reporting System

Figure A.2-1

HERCULES

Vehicle Maintenance Reporting System

UNIT IDENTIFICATION DEFINITION

POWER UNIT

*ID #:_____ *P/T/R: P *YEAR: ____ MAKE:_____ MODEL:_____

SERIAL#/DESCRIPTION:_____

*FLEET CODE: _

*LOCATION CODE: _

*ACTIVITY CODE: __

*OWN/LEASE (O/L): _

CAPACITY: _____

*DATE IN SERVICE: __/__/__

*NEW/USED (N/U): _

*METER @ VMRS ENTRY: _____

*HOUR OR MILE METER (H/M): _

ENGINE MAKE: _____

ENGINE MODEL: _____

*FUEL CODE: _

TRANSMISSION MAKE: _____

TRANSMISSION MODEL: _____

NO. OF AXLES: _

POWER AXLE MAKE: _____

POWER AXLE MODEL: _____

NO. OF TIRES: __

FRONT TIRE SIZE: _____

REAR TIRE SIZE: _____

*PM CODE: _

LICENSE LOCATION: __

LICENSE NUMBER: _____

*ENTRY DATE: __/__/__

*required fields

Entered by: _____

Figure A.2-2

HERCULES Vehicle Maintenance Reporting System

UNIT IDENTIFICATION DEFINITION

REFRIGERATION UNIT

*ID #:[ ][ ][ ][ ][ ] *P/T/R: [R] *YEAR: [ ][ ] MAKE:[ ][ ][ ][ ] MODEL:[ ][ ][ ][ ][ ][ ][ ]

SERIAL#/DESCRIPTION: [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

*FLEET CODE: [ ]
*LOCATION CODE: [ ]
*ACTIVITY CODE: [ ][ ]
*OWN/LEASE (O/L): [ ]
*DATE IN SERVICE: [ ][ ]/[ ][ ]/[ ][ ]
*NEW/USED (N/U): [ ]
*METER @ VMRS ENTRY: [ ][ ][ ][ ][ ]
*HR OR MILE METER (H/M): [ ]
ENGINE MAKE: [ ][ ][ ][ ][ ]
ENGINE MODEL: [ ][ ][ ][ ][ ][ ][ ]
*FUEL CODE: [ ]

STANDBY MOTOR MAKE: [ ][ ][ ][ ][ ]
STANDBY MOTOR MODEL: [ ][ ][ ][ ][ ][ ][ ]
COMPRESSOR MAKE: [ ][ ][ ][ ][ ]
COMPRESSOR MODEL: [ ][ ][ ][ ][ ][ ][ ]
GENERATOR MAKE: [ ][ ][ ][ ][ ]
GENERATOR MODEL: [ ][ ][ ][ ][ ][ ][ ]
EVAPORATOR MAKE: [ ][ ][ ][ ][ ]
EVAPORATOR MODEL: [ ][ ][ ][ ][ ][ ][ ]
*PM CODE: [ ]
*ENTRY DATE: [ ][ ]/[ ][ ]/[ ][ ]

*required fields

Entered by: _____

Figure A.2-3

HERCULES Vehicle Maintenance Reporting System

UNIT IDENTIFICATION DEFINITION

TRAILER

*ID #:[ ][ ][ ][ ][ ] *P/T/R: [T] *YEAR: [ ][ ] MAKE: [ ][ ][ ][ ] MODEL: [ ][ ][ ][ ][ ][ ][ ]

SERIAL#/DESCRIPTION: [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

*FLEET CODE: [ ]
*LOCATION CODE: [ ]
*ACTIVITY CODE: [ ][ ]
*OWN/LEASE (O/L): [ ]
*DATE IN SERVICE: [ ][ ]/[ ][ ]/[ ][ ]
*NEW/USED (N/U): [ ]
*METER @ VMRS ENTRY: [ ][ ][ ][ ][ ][ ]
*HR OR MILE METER (H/M): [ ]
BODY MATERIAL: [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]
OUTSIDE DIMENSIONS: LENGTH: [ ][ ].[ ][ ]
WIDTH: [ ][ ].[ ][ ]
HEIGHT: [ ][ ].[ ][ ]

INSULATED (Y/N): [ ]
LINED (Y/N): [ ]
HEATED (Y/N): [ ]
REFRIGERATED (Y/N): [ ]
PIGGYBACK EQUIPPED (Y/N): [ ]
NO. OF AXLES: [ ]
AXLE CAPACITY: [ ][ ][ ][ ][ ]
NO. OF TIRES: [ ][ ]
TIRE SIZE: [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]
BRAKE TYPE: [ ][ ][ ][ ][ ]
LICENSE LOCATION: [ ][ ]
LICENSE NUMBER: [ ][ ][ ][ ][ ][ ][ ][ ]
*PM CODE: [ ]
*ENTRY DATE: [ ][ ]/[ ][ ]/[ ][ ]

*required fields

Entered by: _____

Figure A.2-4

HERCULES

Vehicle Maintenance Reporting System

REPAIR ORDER

HEADER

*REP. ORDER #: ⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋ *REP. DATE: ⌊_⌋⌊_⌋/⌊_⌋⌊_⌋/⌊_⌋⌊_⌋ LOCATION: ⌊_⌋

*UNIT ID #: ⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋

*METER READING: ⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋

*METER RESET/REPLACEMENT (Y/N): ⌊_⌋ (if yes, enter →)

ACTIVITY CODE: ⌊_⌋⌊_⌋

REASON FOR REPAIR: ⌊_⌋⌊_⌋

REPAIR CLASS: ⌊_⌋

REPAIR SITE: ⌊_⌋

MAJOR REPAIR (Y/N): ⌊_⌋

PM PERFORMED (Y/N): ⌊_⌋ (if yes, enter →)

ESTIMATED L-T-D READING: ⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋

PM OPERATION: ⌊_⌋

PM OPERATION: ⌊_⌋

PM OPERATION: ⌊_⌋

PM OPERATION: ⌊_⌋

DETAIL

LINE NO.	COMPONENT CODE	SERVICE *TYPE (I/O)			
01	⌊_⌋⌊_⌋	⌊_⌋			TOTAL $: ⌊±⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋.⌊_⌋⌊_⌋
	PARTS:				TOTAL $: ⌊±⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋.⌊_⌋⌊_⌋
	LABOR:	HOURS: ⌊±⌋⌊_⌋⌊_⌋⌊_⌋.⌊_⌋		RATE: ⌊_⌋⌊_⌋.⌊_⌋⌊_⌋⌊_⌋⌊_⌋	TOTAL $: ⌊±⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋.⌊_⌋⌊_⌋
	OTHER:				
02	⌊_⌋⌊_⌋	⌊_⌋			TOTAL $: ⌊±⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋.⌊_⌋⌊_⌋
	PARTS:				TOTAL $: ⌊±⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋.⌊_⌋⌊_⌋
	LABOR:	HOURS: ⌊±⌋⌊_⌋⌊_⌋⌊_⌋.⌊_⌋		RATE: ⌊_⌋⌊_⌋.⌊_⌋⌊_⌋⌊_⌋⌊_⌋	TOTAL $: ⌊±⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋.⌊_⌋⌊_⌋
	OTHER:				
03	⌊_⌋⌊_⌋	⌊_⌋			TOTAL $: ⌊±⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋.⌊_⌋⌊_⌋
	PARTS:				TOTAL $: ⌊±⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋.⌊_⌋⌊_⌋
	LABOR:	HOURS: ⌊±⌋⌊_⌋⌊_⌋⌊_⌋.⌊_⌋		RATE: ⌊_⌋⌊_⌋.⌊_⌋⌊_⌋⌊_⌋⌊_⌋	TOTAL $: ⌊±⌋⌊_⌋⌊_⌋⌊_⌋⌊_⌋.⌊_⌋⌊_⌋
	OTHER:				

*required fields

Entered by: _____

Figure A.2-5

A.3 DDS, INCORPORATED
FLEET MAINTENANCE SYSTEM

1. Introduction
2. Desccription of the System
   - 2.1 Work Orders
   - 2.2 Management Reports
3. Hardware
4. References

A.3 Fleet Maintenance System

1. Introduction

The Fleet Maintenance System (FMS) was developed by DDS, Incorporated in cooperation with the San Diego Transit Corporation. Approximately one year was spent in the design, testing, and refinement of the system. Although FMS was designed in conjunction with a specific transit authority, the concept is applicable to any maintenance facility in any industry. The system is generic since the units to be maintained are defined by the individual user, and can be used with any type of vehicle, any type of equipment, any type of building, or any other item requiring periodic maintenance, service, or inspection.

The DDS Fleet Maintenance System (FMS) automates all fleet maintenance records and vehicle history information, and automatically issues timely instructions for all necessary maintenance activities. The system also generates a variety of management reports, and provides daily reports on all activities concerned with fleet maintenance. The objective of FMS is to improve planning, reduce downtime, optimize manpower, and increase vehicle life. It maintains a history of each vehicle in the fleet according to predefined maintenance activities, produces repair orders, and management reports. The Repair Orders detail not only what is to be done to a vehicle, but the procedures for each maintenance item. Preventive maintenance schedules are entered into the system and repair orders are printed when associated time or mileage limits are reached. Daily fueling and mileage data are entered via communications data entry or media processing. This assures timeliness of the information contained in the system and of any recommendations issued by it. The system also generates a variety of management reports, and provides accurate daily reports on all activities concerned with fleet maintenance. These reports include the following:

- Vehicle Inventory and Status,
- Maintenance Activity Dictionary,
- Repair Order Statistics,
- Consumables Reports,
- Road Call Reports, and
- Inspection Reports.

A.3 Fleet Maintenance System

2. Description of the System

To use the system, a description of the units to be maintained by group or series must first be entered. A complete series description is needed to differentiate one series from another and to clearly define the unique characteristics of each. Basic data is entered for each vehicle, including vehicle numbers, serial number identification, current mileage, and any other relevant data needed to construct a complete file. Component information on each vehicle is input separately, and this history is readily available.

The second step in the use of FMS is building a dictionary of all maintenance activities required by the user. Such activities will likely include regular maintenance on the engine, transmission, brakes, and all other components and assemblies. Each maintenance activity is assigned a four digit identifier number, and the entire maintenance function is defined in detail. Standard Maintenance Procedures (SMP) can also be defined.

The third step is to combine the individual vehicle history data with the dictionary of specified maintenance activities, and developing recommendations for a preventive maintenance (PM) schedule for each vehicle.

The fourth and last step is to enter the most recent inspection history. The system data base will then include the complete vehicle history, the dictionary of specific activities to be performed on the vehicle, and the current vehicle condition. FMS then automatically takes over the responsibility of maintenance administration and record keeping.

Current mileage for each vehicle is entered as the vehicle is fueled. PM Work Orders (WO) dependent on time or mileage are created automatically according to the PM schedule. In addition to the PM Work Orders, the system maintains a file of work orders for road calls, accidents, requests by foreman, unit or component rebuilds, and service. These work orders can be created and retrieved at any time by the foreman or other authorized personnel. Each WO contains a clearly stated and fully explained Specific and Standard Maintenance Procedure and all information needed by a mechanic to perform the work. When the work has been completed, signed off and closed out, the vehicle history is updated automatically.

FMS provides numerous management reports which enable maintenance managers to monitor operations of the maintenance facility on a daily, monthly or annual basis and to obtain information at any time as required. Up-to-date information makes it possible to analyze trends on a daily basis and to identify potential problems. Parameters for the operation of each series of vehicles are established according to the manufacturer's specifications, or modified by the experience of the maintenance manager. Format and content of the reports may be modified to suit the the needs of the user.

A.3 Fleet Maintenance System

2.1 Work Orders

Work Orders and Action Orders are identical and are herein used interchangeably.

PM Action Order

PM Work Orders are automatically generated from daily odometer readings input when vehicles are fueled. The system examines the vehicle history and current mileage, and then searches the PM recommendations and identifies the maintenance activities needed. It then prints the required PM Work Order. An example is shown in Fig. A.3-1. The WO's are used to schedule the vehicles for inspection and are given to the inspection foreman and crew so that they can follow the detailed procedures printed. When the inspection is completed, the work order is signed, closed, and entered into FMS. This closing automatically updates the vehicle history as well as other areas of the system such as the Forecasting Module and State Safety Inspection Requirements.

Road Call Action Orders

Road Call Work Orders are printed as required when a vehicle is inoperative off the property. This Work Order contains all pertinent information regarding the time the vehicle broke down, the location, the route number, and the defect, if known. An example of a Road Call Action Order is shown in Figure A.3-2. It may be reformatted to conform to specific requirements. The Road Call Work Order is issued to a mechanic, who completes it after responding to the road call. The mechanic's entry closes the Work Order, and the historical information is automatically updated. Road call information is compiled in the Monthly Road Call Report, which highlightes units with a history of excessive breakdowns.

Accident Action Orders

Accident Work Orders are used to estimate repairs for damaged vehicles, including parts and labor. Figure A.3-3 shows an example of an Accident Action Order. This work order is the primary tool needed to identify corrective action, and aids in determining steps required for body work, and paint and glass repair. A schematic of the damaged vehicle is included with the work order to assist the Claims Department in identifying the precise damage and determining appropriate insurance claims actions. Accident Work Orders are treated differently from other work orders. They are, however, closed out in the same manner as other work orders.

A.3 Fleet Maintenance System

Foreman Request Action Orders

The Foreman's Request Work Orders are generated by the maintenance foreman, as required, to perform on the spot repairs. See Figure A.3-4 for an example. At the time the request is made, the PM Schedule is also checked. If the vehicle is within some preestablished time or percentage limit of some PM task, that task will be included in the work order. The limits used to may be freely selected by the user. This feature encourages consolidation of maintenance activities, possibly reducing vehicle down time. When a work order is completed and closed, the history file is automatically updated.

Unit Rebuild Action Order

The Unit Rebuild Work Order shown in Figure A.3-5 is generated when an enigne, transmission or other major component is to be rebuilt either in the authorities' general repair shop or by an outside vendor. A component history is maintained by the system. it includes identification of the vehicles the component was installed in, the dates of rebuilds, the identity of the person or unit rebuilding the item, and other related information. Components are tracked by serial number. When the Unit Rebuild Work order is closed, the component history is updated along with the vehicle assignment or shelf status.

Service Action Order

The Service Work Order shown in Figure A.3-6 is used for routine servicing and non-maintenance related functions on vehicles, equipment, or buildings. Any number of units may be requested and is keyed to a specific maintenance activity number. The Service Work Order, in many situations, provides the flexibility to track other items extraneous to the primary maintenance facility.

2.3 Management Reports

Vehicle Inventory and Status Report

The Vehicle Inventory and Status Report, including the associated summary, provides a complete inventory of all revenue and non-revenue vehicles by series and vehicle numbers. An example of this report is shown in Figure A.3-7. It includes all historical data pertaining to the vehicles, plus a current status code and two lines of comments. This report is printed as required.

Activity Dictionary Report

The Activity Dictionary Report is a complete list of every maintenance activity performed by the maintenance facility. Figure A.3-8 shows an example of this report. It includes a description of the maintenance activity, reference to the appropriate Standard Maintenance Procedure and other comments. It is intended to be a reference document for the foreman and can be used to determine labor and facility needs and also training requirements. This report is printed on request. The Activity Dictionary validates all maintenance entries or requests.

Series PM Recommendations Report

The Series PM Recommendation Report is used to develop a PM schedule for each series of vehicle. Figure A.3-9 shows an example of this report which is printed when required. It identifies time and mileage related maintenance recommendations for each series of vehicles. Recommendations may be altered to accurately reflect intervals for replacement of critical components. It is recommended that this report is reviewed at least quarterly.

Daily Exceptions Report

The Consumables Daily Exception Report, an example of which is shown in Figure A.3-10, provides information on fuel, oil, automatic transmission fluid (ATF), and coolant usage levels that fall above or below the allowed variances. Standard variances are provided by FMS, but may be changed by the user to conform to his own experience. This report is designed to identify the vehicles with potential problems or inaccurate input data. The system requires that actions are taken or corrections made before permanant files are updated. This exception reporting allows detection of major problems and assures accuracy and integrity of the consumables information files.

A.3 Fleet Maintenance System

Consumables Month to Date Report

The Consumables Month to Date report provides complete information on consumption of fuel, oil, automatic transmission fluid and coolant, summarized by series and vehicle. An example of this report is shown in Figure A.3-11. Established limits or variances for each series make it easy to detect potential problems, and to analyze fleet operations by series. Since these consumables constitute a large portion of the total operating budget, detailed reporting could assist in effective cost control. This report can be printed on request or monthly.

Consumables Year to Date Report

The Consumables Year to Date Report summarizes all consumables usage by accounting periods. See Figure A.3-12 for details. It provides an overview of active vehicle miles, totals usage of fuel and other consumables, and determines averages on an annual basis. A percentage of variance is also reported, which provides a basis for establishing variance levels for daily and monthly reports. This information can be used to plan annual budgets.

Not-Probed Report

The daily Not-Probed Report, and example of which is shown in Figure A.3-13, indicates active vehicles that were not signed off as having the fare box cleared. It enables management to closely monitor the daily revenue function. It also includes the last five fuelings and mileages to assist in determining vehicle status.

Monthly Road Call Report

The Road Call report details all road call activity for the entire fleet. It can be printed weekly or monthly, by vehicle number, by defect, and by operator number. Also included in this report is a summary by vehicle series. This report includes mileage per vehicle between chargeable road calls. Trends can easily be established for vehicle downtimes, and individual operators can also be monitored. The report, shown in Figure A.3-14, accumulates total time lost, lists individuals dispatched and gives applicable work order numbers.

Oil Analysis Report

The Oil Analysis Report is designed for users utilizing this method of decreasing oil usage and detecting potential problems. The information required for this report may be entered into FMS automatically via communications lines with an oil analysis lab. All critical test areas are included in this report, an example of which is shown in Figure A.3-15. Trend analyses of accumulated data and recommendations for corrective actions are also included.

A.3 Fleet Maintenance System

C.H.P. Inspection Report

The California Highway Patrol report is used for transit authorities in California. Figure A.3-16 presents an example of this report which is printed on request. It satisfies all safety record requirements for Section 13, of the California Administrative Code. This report can, however, be modified to satisfy any agency or state safety inspection requirement. When an inspection report is requested, the selected vehicle numbers are entered and their maintenance history is printed, including all work orders, dates, mileages, and inspections performed.

Component History Report

The Component History report, an example of which was not available at this time, provides detailed information on component history. It includes all rebuilt components, component life, vehicle assignment, and warranty reporting. Each component is tracked as a separate item, providing its own historical reference. Replacement intervals can be changed according to the experience of the transit authority, and full reporting to the manufacturers is available for warranty items. Trend Analysis can be made, as well as assessments of rebuild shops and personnel involved in rebuilding components.

A.3 Fleet Maintenance System

3. Hardware

The Fleet Maintenance System is a microcomputer based system which operates on a 8m Hz 68000 microprocessor (i.e., a 32 bit processor). Multiple 16 bit peripherals and special function I/O processors provide support in the multi-user and multi-tasking environment.

One megaByte of virtual memory hardware operates at 120 ns. per board, supporting the processor with fully pipelined memory access through a high speed memory address translating unit. All memory accesses are fully overlapped, providing high speed access to the entire 16 megaByte address space per users with no memory map overhead.

Winchester disk and diskette support allows for flexibility in configuration and up to 300 megaBytes of on-line storage.

Microprocessor controlled communications are also available to allow communications with IBM mainframes, other hosts, regulated packet switching companies (Tymnet, Telenet, etc.) and other mini and microcomputers under a variety of protocols.

Printers are supported through the serial board which provides for eight serial (RS232C) ports and two Centronics compatible parallel interface ports per board.

The FMS operating system is an enhanced version of UNIX with an extensive set of utilities. It provides virtual 16 megaByte 68000 processing capability. In addition, it provides for efficient handling of interrupts through the I/O processor, and multi-user support.

4. References

A.3-1 Fleet Maintenance System Profile, DDS Inc., 1983.

A.3-2 Unpublished notes and memoranda, DDS Inc., 1983.

0303 12-11132

VEHICLE # 0303 LOCATION SAN DIEGO TRANSIT CORPORATION TIME 01:05 PM
DIVISION 1 SERIES # 03## PM ACTION ORDER OPEN 01/18/83 PAGE 1
CURRENT MILEAGE 960,000 INITIATED BY: FMS
LAST ACTION 12-11132 01/18/83 (OPEN)

ACTIVITY	DESCRIPTION	USE PART NBR.	COMMENTS	LAST A/O INFO.	MECH. #'S
1040.0000	'A' INSPECTION		REFER TO SMP # I/A-1	12/10/82	
1030.0000	'B' INSPECTION		REFER TO SMP # I/A-1		
1020.0000	'C' INSPECTION				
1010.0000	'D' INSPECTION				
2220.0000	AIR COMPRESSOR - BENDIX, R & R				
2229.0000	AIR GOVERNOR VALVE, R & R				
3099.0000	ENGINE, TUNE-UP		REFER TO SMP # R/B-1		
3105.0000	BLOWER, R & R				
3215.0000	WATER PUMP, R & R				
3225.0000	FAN DRIVE, R & R				
3235.0000	RADIATOR, R & R				
3408.0000	EXHAUST SYSTEM - MUFFLER ONLY R & R				
4020.0000	TRANSMISSION OIL COOLER, R & R				
6332.0000	A/C - ALTERNATOR AND BELT, R & R				
6393.0000	HEATING - VENTILATION MOTOR, REPAIR/REPLACE				
6397.0000	DIVERSION PUMP, R & R				
6905.0000	BATTERIES - R & R, CLEAN TRAY				

THE ABOVE WORK HAS BEEN COMPLETED AND INSPECTED BY:

FOREMAN'S SIGNATURE _____

FOREMAN'S BADGE NUMBER _____ DATE _____

PM Action Order

Figure A.3-1

0202 11-11127

VEHICLE # 0202 SAN DIEGO TRANSIT CORPORATION TIME 06:30 AM
DIVISION 1 SERIES # 0200 ROAD CALL ACTION ORDER OPEN 01/18/83 PAGE 1
INITIATED BY: 370080

LAST ACTION 11-11126 01/18/83 (OPEN)

ACTIVITY	DESCRIPTION	LAST A/O INFO.

0101. ROAD CALL ODOMETER _____

VEHICLE WILL BE AT:

LOCATION _____

TIME LEFT _____ ___AM ___PM INBOUND _____ OUTBOUND _____

TROUBLE REPORTED:

---- BRAKES
---- ENGINE
---- TRANSMISSION
---- STEERING
---- TIRES/SUSP./LUGS
---- ENGINE COOLANT
---- ELECTRICAL
---- LIGHTS
---- DESTINATION SIGNS
---- OUT OF FUEL
---- BODY/WINDOWS/DOORS
---- HEATER/DEFROSTER/A.C.
---- WHEELCHAIR LIFT
---- RADIO/ALARMS
---- FARE BOX
---- BIKE RACK
---- VANDALISM
---- UNSANITARY
---- ACCIDENT

TRAIN _____ ROUTE _____

SCHEDULED TIME LOST THIS FAILURE _____

OPERATOR'S SIGNATURE _____

OPERATOR'S BADGE NUMBER _____

COMMENTS:

MECHANIC REPORT

NBR. OF VEHICLE TAKEN ON CALL _____

SERVICE TRUCK _____ TIME LEFT _____
LOT DISPATCHER STAMP

TIME ARRIVED AT VEHICLE _____
REPAIRS MADE _____

VEHICLE CHANGE _____

VEHICLE TOWED _____ TIME RETURNED _____
LOT DISPATCHER STAMP

SERVICE COMPLETED _____

DEFECTS FOUND / REPAIRS MADE

PROPER'S SIGNATURE _____

PROPER'S BADGE NUMBER _____

MECHANIC'S SIGNATURES _____/_____
_____/_____

MECHANIC'S BADGE NUMBERS _____/_____/_____/_____

THE ABOVE WORK HAS BEEN COMPLETED AND INSPECTED BY:

FOREMAN'S SIGNATURE _____

FOREMAN'S BADGE NUMBER _____ DATE _____

Road Call Action Order

Figure A.3-2

0202

VEHICLE # 0202 LOCATION _____ SAN DIEGO TRANSIT CORPORATION 13-11128
DIVISION 1 SERIES # 0200 ACCIDENT ACTION ORDER TIME 06:32 AM
CURRENT MILEAGE 960,000 OPEN 01/18/83 PAGE 1
LAST ACTION 11-11127 01/18/83 (OPEN) INITIATED BY: 370080

0200 SERIES 1990 GENERAL MOTORS T&CD USA MODEL - TDH5301 51 PASSENGER
40' X 102 /VIN YC 1690/ENGINE DDA 6V71/TRANSMISSION DDA VH/AXLE RATIO 4.7143:1/6 FIRESTONE TIRES
SIZE 8.25 X 22.5/2 DELCO REMY 6 D BATTERIES/300 AMP DELCOTRON MODEL D50 GENERATOR/DELCO REMY MODEL
MT300 STARTER/PASSENGER SEATS-AMERICAN 6426/DOUBLEDENSITY LAMINATED GLASS/ROLLER TYPE DESTINATION
SIGNS.

LICENSE:

ACTIVITY	DESCRIPTION OF REPAIRS	LABOR/HOURS	PARTS
7001.00000	ACCIDENT		
.7054	PANEL - INTERMEDIATE RT. SIDE INCL. POST, R&R		
.7061	PANEL-SKIRT, RIGHT SIDE, R & R		
.7195	EXTERIOR TRIM-BODY MOULDING RIGHT, R&R		
.7611	PAINT COACH EXT.-RT. SIDE, ONLY		
	TOTAL		

The above is an ESTIMATE, based on our inspection, and DOES NOT Cover additional Parts or Labor which may be required after the work has been opened up. Occasionally, after work has started, worn, broken, or damaged parts are discovered which are not evident on first inspection. Quotations on parts and labor are current and subject to change.

LABOR	$		
PARTS	$		
LOSS OF USE	$		
	$		
	$		
TOTAL	$		

ESTIMATED BY: _____

DATE _____ BADGE NUMBER _____

Accident Action Order

Figure A.3-3

0202 15-11130

VEHICLE # 0202 LOCATION _____ SAN DIEGO TRANSIT CORPORATION TIME 06:33 AM
DIVISION 1 SERIES # 0200 FOREMAN REQUEST ACTION ORDER OPEN 01/18/83 PAGE 1
CURRENT MILEAGE 960,000 INITIATED BY: 370080
LAST ACTION 13-11126 01/18/83 (OPEN)

ACTIVITY	DESCRIPTION	USE PART NBR.	COMMENTS	LAST A/O INFO.	MECH. #'S
2035.00000	BRAKE RELINE, DRIVE AXLE		REFER TO SMP # R/R-1		
.2973	CK SLACK ADJUSTERS				
.2974	REPLACE CAM BUSHINGS				
.2976	CK BRAKE DIAPHRAGM				
.2977	CK BRAKE AIR LINES				
.2990	ADJ AND SET-UP AIR SYSTEM PER SEC.				
.2991	CK AND ADJUST BRAKES				
.5967	CK BELLOWS AND MOUNTINGS				
5314.00000	FRONT AXLE - ALIGNMENT				
7012.00000	BULKHEAD - STEPWELL, REPAIR				

THE ABOVE WORK HAS BEEN COMPLETED AND INSPECTED BY:

FOREMAN'S SIGNATURE _____

FOREMAN'S BADGE NUMBER _____ DATE _____

Foreman Request Action Orders

Figure A.3-4

6049

DIVISION 1

SAN DIEGO TRANSIT CORPORATION
UNIT REBUILD ACTION ORDER

14-11129

TIME 06:33 AM
OPEN 01/18/83
INITIATED BY: 370080

PAGE 1

ACTIVITY	DESCRIPTION	USE PART NBR.	COMMENTS	RECM. 6'S
6049.0000	STARTER - R & R			
	QUANTITY: 25			

THE ABOVE WORK HAS BEEN COMPLETED AND INSPECTED BY:

FOREMAN'S SIGNATURE _____

FOREMAN'S BADGE NUMBER _____ DATE _____

Figure A.3-5

2973 — 14-111131

DIVISION 1

SAN DIEGO TRANSIT CORPORATION
SERVICE ACTION ORDER

TIME 06:34 AM
OPEN 01/18/83 — PAGE 1
INITIATED BY: 370080

ACTIVITY	DESCRIPTION	USE PART NBR.	COMMENTS	RECM. #'s
2973.0000	CK BLACK ADJUSTERS			
	QUANTITY: 25			

THE ABOVE WORK HAS BEEN COMPLETED AND INSPECTED BY:

FOREMAN'S SIGNATURE _____

FOREMAN'S BADGE NUMBER _____ DATE _____

Service Action Order

Figure A.3-6

SAN DIEGO TRANSIT CORPORATION

VEHICLE INVENTORY and STATUS REPORT

100x SERIES 1978 R.A.H. ARTICULATED MODEL - 10[illegible] 49 PASSENGER
VIN [illegible]/ENGINE R.A.H. D[illegible]TURN/TRANSMISSION RENK BORGMAT 8/64/AXLE RATIO 5.2[illegible]1/8 GOODYEAR TIRES SIZE 12.0 X 20-0/1 DELCO REMY 8 D BATTERY AND 2 DELCO REMY DN 50 GENERATOR 24 V LEECE-NEVILLE ALTERNATOR FOR AC/24V BOSCH STARTER/TYPE G TRANE AIR CONDITIONING, COMPRESSOR/POWER ASSIST STEERING/ PASSENGER SEATS-AMERICAN 64617/DRIVER SEAT-NATIONAL 72-47/LAMINATED TINTED WINDOW GLASS/FIXED WINDOWS TRANSIGN ELECTRONIC DESTINATION SIGNS AND ROUTE DESIGNATORS

VEHICLE NUMBER	VEHICLE ID NO.	LICENSE NUMBER	PURCHASE PRICE	DATE RECEIVED	IN SERVICE DATE	MILEAGE RECV'D	ENGINE SERIAL #	TRANS. SERIAL #	CURRENT MILEAGE	STATUS CODE	COMMENTS
1001	[illegible]	E72[illegible]	178[illegible]	03/11/79	04/01/79	005236	3178 [illegible]		0133134	A	
1002	[illegible]	E71[illegible]	178000	09/22/78	11/01/78	003448	3179 [illegible]		0110319	A	
1003	[illegible]	E71[illegible]	178[illegible]	09/22/78	11/01/78	[illegible]3698	3179 [illegible]		0133884	A	
1004	[illegible]	E71[illegible]	178000	09/22/78	04/01/79	003610	3179 [illegible]		0134895	A	
1005	[illegible]	E71[illegible]	178[illegible]	09/22/78	04/01/79	[illegible]3581	3180 [illegible]		0133777	A	
1006	[illegible]	E71[illegible]	178000	09/22/78	01/01/79	[illegible]3[illegible]	3180 [illegible]		[illegible]8437	A	
1007	[illegible]	E72[illegible]	178[illegible]	09/26/78	11/01/78	[illegible]3589	3181 [illegible]		0119984	A	
1008	[illegible]	E71[illegible]	178[illegible]	[illegible]/78	01/01/79	003491	3181 [illegible]		0134411	A	
1009	[illegible]	E71[illegible]	178[illegible]	[illegible]/78	04/01/79	[illegible]3578	3181 [illegible]		0139329	A	
1010	[illegible]	E71[illegible]	178[illegible]	[illegible]/78	01/01/79	003538	3182 [illegible]		0133210	A	
1011	[illegible]	E71[illegible]	178[illegible]	[illegible]/78	01/01/79	[illegible]3[illegible]	3182 [illegible]		[illegible]2[illegible]	A	

SAN DIEGO TRANSIT CORPORATION
VEHICLE INVENTORY and STATUS REPORT

STATUS TOTALS

SERIES NUMBER	ACTIVE	DAMAGED	LEASED	PARKED	SOLD	TOTAL on HAND
2[illegible]	[illegible]	[illegible]	[illegible]	42	[illegible]	42
[illegible]	31	1	[illegible]	[illegible]	[illegible]	[illegible]
4[illegible]	4[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4[illegible]
5[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5[illegible]
7[illegible]	24	1	[illegible]	[illegible]	[illegible]	2[illegible]
8[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8[illegible]
1[illegible]	4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SUBTOTALS	2[illegible]	4	[illegible]	[illegible]	[illegible]	[illegible]
0[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
93[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9[illegible]	6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
99[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
99[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
99[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
99[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
99[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SUBTOTALS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TOTALS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Figure A.3-7

01/18/03 SAN DIEGO TRANSIT CORPORATION PAGE 4

MD020 ACTIVITY DICTIONARY (ROSINI)

ACT. CARD	ACTIVITY NUMBER	DESCRIPTION
	2000	MECHANICAL SECTION - BRAKE SYSTEM
	2001	BRAKE DEFECT
	2002	BRAKES - VANDALISM
	2003	BRAKE LATHE/KIT FABRICATION
	2011	BRAKE RELINE, FRONT AXLE
	2012	BRAKE RELINE - RT FRONT AXLE
	2013	BRAKE RELINE - LF FRONT AXLE
	2030	BRAKE RELINE, DRIVE AXLE
	2036	BRAKE RELINE - RT DRIVE AXLE
	2037	BRAKE RELINE - LT DRIVE AXLE
	2040	BRAKE RELINE - TRAILER AXLE
	2041	BRAKE RELINE - RT TRAILER AXLE
	2042	BRAKE RELINE - LT TRAILER AXLE
	2045	EMERGENCY BRAKE RELINE
	2046	EMERGENCY BRAKE RELINE, INCL. DRUM R & R
	2111	BRAKE SPIDER, RF, R & R
	2112	BRAKE SPIDER, RF, REPAIR
	2121	BRAKE SPIDER, LF, R & R
	2122	BRAKE SPIDER, LF, REPAIR
	2131	BRAKE SPIDER, R - DRIVE, R & R
	2132	BRAKE SPIDER, R - DRIVE, REPAIR
	2141	BRAKE SPIDER, L - DRIVE, R & R
	2142	BRAKE SPIDER, L - DRIVE, REPAIR
	2151	BRAKE SPIDER, R - TRAILER, R & R
	2152	BRAKE SPIDER, R - TRAILER, REPAIR
	2161	BRAKE SPIDER, L - TRAILER, R & R
	2162	BRAKE SPIDER, L - TRAILER, REPAIR
	2170	SLACK ADJUSTERS - O/H
	2171	SLACK ADJUSTER - RF, R & R
	2172	SLACK ADJUSTER - LF, R & R
	2173	SLACK ADJUSTER - R - DRIVE, R & R
	2174	SLACK ADJUSTER - L - DRIVE, R & R
	2175	SLACK ADJUSTER - R - TRAILER, R & R
	2176	SLACK ADJUSTER - L - TRAILER, R & R
	2201	AIR SYSTEM DEFECT
	2210	AIR EQUIPMENT - O/H
	2211	AIR SYSTEM MINOR B.O. REPAIR
	2220	AIR COMPRESSOR - BENDIX, R & R
	2221	AIR COMPRESSOR - BENDIX, O/H
	2229	AIR GOVERNOR VALVE, R & R
	2231	PRESSURE PROTECTION VALVE - R&R
	2233	EMERGENCY RELEASE VALVE - R&R
	2235	TANK CONTROL VALVE - R&R
	2237	SYNCHRO VALVE/CHECK VALVE - R&R
	2239	INVERSION VALVE - R&R
	2241	BRAKE APPLICATION VALVE - R&R
	2243	MOISTURE EJECTOR VALVE - R&R
	2245	SAFETY VALVE, R & R
	2247	LOW AIR PRESSURE SWITCH, R & R
	2248	TREADLE VALVE, R & R
	2250	BRAKE DIAPHRAGMS - COMPLETE, R & R
	2251	BRAKE DIAPHRAGMS, RF, R & R

Activity Dictionary

Figure A.3-8

01/18/83 SAN DIEGO TRANSIT CORPORATION PAGE 1

MB021 SERIES PM RECOMMENDATIONS (RG36R1)

PRIMARY ACTIVITY	SECONDARY ACTIVITY	DESCRIPTION	MILEAGE	DAYS	% TO RECOMMEND	PART NBR.	COMMENT(S)
SERIES = 0200							
0100		OFF PROPERTY SERVICE					
0101		ROAD CALL					
0103		DRIVER INITIATED B.D.					
0104		TRANSPORTATION DEPARTMENT - NO DEFECT					
0105		EXCHANGE FOR/TYPE- TRANSPORTATION DEPARTMENT					
0107		EXCHANGE FOR/TYPE- MAINTENANCE DEPARTMENT					
0109		TIRES/LUGS					
0200		CAMPAIGN					
0801		UNSANITARY					
0810		CLEANING/HOSTLING - REVENUE VEHICLES					REFER TO SMP = S/L-2
0811		CLEANING/HOSTLING - NON REVENUE VEHICLES					REFER TO SMP = S/L-4
0812		CLEANER/HOSTLER - OTHER DUTIES					REFER TO SMP = S/L-3
0820		SERVICE AND FUEL - REVENUE VEHICLES					REFER TO SMP = S/L-1
0825		STEAM CLEANING					REFER TO SMP = R/R-3
0850		INTERIOR CLEANING - REVENUE VEHICLES					REFER TO SMP = S/L-5
1010		'D' INSPECTION					REFER TO SMP = I/R-1
	1020	'C' INSPECTION					
	1030	'B' INSPECTION					
	1040	'A' INSPECTION					
	2231	PRESSURE PROTECTION VALVE - R&R					
	2237	SYNCHRO VALVE/CHECK VALVE - R&R					
	2239	INVERSION VALVE - R&R					
	2241	BRAKE APPLICATION VALVE - R&R					
	2243	MOISTURE EJECTOR VALVE - R&R					
	2245	SAFETY VALVE, R & R					
	2247	LOW AIR PRESSURE SWITCH, R & R					
	2250	BRAKE DIAPHRAGMS - COMPLETE, R & R					
	2990	ADJ AND SET-UP AIR SYSTEM PER SEC.					
	3969	THERMOSTATS - R&R					
	3988	LUBE THROTTLE CABLES					
	3989	LUBE SHIFT CABLES					
	6357	DIVERSION PUMP, R & R					
1020		'C' INSPECTION					REFER TO SMP = I/R-1
	1030	'B' INSPECTION					
	1040	'A' INSPECTION					
	2987	INPSECT AIR COMPRESSOR					RMV INTAKE & EXHAUST
	2988	CK AIR GAUGE ON DASH					= OR-5 LBS - REPLACE
	2989	TEST AIR TANK CHECK VALVES					
	3967	CHANGE SECONDARY FUEL FILTER					
	3968	R/R WINDSHIELD WIPER AIR STRAINER					
	3986	LUBE CONTROL ROD LINKAGE					
	4978	CHANGE DIFFERENTIAL OIL					13 QTS
	4980	CHANGE TRANSMISSION OIL & FILTER					24 QTS
	5988	ADJUST RIDE HEIGHT					
	5989	RE-TORQUE SUSPENSION					SEE MAINT MAN 4 TORQ
	6110	ADJUST HEADLIGHT AIM					
	6968	CK NUTS ON AMPHENOL PLUGS					
	6969	CK ENGINE DOOR WIRING HARNESS					
	6975	TEST SPECIFIC GRAVITY OF BATTERIES					
	6976	LOAD TEST BATTERIES					
	6977	CK GENERATOR CHARGING OUTPUT					
	6978	CK AND ADJUST REGULATOR					

Series PM Recommendations

Figure A.3-9

```
01/06/83                          SAN DIEGO TRANSIT CORPORATION                                              PAGE   1
                                  DAILY  EXCEPTIONS  REPORT
MD002A                                                                                                      (RO66R1)
                  ***** C U R R E N T   C O N S U M A B L E S   I N F O. *****.    *** LAST * FUELINGS CONSUMABLES INFO. ***:
                  DATE    MILEAGE   FUEL  MPG   OIL  MPG   ATF  MPG  CLNT  MPG        DATE     MILEAGE   FUEL    OIL  ATF  CLNT
----------------------------------------------------------------------------------  ------------------------------------------------

VEHICLE # 0202   11/16/82 [illegible] [illegible] 2.0 [illegible] [illegible] 2 1[illegible]0 1 3[illegible]   11/1[illegible]/82  954[illegible]  100.0   1    1    1
SERIES #  02[illegible]                                                              11 14 82  9[illegible]42[illegible]  110.0   1    0    2
                                                                                     11 13 82  9[illegible]4[illegible]   100.0   0    0    0
        ERRORS:  FUEL  -  7 MPG UNDER  ATF  -  6 MPG UNDER  MILEAGE ERROR:-1[illegible]   11 12 82  9[illegible]38[illegible]   1[illegible]   1    1    1
        ------   OIL   -  5 MPG OVER   CLNT -  * MPG UNDER                            11 1[illegible] 82  9[illegible]3[illegible]   1[illegible].0   1    1    1

VEHICLE # 03[illegible]1  11/16/82 [illegible] 1[illegible]
SERIES #  03[illegible]

        ERRORS:  FUEL  -  * MPG UNDER
        ------

VEHICLE # 0302   11/16/82 [illegible]14[illegible] 12[illegible]    22
SERIES #  03[illegible]

        ERRORS:                        ATF  -  * MPG OVER
        ------
```

Daily Exceptions Report

Figure A.3-10

01/06/83 SAN DIEGO TRANSIT CORPORATION PAGE 1

CONSUMABLES REPORT (MTD)

M0003 (RUS781)

VEHICLE NUMBER	STATUS	MI. LAST FUELING		MILES TRAVELED	FUEL: GALLONS USED	FUEL: MPG	OIL: QTS. USED	OIL: MPG	OIL: QTS. CHGD	A.T. FLUID: QTS. USED	A.T. FLUID: MPG	A.T. FLUID: QTS. CHGD	COOLANT: QTS. USED	COOLANT: MPG	COOLANT: QTS. CHGD	COMMENTS
SERIES NUMBER 0200																
0202	A	954300	CUR	300	150.0	2.0	20	15	20	2	150	0	1	300	0	
			MTD	34300	5000.0	68.6	100	343	100	20	171	10	10	343	0	
SERIES TOTAL = 1			TOTAL ACTIVE = 1													
TOTALS			CUR	300	150.0	2.0	20	15	20	2	150	0	1	300	0	
AVERAGES			CUR	300	150.0	2.0	20	15	20	2	15	0				
			MTD	34300	5000.0	68.6	100	343	100	20	1717	10	10	343	0	
			MTD	34300	5000.0	68.6	100	343	100	20	1717	10				

Consumables (Month to Date)

Figure A.3-11

01/06/83 SAN DIEGO TRANSIT CORPORATION PAGE 1

CONSUMABLES REPORT (YTD)

MD004 (R06SR1)

SERIES NUMBER	AVG. ACTIVE	MILES TRAVELED	FUEL GALLONS USED	FUEL MPG	OIL QTS. USED	OIL MPG	A.T. FLUID QTS. USED	A.T. FLUID MPG	COOLANT QTS. USED	COOLANT MPG
0200	10	[illegible]	[illegible]	[illegible]	1218	[illegible]	[illegible]	[illegible]	374	340
0300	10	[illegible]	[illegible]	[illegible]	1218	[illegible]	[illegible]	[illegible]	374	340

01/06/83 SAN DIEGO TRANSIT CORPORATION PAGE 2

CONSUMABLES REPORT (YTD)

MD004 (R06SR1)

ACCTNG PERIOD	AVG. ACTIVE	MILES TRAVELED	FUEL GALLONS USED	FUEL MPG	FUEL PRCNT INCR.	OIL QTS. USED	OIL MPG	OIL PRCNT INCR.	A.T. FLUID QTS. USED	A.T. FLUID MPG	A.T. FLUID PRCNT INCR.	COOLANT QTS. USED	COOLANT MPG	COOLANT PRCNT INCR.
11	22	[illegible]	4823.0	3.7	[illegible]	[illegible]	[illegible]	[illegible]	64	281	[illegible]	66	273	0.0
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	68	[illegible]	7.8
01	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	66	303	(15.2)	66	303	3.0
02	18	[illegible]	[illegible]	[illegible]	4.6	[illegible]	110	[illegible]	66	324	6.8	66	333	10.0
03	22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	66	[illegible]	9.1	66	364	9.1
04	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	72	[illegible]	(21.3)	62	323	(11.3)
05	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8.0	56	321	(0.4)
06	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	62	323	[illegible]	60	333	3.7
07	19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	48	[illegible]	[illegible]	50	520	56.0
08	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	56	414	(23.6)	70	343	(34.1)
09	22	[illegible]	[illegible]	[illegible]	[illegible]	214	[illegible]	[illegible]	52	355	(14.3)	58	379	10.6
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	60	333	(12.1)
TOTAL	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]		744	341.4		748	339.6	

Consumables Report (Year to Date)

Figure A.3-12

01/06/83 SAN DIEGO TRANSIT CORPORATION PAGE 1

'NOT PROBED' REPORT

MD0029 (R0068R2)

	***** CURRENT CONSUMABLES INFO. ***** DATE	MILEAGE	FUEL	MPG	OIL	MPG	ATF	MPG	CLNT	MPG	*** LAST 5 FUELINGS CONSUMABLES INFO. *** DATE	MILEAGE	FUEL	OIL	ATF	CLNT
VEHICLE # 0202	11/16/82	[illegible]	150.0	2.0	20	1[illegible]	2	15[illegible]	1	3[illegible]	11/15/82	[illegible]	100.0	1	1	1
SERIES # 0200											11/14/82	[illegible]	110.0	1	0	2
											11/13/82	[illegible]	100.0	0	0	0
	******************* NOT PROBED *******************										11/12/82	[illegible]	100.0	1	1	1
											11/11/82	[illegible]	100.0	1	1	1

"Not Probed" Report

Figure A.3-13

SAN DIEGO TRANSIT CORPORATION PAGE 1

MONTHLY ROAD CALL REPORT

MD030 02/11/83 (R061R1)

By VEHICLE NUMBER

From 02/04/83 To 02/07/83

VEH. NBR.	OPER. NUMBER	ACT. NBR.	DESCRIPTION	A/O NUMBER	A/O DATE	MILEAGE	MI.BTWN CHG.R/C	TIME REPORTED	LOCATION OF BREAKDOWN	FRMN'S NUMBER	TIME LOST	TOWED IN?	Non-CHRG
0202	885746	6326	A/C - HYDRAULIC PU	1111144	02/04/83	0944580		15:20PM	MAIN ST.	664736	0.8		
	665588	4010	TRANSMISSION, R &	1111148	02/07/83	0945434	854	21:50PM	3rd & BROADWAY	562384	1.2	Y	
		0101	ROAD CALL	1111149	02/07/83			17:35PM					Y
0203		0101	ROAD CALL	1111145	02/05/83			10:53AM					Y
0301		0101	ROAD CALL	1111146	02/05/83			13:22PM					Y
0302		0101	ROAD CALL	1111147	02/06/83			08:42AM					Y

AVERAGE MILES BETWEEN ROAD CALLS: 427

TOTAL NBR. OF VEHICLES TOWED IN: 1 TOTAL Non-CHARGEABLE ROAD CALLS: 4

MONTHLY ROAD CALL REPORT

MD030 02/11/83 (R061R1)

By ACTIVITY NUMBER

From 02/04/83 To 02/07/83

ACTIVITY NBR.	DESCRIPTION	SERIES SUMMARY 0200	0300	0400	0600	0700	0800	0900	1000	1100	TOTAL
0101	ROAD CALL	4	2	0	0	0	0	0	0	0	6
4010	TRANSMISSION, R & R	1	0	0	0	0	0	0	0	0	1
6326	A/C - HYDRAULIC PUMP	1	0	0	0	0	0	0	0	0	1

NBR. OF ROAD CALLS FOR REVENUE VEHICLES = 6

****

Monthly Road Call Report

Figure A.3-14

OIL ANALYSIS REPORT

02/09/83

UNIT # 00303

OPERATING DATA / PHYSICAL DATA

LAB #	DATE SAMPLED	OIL TIME	UNIT TIME	OIL ADDED	DATE TESTED	FUEL % VOL.	SOLIDS % VOL.	WATER % VOL.	VISCOSITY		NEUTRALIZATION NUMBER	
009459	061781	0010435	0014750	2	061881			SPECTRO TREND INDICATES OIL IS OK				
006352	071281	0016420	0020739	3	071381			SPECTRO TREND INDICATES OIL IS OK				
001004	081781	0022496	0026811	3	081981			SPECTRO TREND INDICATES OIL IS OK				
008776	092281	0033642	0037957	2	092381			SPECTRO TREND INDICATES OIL IS OK				
002114	101881	0043001	0047319	1	101981			SPECTRO TREND INDICATES OIL IS OK				
001102	111781	0052960	0057275	0	111881	8.5	0.9	1.05	54	040	3.20	TBN

SPECTROCHEMICAL DATA

LAB # ---)) *****	9459	6352	1004	8776	2114	1102
IRON	65	69	77	83	90	198
ALUMINUM	2	6	5	8	9	12
CHROMIUM	2	7	8	5	7	14
COPPER	15	17	20	23	26	83
LEAD	12	10	13	19	21	43
TIN	6	5	8	9	12	28
NICKEL	0	0	0	0	0	0
SILVER	0	0	0	0	0	0
SILICON	5	4	8	7	6	9
SODIUM	25	24	26	25	24	27
BORON	0	0	0	0	0	0
ZINC	853	867	882	878	880	796
PHOSPHOROUS	1101	1076	1154	1203	1209	1036
CALCIUM	2701	2802	2798	2699	2753	2502
MAGNESIUM	0	0	0	0	0	0
BARIUM	0	0	0	0	0	0
TITANIUM	0	0	0	0	0	0
VANADIUM	0	0	0	0	0	0

RECOMMENDATIONS

***** CRITICAL DATA - PHONED *****

CHECK FOR FUEL LEAKS (HIGH FUEL DILUTION)

RESAMPLE AT 1000 MILES

CHANGE OIL FILTER(S)

CHECK INJECTORS, LINERS, AND SEALS FOR FUEL LEAKS

COMMENTS:

Oil Analysis Report

Figure A.3-15

SAN DIEGO TRANSIT CORPORATION
C.H.P. INSPECTION
02/14/83

MB025 (R0168R1)

VEHICLE NUMBER	ACTIVITY NUMBER	DESCRIPTION	DATE PERFORMED	MILEAGE	A/O NUMBER	1st MECH. NBR.	2nd MECH. NBR.	3rd MECH. NBR.
0431	1040	'A' INSPECTION	12/31/82	0599150				
	1050	'I' INSPECTION	01/10/83	0599913				
0432	1010	'D' INSPECTION		0621330				
	1020	'C' INSPECTION		0632016				
	1030	'B' INSPECTION		0643394				
	1040	'A' INSPECTION	01/07/83	0630099				
	1050	'I' INSPECTION	01/07/83	0630099				
0433	1010	'D' INSPECTION		0603799				
	1020	'C' INSPECTION		0596139				
	1030	'B' INSPECTION	11/30/82	0607628				
	1040	'A' INSPECTION	01/10/83	0611535				
	1050	'I' INSPECTION	01/10/83	0611535				
0434	1010	'D' INSPECTION		0561982				
	1020	'C' INSPECTION		0570338				
	1030	'B' INSPECTION		0570338				
	1040	'A' INSPECTION	01/20/83	0574431				
	1050	'I' INSPECTION	01/20/83	0574431				
0435	1010	'D' INSPECTION	01/10/83	0584566				
	1020	'C' INSPECTION		0580195				
	1030	'B' INSPECTION		0580974				
	1040	'A' INSPECTION	01/10/83	0584566				
	1050	'I' INSPECTION	01/10/83	0584566				
0436	1010	'D' INSPECTION		0566185				
	1020	'C' INSPECTION		0573167				
	1030	'B' INSPECTION		0578602				
	1040	'A' INSPECTION		0582407				
	1050	'I' INSPECTION	11/29/82	0584663				
0437	1010	'D' INSPECTION	11/29/82	0582630				
	1020	'C' INSPECTION		0562421				
	1030	'B' INSPECTION	01/13/83	0586437				
	1040	'A' INSPECTION	01/13/83	0586437				
	1050	'I' INSPECTION	01/13/83	0586437				
0438	1010	'D' INSPECTION		0568340				
	1020	'C' INSPECTION		0568340				
	1030	'B' INSPECTION		0574233				
	1040	'A' INSPECTION	12/31/82	0578233				
	1050	'I' INSPECTION	01/13/83	0579910				
0439	1010	'D' INSPECTION		0584970				
	1020	'C' INSPECTION	12/28/82	0599283				
	1030	'B' INSPECTION	12/08/82	0597192				
	1040	'A' INSPECTION	12/08/82	0597192				
	1050	'I' INSPECTION	01/13/83	0600772				
0440	1010	'D' INSPECTION		0621830				
	1020	'C' INSPECTION		0622728				
	1030	'B' INSPECTION	12/15/82	0639531				
	1040	'A' INSPECTION	12/15/82	0639531				
	1050	'I' INSPECTION	01/13/83	0642079				

C.H.P. Inspection Report

Figure A.3-16

A.4 FACTS CORPORATION, THE

CPMU/V

1. Introduction
2. Description of the System
   - 2.1 Files
   - 2.2 Reports
3. Hardware
4. References

A.4 CPMU/V

Introduction

CPMU/V is a software system for general analysis and control of rolling stock in single or multiple units. The system includes cost accounting, cost control, daily control of operations, general purpose fleet management information, fleet administration, vehicle efficiency and performance capabilities, vehicle repair history, lease or purchase benefit options, and capital investment payback functions.

CPMU/V is one of the many applications of the applications generating language, CPMU (TM). The programs and algorithms of CPMU provide for comparative analysis of variables. These variables can be of any kind. They include, but are not limited to: accounting codes, components of structures such as machines, organisms, celestial systems, and conceptual abstractions such as mathematical systems, molecular constructs, conceptual patterns. The comparative analyses can also be of any kind. They include, but are not limited to logical, spatial, mathematical, cost, efficiency, performance, correctness proveability relationships.

CPMU/V is designed for management and control of any type of fleet. Reports of fleet expenses, driver expenses, mechanic productivity, component and assembly cost analysis, fuel, and vehicle histories are provided by the system. Incorporated into this system is a report generator that provides exception reporting, query functions, and capability to reformat reports. For example, the following query, although uncommon in its selection criteria, illustrates the capability and flexibility of the CPMU/V system:

> "What is the average cost per mile of all 1980 Chevrolet Citations, based in Kansas, assigned to zone 7, with 6 cylinders, with automatic transmissions, with more than 40,000 miles, with fuel consumption between 21 and 23 miles per gallon, with parts costs greater than or equal to $168.00, with Personal Use Credit less than $650.00, and with total costs more than $875.00?"

In addition to all of the enumerated variables, descriptive or calculated and provided with CPMU/V, descriptive variables for record selection and report generation can be added.

CPMU/V is designed to operate on a variety of microcomputers, such as the Apple II, TRS-80/II, Northstar and IBM Personal Computer, with CP/M or MP/M operating systems and dBASE II. The minimum disk storage requirement for the system is 378 K bytes either on hard disk or distributed on floppies.

2. Description of the System

The CPMU/V system calculates vehicle fuel and repair expenses including parts and labor costs. It also calculates any other vehicle expenses which are recorded, such as depreciation, personal use credit, purchase price, insurance, etc. The files needed for these calculations may be converted directly from the users current manual files. The user may define his own coding system or use the CPMU/V coding system, which is based on the American Trucking Association Vehicle Maintenance Reporting Standards (VMRS) coding system described in Appendix A.1, above.

The CPMU/V system is menu driven. The main menu contains the following options:

1. File Maintenance (add, change, delete, or list)
2. Reports
3. Quick Inquiry by Vehicle
4. Post Data to Cost Files
5. Quit

Selecting Option 1, File Maintenance, will call the File Maintenance Menu with the following options.

1. Vehicle File
2. Repair Order File
3. Fuel File
4. Expense File
5. Miles File
6. Codes File
7. Quit

Each option represents a different computer file. These files are described in Section 2.1.

Selecting Option 2, Reports, of the Main Menu will call the Report Menu with the following options:

1. Management Reports (with selection criteria)
2. Master user Defined Report
3. Master Cost Summary Report
4. Master Fuel Usage Report
5. Master Cost Analysis by Code Report
6. Quit

This menu allows the generation of master reports and management reports. The reports are described in Section 2.2.

Selecting Option 3 of the Main Menu, Quick Inquiry by Vehicle, will call the Quick Inquiry Menu shown in Figure A.4-14.

Selecting Option 4 of the Main Menu, Post Data to Cost Files, will call the Posting Menu shown in Figure A.4-15.

A.4 CPMU/V

2.1 Files

Vehicle File
This file describes each vehicle by items, such as its number, make, model, and driver. The information is initially entered during the program set-up, but can be changed at any time.

Repair Order (R.O.) File
This file describes vehicle repairs. It is divided into the following three parts:

a. R.O. Header File
The Repair Order Header contains data such as time and place of repair, vehicle number, reason for repair, and repair order number.

b. R.O. Parts File
This file contains each part used to repair the vehicle. Each entry is related to the repair order number of its associated repair order header.

c. R.O. Labor File
This file contains the labor hours used to repair the vehicle. Each entry is related to the repair order number of the associated repair order header.

Fuel File
This file contains the date, amount and cost of the fuel used by each vehicle. Inquiries of fuel usage by vehicle may be made for any period.

Expense File
This file contains the date, cost, and type of vehicle expenses other than parts, labor, and fuel.

Miles File
Contains odometer readings for each vehicle.

Codes File
Contains a code number and description for each repair category, and expense category that is to be monitored. These codes are initially defined during set-up, but can be changed at any time. The ATA codes are the default.

Examples of listings of these files are shown Figures A.4-1 through A.4-8.

2.2 Reports

Master Cost Summary

Summarizes the total cost and cost per mile of each vehicle, average cost per vehicle and per mile of all selected vehicles, and the total cost of all selected vehicles. Included in this report is the vehicle number, make, model, fuel, labor, and parts costs, and other expenses (see Figure A.4-9).

Master Fuel Usage Report

Contains the vehicle number, opening and closing odometer readings from the Miles File, miles travelled, gallons used from the Fuel File, and the miles per gallon of each vehicle. Also contained in this report is the average fuel usage per vehicle of all selected vehicles, and the total miles and fuel usage of all selected vehicles (see Figure A.4-10).

Master Cost Analysis by Code Report

Contains a summary by vehicle for each labor, part, or expense code, and the cost per mile and total cost over month-to-date (MTD), year-to-date (YTD) and term-to-date (TTD) periods. The Average Total per Vehicle is the summation of vehicle totals divided by the number of vehicles. This can be determined for all selected vehicles and all selected components. Since the set of codes can represent assemblies, subassemblies, components, and parts, these averages, when compared to the average of other sets of codes, provide a means of comparative component and structural analysis. Groups of codes may also be compared. Grand totals, which are a summation of all the vehicle totals, are also provided (see Figure A.4-11).

Management Reports

Provides a versatile "user friendly" unlimited report selection capability. The report foremats of the Management Reports is the same as the Master Reports previously described, i.e. Cost Summary Report, Fuel Usage Report, and Cost Analysis by Code Report. The difference between the Master Reports and the Management Reports is that the Master Reports report on all vehicles and compute the totals and averages for all vehicles. The Management Reports generate reports on only those vehicles specified and base totals and averages on only the specified vehicles. This capability provides considerable flexibility in performing comparative analysis (see Figures A.4-12 and A.4-13 for details).

Master User Defined Reports

Allows the user to print or display a report of any foremat the user wants to specify.

A.4 CPMU/V

3. Hardware

The CPMU/V system is designed to operate on either an 8080, 8085, or Z-80 based microprocessor systems such as are available in the Apple II, TRS-80/II, or Northstar, or any system which emulates these processors, or the IBM Personal Computer. The minimum memory size required is 56 K bytes. For the IBM Personal Computer 96 K bytes is required.

One or more disk or diskette units is required. For single disk or diskette units, the minimum required storage capacity is 378 K bytes. For two or more disk or disketts units, the minimum required storage capacity is 126 K bytes per unit.

The CPMU/V system requires either the CP/M or MP/M operating system (Version 1.4 or 2.X) or a CP/M or MP/M emulator and dBASE II†. The version of dBASE II must be compatible with the users version of CP/M and the hardware configuration. dBASE II facilitates the manipulation of fields, records, and files to manage data as desired.

4. References

A.4-1 CPMU/V, The Facts Corp., 1983.

VEHICLE LISTING

VEHICLE	FLEET	VIN	MAKE	MODEL	YEAR	COLOR	PLATE	DRIVER	BUY DATE	BUY AMOUNT	DEPREC	VALUE
0001			GMC	SUBURBAN	0				0	0.00	0.00	0.0
0011			FORD	VAN	0				0	0.00	0.00	0.0
0019			FORD	VAN	0				0	0.00	0.00	0.0
0020			GMC	SUBURBAN	0				0	0.00	0.00	0.0
0066			GMC	SUBURBAN	0				0	0.00	0.00	0.0
0080			GMC	SUBURBAN	0				0	0.00	0.00	0.0
0107			FORD	VAN	0				0	0.00	0.00	0.0
0133			CHEV.	WAGON	0				0	0.00	0.00	0.0

Figure A.4-1

PAGE NO. 00001

REPAIR ORDER HEADER LISTING

RONUMBER	COMPANY	FACILITY	FLEET	VEHICLE	DATE	MILES	ACTIVITY	REASON	REPORT	CLASS	SITE	DATE FROM	TIME FROM	WRITTEN
00000000000				V000000	123181	0	0	0	0	0	0	0	0	
00000000001				V000000	10182	0	0	0	0	0	0	0	0	
00000000002				V000000	20182	0	0	0	0	0	0	0	0	
11111111111				V111111	123181	0	0	0	0	0	0	0	0	
XXXXXXXXXXX	CC	FA	FLE	VXXXXXX	111111	2222222	3	44	5555555	6	7	111111	2222	XXX
	CC													XXX
														XXX
YYYYYYYYYYY				VYYYYYY	0	0	0	0	0	0	0	0	0	

Figure A.4-2

PAGE NO. 00001

REPAIR ORDER PARTS LISTING

RONUMBER	CODE	PART	PARTNUMBER	QTY	UNITPRICE	FAIL CODE
1111111111	1 1	999	123456789012 345678901234	2	10.00	
1111111111	12 0			2	20.00	
1111111111	12 0			3	15.00	
0000000000	0 0			4	100.00	
YYYYYYYYYY				10	3.75	
0000000001	0 0			1	2000.00	
0000000002	0 0			1	2000.00	

Figure A.4-3

PAGE NO. 00001

REPAIR ORDER LABOR LISTING

RONUMBER	INSTRUC	DATE	EMPLOY NO	CODE	WORK ACC	ACTTIME	STDTIME
1111111111	IIIIIIIIIIII IIIIIIIIIII	0	9999	1 1	99	10.00	0.0
00000000000		0		1 0		10.00	0.0
1111111111		0		1 1		9.00	0.0
00000000000		0		1 0		9.00	0.0
00000000000		0		0 0		3.00	0.0
00000000001		0		1 1		100.00	0.0
00000000002		0		2 1		200.00	0.0

Figure A.4-4

PAGE NO. 00001

FUEL LISTING

VEHICLE	DOLLARS	GALLONS	MILES	METER	DATE	FUEL TYPE
V000000	15.00	10.0	1100.0	0.0	10182	X
V111111	35.00	35.0	13000.0	0.0	20182	
VXXXXXX	32.30	10.0	0.0	0.0	20182	
V111111	9.00	9.0	11000.0	0.0	123181	
V000000	12.00	8.0	1000.0	0.0	123181	

Figure A.4-5

PAGE NO. 00001

EXPENSE LISTING

VEHICLE	DATE	CODE	AMOUNT
V000000	23082	100	200.00
V111111	10182	101	300.00
V000000	13082	100	330.00
V111111	23082	100	400.00

Figure A.4-6

PAGE NO. 00001

MILES LISTING

VEHICLE	OPENTTD	OPENYTD	OPENMTD	CLOSE	DATE
T001	36453.0	0.0	0.0	37462.0	0
T002	31410.0	0.0	0.0	32416.0	0
T003	27999.0	0.0	0.0	28560.0	0
T004	31349.0	0.0	0.0	32021.0	0
T010	29090.0	0.0	0.0	29473.0	0
T030	4655.0	0.0	0.0	4948.0	0

Figure A.4-7

PAGE NO. 00001

CODES LISTING

CODE	NAME
0 0	NAME-FOR-CODE-0 0
1 0	NAME-FOR-CODE-1 0
1 1	NAME-FOR-CODE-1 1
100	MUMBLE FRATS
101	HEAVYDUTY REPAIRS

Figure A.4-8

COST SUMMARY REPORT

VEHICLE	MAKE	MODEL	FUEL $	LABOR $	PARTS $	EXPENSE $	TOTAL $	CPM $
0001	GMC	SUBURB	121.50	100.00	50.00	120.00	391.50	0.029
0133	CHEV	WAGON	118.26	10.00	53.00	0.00	181.26	0.030
0080	GMC	SUBURB	132.07	127.00	22.00	76.00	357.07	0.032
0020	GMC	SUBURB	521.54	30.10	34.00	0.00	585.64	0.035
0064	GMC	SUBURB	247.98	24.00	3.95	56.00	331.93	0.038
0107	FORD	VAN	546.86	80.00	5.70	100.00	732.56	0.042
0011	FORD	VAN	897.18	40.00	33.70	100.00	1070.88	0.045
0019	FORD	VAN	930.03	90.00	8.15	100.00	1128.18	0.047
AVERAGE PER VEHICLE - ALL SELECTED VEHICLES			439.42	62.63	26.31	69.00	597.37	0.037
TOTAL - ALL SELECTED VEHICLES			3515.42	501.10	210.50	552.00	4779.02	

Figure A.4-9

FUEL USAGE REPORT

VEHICLE	ODOMETER OPENING	ODOMETER CLOSING	MILES TRAVELLED	GALLONS	MPG
T030	4655.0	4948.0	293.0	84.60	3.50
T004	51349.0	52021.0	672.0	168.10	4.00
T001	36453.0	37462.0	1009.0	244.00	4.10
T002	31410.0	32416.0	1006.0	199.80	5.00
T010	29090.0	29473.0	383.0	74.90	5.10
T003	27999.0	28560.0	561.0	88.60	6.30
AVERAGE PER VEHICLE - ALL SELECTED VEHICLES			654.0	143.33	4.66
TOTAL - ALL SELECTED VEHICLES			3924.0	860.00	

Figure A.4-10

COST-ANALYSIS-BY-CODE REPORT

VEHICLE: V000000 MAKE: SAAB MODEL: TURBO

	CPM($)			***TOTAL($)***		
	TTD	YTD	MTD	TTD	YTD	MTD
0 0 NAME-FOR-CODE-0 0	0.000	0.000	0.000	4475.00	4000.00	2000.00
1 1 NAME-FOR-CODE-1 1	0.000	0.000	0.000	2500.00	2500.00	0.00
TOTAL THIS VEHICLE	0.000	0.000	0.000	6975.00	6500.00	2000.00

VEHICLE: V111111 MAKE: CHEVY MODEL: CITATION

	CPM($)			***TOTAL($)***		
	TTD	YTD	MTD	TTD	YTD	MTD
1 1 NAME-FOR-CODE-1 1	0.000	0.000	0.000	495.00	0.00	0.00
TOTAL THIS VEHICLE	0.000	0.000	0.000	495.00	0.00	0.00

	CPM($)			***TOTAL($)***		
	TTD	YTD	MTD	TTD	YTD	MTD
AVERAGE TOTAL PER VEHICLE - ALL SELECTED CODES, ALL SELECTED VEHICLES	0.000	0.000	0.000	3735.00	3250.00	1000.00
GRAND TOTAL - ALL SELECTED CODES, ALL SELECTED VEHICLES	0.000	0.000	0.000	7470.00	6500.00	2000.00

Figure A.4-11

********** MANAGEMENT REPORTS **********

1. COST SUMMARY REPORT
2. FUEL USAGE REPORT
3. COST ANALYSIS BY CODE REPORT
4. QUIT

1. COST SUMMARY REPORT

ENTER SELECTION VALUES...

VARIABLE	EQUAL TO...	GREATER THAN...	LESS THAN
DATE			
VEHICLE			
FLEET			
VIN			
MAKE			
MODEL			
YEAR			
COLOR			
PLATE			
DRIVER			

.
.
.
etc.

ENTER SELECTION VALUES...

VARIABLE	EQUAL TO...	GREATER THAN...	LESS THAN...
DATE			
VEHICLE			
FLEET			
VIN			
MAKE	SAAB		
MODEL			
YEAR		77	81

Figure A.4-12

3. COST ANALYSIS BY CODE REPORT.

ENTER SELECTION VALUES...

CODE	EQUAL TO...	GREATER THAN...	LESS THAN...
101		1000.00	3000.00
CPM101			
102			
CPM102		1.0	3.0
103			
CPM103			3.0

Figure A.4-13

```
********** QUICK INQUIRY MENU **********

0.  VEHICLE          FILE

1.  RO HEADER        FILE
2.  RO PARTS         FILE
3.  RO LABOR         FILE

4.  FUEL             FILE
5.  FUEL USAGE       FILE

6.  EXPENSE          FILE

7.  COST             FILE

8.  MILES            FILE

9.  QUIT
```

Figure A.4-14

```
***** POSTING MENU *****

ENTER CUTOFF MONTH AND YEAR (MMYY)



1. POST LABOR ONLY
2. POST PARTS ONLY
3. POST FUEL  ONLY
4. POST EXPENSES ONLY
5. POST LABOR. PARTS. FUEL AND EXPENSES
6. QUIT
```

Figure A.4-15

A.5 FLEET TECHNOLOGIES INTERNATIONAL
FLEET CONTROLLER

1. Introduction
2. Description of the System
   - 2.1 Menu Options
   - 2.2 Outputs
3. Hardware
4. References

A.5. Fleet Controller

1. Introduction

Fleet Controller is a fleet management system developed by Fleet Technologies International. Its capabilities include the following.

- Maintenance of vehicle histories,
- Processing of repair order information,
- Track of fuel and fluid consumption,
- Tracking of major component rebuild histories,
- Tracking of vehicles and vehicle usage,
- Scheduling of preventive maintenance (PM),
- Monitoring of mechanic seniority levels and labor rates,
- Monitoring of road calls,
- Compilation of cost reports.

Fleet Controller uses the Vehicle Maintenance Reporting Standards (VMRS) of the American Trucking Association, described in Section 2.1.

It uses a network data base management system, MDBS^{T}, with the capability to capture detailed maintenance history descriptions. The VMRS numerical codes are translated into understandable English descriptions for report generation. MDBS allows interface with electronic spread sheets for budgetting. The system has an inquiry capability and the capability to create exception reports, when required.

Fleet Controller was designed for operation on the IBM Personal Computer with 64K bytes of main memory.

A.5. Fleet Controller

2. Description of the System

The Fleet Controller is a menu driven system. The functional capabilities are described by stepping through the main and subsequent menus and by describing the outputs provided by the system.

2.1 The Menu Options

The Main Menu Options

(A) Mechanic and Vehicle Set Ups
(B) Daily Fuel Data Entry
(C) Repair Order Entry
(D) Reports and On-Line Screens
(F) Transfers and Deletions
(G) Mechanic and Vehicle Changes
(S) Stop

Any of these functions is selected by entering the accompanying letter. The system responds by displaying one of the lower level menues. These are described in the following.

The Mechanic and Vehicle Set Ups Menu

(A) Vehicle Description
(B) Division
(C) Vehicle Addition
(D) Mechanic Addition
(E) Reason for Repair
(F) Work Accomplished
(G) Position
(H) System
(I) Component
(J) Indirect Labor

(X) Return to Main Menu

This Menu is used to set up the system for the first time as well as for future additions. Desired functions are selected by entering a letter. The system was designed for a user to incorporate his own organizational structure. After vehicle descriptions and divisions (at least one) are described, specific vehicles and mechanics are entered. The remaining functions (E) through (J) are pre-established according to American Trucking Associations VMRS Codes. Additional codes may, however, be added.

A.5. Fleet Controller

A single labor rate is provided for each division. Thus, only the average labor cost of repairs at a division may be provided, and it is not possible to determine the specific cost of a single repair.

The description of mechanics is entered by number, name, Social Security Number, date hired, and Division Number.

The indirect labor codes include items such as: supervision, fueling buses, washing buses, parts pickup, parts handling, waiting for parts, no instructions, shop maintenance, cleaning shop, snow removal, training, personal injury, radio repair, brake adjustment, changeout bus.

The Daily Fuel Data Entry Menu

(A) Enter Data
(B) Enter PM Data

(X) Return to Main Menu

These functions permit the user to enter, for each vehicle, the fuel and oil consumed and miles driven each day. The fuel and engine and transmission oil consumed are input from the fueler's daily fuel log. Oil changes are differentiated from adding oil. The miles driven are calculated from route schedules and entered along with fuel log data. Any preventive maintenance performed on a vehicle is also entered from daily reports.

The Repair Order Entry Menu

(A) Data Entry

(X) Return to Main Menu

The Repair Order Data Entry function permits the user to enter repair order data from shop RO's. The repair order data include: date, mechanic, indirect and rebuild type, vehicle no., last and current mileage. also included are system repair details, especially, reason for repair, work accomplished, system, component, position, and time to repair.

The Reports and On-line Screens Option of the main menu does not lead to another menu. Rather, instructions for entering the Query will come up on the CRT. It enables the user to select data for immediate on-line review. One of 22 Standard Reports may be selected, or the user may create any desired report from the input data.

A.5. Fleet Controller

The Transfers and Deletion Menu

(A) Vehicle Transfer
(B) Mechanic Transfer
(C) Vehicle Deletion
(D) Old History Deletion

(X) Return to Main Menu

This menu is used to remove data no longer needed for fleet operation, and to transfer vehicles and mechanics from one division to another. Old histories, including maintenance records prior to a specified year and month, may be deleted.

The Mechanic and Vehicle Changes Menu

(A) Mechanic Data
(B) Vehicle Description
(C) Reason for Repair Description
(D) Work Accomplished Description
(E) Position Description
(F) System Description
(G) Component Description
(H) Indirect Labor Description
(I) Special Vehicle Code
(J) Labor Rate

This menu allows the user to make changes to data entered previously, or to correct entry errors. It also allows changes to labor rates and to establish groups of special vehicles.

A.5. Fleet Controller

2.2 Outputs

The "Reports and On-line Screens" option of the main menu provides access to Query and permits selection of any of 33 standard reports. If these reports are inadequate, others may be freely created by the user. Table A.5-1 lists the standard reports. Quick Name is the code used for a report in Query.

History Reports

Historic information can be retrieved either by systems or groups of systems, or by vehicles or groups of vehicles. Considerable flexibility exists in defining the vehicle groups. They may represent vehicles of the same type, groups of vehicle numbers, vehicles assigned to an organizational unit, or other selected combinations. The listings may be arranged in chronological order, or first organized into systems and then chronologically ordered. Moreover, histories can be retrieved in any format for some specific condition, or for a set of conditions. Totals for all listings can be determined. New categories can be added at any time for almost any of the codes.

History reports are the repair detail records of each vehicle in the fleet. Figure A.5-1 shows examples of vehicle history by system and by date. An example of a Road Call Report is shown if Figure A.5-2. The Complete History Report is generally produced annually for archival purposes in conjunction with clearing old, unneeded data out of the system.

Road Call Reports can be generated for any time period, and for almost any type of condition. For example, all road calls for 1982 that resulted in turn signal flasher repair or replacement could be listed.

Fuel Consumption Reports

Miles per gallon, miles per quart of engine oil, and miles per quart of transmission oil for the current month, year-to-date, or over the life of the vehicle are reported. Reports can be produced for any time interval. They can also be generated by division and vehicle type. Vehicle type summary reports are provided for analysis of trends at alternative locations.

An example of a Fuel Consumption Report by Vehicle is shown in Figure A.5-3. The miles per quart of transmission fluid (MPQT), on a monthly basis, could provide an indication of potential transmission leakage problems. Engine oil fuel consumption may be used similarly. Examples of monthly and annual Fuel Consumption Summary Reports by division and by vehicle type are shown in Figure A.5-4.

A.5 Fleet Controller

Preventive Maintenance (PM) Scheduling

Scheduling of preventive maintenance can be done for four different levels (A, B, C, and D) of preventive maintenance. The user specifies the mileage intervals for each level. These intervals can be changed at any time and can also be different for different reasons or vehicle types. A very short PM interval (500-1,000 miles) may be specified on break-in oil, so that it, and the unavoidable high-wear assembly contaminants in it, can be removed on time.

Special preventive maintenance (SPM) events may be scheduled in the following fife categories:

- Engine
- Transmission
- Differential
- Cradle
- Other

To obtain a standard PM Due Report, the user specifies a "lead time interval" within which the due dates of the maintenance events to be displayed are to fall. A separate report may be printed for each type of maintenance event. The examples shown in Figure A.5-5 are exception reports of all vehicles with an 800 mile lead time on a 9000 mile APM and a 27,200 mile BPM. A PM report may also be produced for a single division. Each PM Due Report is accompanied by a report on the current month's fuel, engine oil, and transmission oil consumption.

The system permits the preview of PM's for workload planning.

Inventory Reports

Three types of inventory reports are produced: vehicle inventory, mechanic inventory, and mechanic seniority . The Vehicle Inventory Report shown in Figure A.5-6 lists all vehicles by type within a division. A listing of mechanics by number for each division or mechanic seniority for all divisions is shown in Figure A.5-7.

Information contained in the Mechanic Seniority Reports may be compiled in many different ways, including the following:

- Alphabetically, by last name for any organizational unit or for the entire organization.
- By employee number for the entire organization.
- By seniority, date, and division.
- By seniority date.
- By seniority date within a classification and within an organizational unit, or within the entire organization.

Major Component Rebuild Summary

The Major Component Rebuild Summary, shown in Figure A.5-8, tracks the rebuilt component from installation through its life, even if cycled through more than one vehicle. RBL is the rebuilt component number that is recorded each time the component is rebuilt.

Component Rebuild History Reports allow the allocation of labor, time and cost of rebuilding to major components such as engines and transmissions. Time and cost may be retrieved at any time by serial number of the component. These costs can be added to an individual vehicle's history when the component or assembly is installed. Serial numbers are recorded to provide audit trails in case of quality control problems.

Monthly Consumables Audit Report

An example of a Monthly Consumables Audit Report is shown in Figure A.5-9. It contains a record of the total fluids used in the system for any month or year-to-date, or over the life of the system. These totals can be compared with the quantities actually purchased. Also contained in the report are total miles driven.

Daily Data Entry Check

The Daily Data Entry Check is a report used to check the correctness of the day's input. It is generally not printed.

Utility Reports

Listings in increasing order of the vehicle numbers and mechanic numbers may be produced. Also, listings of description codes used by mechanics when filling out repair orders may be printed.

Non Standard Reports

Figures A.5-10, -11, and -12 are examples of non standard exception reports created by making logical comparisons. For example, a request may be made for all vehicles with mileage greater than (>) 100,000 or older than (<) 04/01/82.

Figure A.5-10 shows an example of a request for a road call report for July 1982; a request for a report, listing all warranty maintenance performed by a given division; and a request for a report listing all preventive maintenance performed on vehicle 4500.

Figure A.5-11 shows an example of a request for a report on the front brake relining history of vehicle 8144.

The examples shown in Figure A.5-12 illustrate a fuel consumption summary for a vehicle type (GMC V8) for 1982, and a preventive maintenance report for a group of special vehicles. The top part of the figure shows the fuel consumption, by vehicle, at division 32, for the three month period of July, August, and September 1982. The lower part of the figure lilsts the mechanics of Division 32 and the dates of their hire.

A.5 Fleet Controller

Cost Reports

Summaries of costs in terms of total cost and cost per mile for fuel, parts, labor, and total maintenance for each month, year-to-date, and life-of-unit, for each vehicle and for each group of vehicle types within a division, can be produced. The summaries for each month are retained, so that multi-month comparisons may be made. The cost per mile for an individual vehicle may be compared to the cost per mile of the vehicle type. Costs can also be determined at the system level (i.e., engine, brakes, cranking system, etc.) for the life-of-unit by individual vehicle and by vehicle type. Any of these costs can be included in the detailed history, for retrieval on demand by individual vehicle, or by group of vehicles.

3. Hardware

Fleet Controller was designed for use on the IBM Personal Computer XT with at least 64 K bytes of memory (RAM). The basic system unit contains the 8088 processor, a 10 M byte fixed disk drive, 320 K byte dikette drive, an asynchronous communication adapter, and 128 K bytes of memory.

4. References

A.5-1 Fleet Controller - A Total System for Vehicle Maintenance, Fleet Technologies Inc., 1982.

x x x STANDARD REPORTS x x x

Table of Reports

REPORT NAME	QUICK NAME	CODE
history reports		
1. Vehicle Repair History by System	HIST	PATH1
2. Vehicle Repair History by Date	HIST	PATH2
3. Road Call Report (Reason for Repair)	HIST	PATH3
4. Complete History (Annual Archival)	ARCHIST	PATH3
fuel consumption reports		
5. Fuel Consumption Report by Vehicle	FUEL	PATH4
6. Fuel Consumption Summary by DV & VT	FUELVT	PATH6
preventive maintenance		
7. Preventive Maintenance Due Report	PM	PATH4
inventory reports		
8. Vehicle Inventory (two quick names)	VEHICLE INV	PATH5
9. Mechanic Inventory Report	MECHANIC	PATH7
10. Mechanic Senority Report	MECHANIC	PATH8
miscellaneous reports		
11. Major Component Rebuilt Summary	REBUILT	PATH9
12. Monthly Consummables Audit Report	AUDIT	PATH10
13. Daily Data Entry Check	HIST	PATH1
utility reports		
14. List of Vehicle Numbers	VEHLIST	
15. List of Mechanic Numbers	MECHLIST	
16. Vehicle-Type Codes	VEHTYPE	
17. Reason for Repair Codes	REASON	
18. Work Accomplished Codes	WORK	
19. System Codes	SYSTEM	
20. Component Codes	COMPONENT	
21. Position Codes	POSITION	
22. Indirect Labor Codes	INDIRECT	
(no CODE required for utility reports)		

--> VEHICLE HISTORY BY SYSTEM - AUG 31, 1982

VEHN	SY	DATE	MILES		WORK DONE		MECH	TIME	RON
4500	13	01/05/1982	100100	OVERHAUL	BRAKES	REAR	0005	7	10100
4500	13	01/30/1982	132000	OVERHAUL	BRAKES	REAR	0005	7	80179
4500	13	01/10/1982	116207	RPL NEW	S CAM	RT FT	0005	1	50106
4500	13	01/10/1982	116207	OVERHAUL	BRAKES	FRONT	0005	6	50106
			464514					21	
um									
4500	16	01/11/1982	116207	ADJUST	SUSPENSION SYS	LF FT	0005	1	50132
			116207					1	
um									
4500	27	01/06/1982	100300	RPL RBLT	AUTO TRANS		0003	8	30125
4500	27	01/10/1982	100850	RPL RBLT	AUTO TRANS		RBLT	24	T101
4500	27	01/10/1982	100850	RPL RBLT	AUTO TRANS		0003	7	30950
4500	27	01/09/1982	100630	CLEAN	VALVE BODY		0003	6	30925
4500	27	01/08/1982	100520	RPL RBLT	TRANS GOVERNOR		0003	3	30910
4500	27	01/07/1982	100480	ADJUST	SHIFT LINKAGE		0003	2	30890
4500	27	01/06/1982	100300	RPL RBLT	AUTO TRANS		RBLT	21	T100

--> VEHICLE HISTORY BY DATE - AUG 31, 1982

VEHN	SY	DATE	MILES		WORK DONE		MECH	TIME	RON
4500	13	01/30/1982	132000	OVERHAUL	BRAKES	REAR	0005	7	80179
4500	40	01/25/1982	131300	PM-C	PREVENTIVE MAINT		0006	6	80103
4500	45	01/23/1982	127890	RPL NEW	1 OR 2 LINER KIT	#6CYL	0006	6	71384
4500	40	01/22/1982	117100	PM-B	PREVENTIVE MAINT		0004	7	50200
4500	45	01/22/1982	127890	RPL NEW	1 OR 2 LINER KIT	#6CYL	0006	7	71361
4500	40	01/20/1982	102200	PM-B	PREVENTIVE MAINT		0004	7	10300
4500	44	01/18/1982	126970	RPL NEW	FUEL INJECTOR	#6CYL	0006	5	71315
4500	44	01/16/1982	126250	RPL RBLT	FUEL INJECTOR	ALL	0006	4	71295
4500	44	01/15/1982	126250	RPL RBLT	FUEL INJECTOR	ALL	0006	6	71288
4500	16	01/11/1982	116207	ADJUST	SUSPENSION SYS	LF FT	0005	1	50132
4500	27	01/10/1982	100850	RPL RBLT	AUTO TRANS		0003	7	30950
4500	13	01/10/1982	116207	RPL NEW	S CAM	RT FT	0005	1	50106
4500	13	01/10/1982	116207	OVERHAUL	BRAKES	FRONT	0005	6	50106
4500	27	01/10/1982	100850	RPL RBLT	AUTO TRANS		RBLT	24	T101
4500	27	01/09/1982	100630	CLEAN	VALVE BODY		0003	6	30925
4500	27	01/08/1982	100520	RPL RBLT	TRANS GOVERNOR		0003	3	30910
4500	27	01/07/1982	100480	ADJUST	SHIFT LINKAGE		0003	2	30890
4500	32	01/07/1982	100482	RPL RBLT	ELECTRIC STARTER		0003	4	30905

Figure A.5-1

--> ROAD CALL REPORT FOR JANUARY, 1982

VEHN	SY	DATE	MILES	WORK DONE		MECH	TIME	RON
4500	27	01/06/1982	108300	RPL RBLT AUTO TRANS		0003	8	30125
4500	27	01/10/1982	108850	RPL RBLT AUTO TRANS		0003	7	30950
4500	27	01/09/1982	108630	CLEAN VALVE BODY		0003	6	30925
4500	27	01/08/1982	108520	RPL RBLT TRANS GOVERNOR		0003	3	30910
4500	27	01/07/1982	108480	ADJUST SHIFT LINKAGE		0003	2	30890
4500	44	01/15/1982	126250	RPL RBLT FUEL INJECTOR	ALL	0006	6	71288
4500	44	01/16/1982	126250	RPL RBLT FUEL INJECTOR	ALL	0006	4	71295
4500	45	01/22/1982	127890	RPL NEW 1 OR 2 LINER KIT	#6CYL	0006	7	71361
4500	45	01/23/1982	127890	RPL NEW 1 OR 2 LINER KIT	#6CYL	0006	6	71384
			******				49	

um

Figure A.5-2

--> FUEL REPORT FOR THE MONTH OF JULY, 1982

DV	VT	VEHN	YRMO	MPG	MPQ	MPQT	
31	01	4500	8207	4.0	3000.0	272.7	
31	01	4501	8207	4.1	310.0	3100.0	
				4.1	1655.0	1686.4	ave
31	02	4800	8207	3.9	295.0	2950.0	
31	02	4801	8207	4.2	315.0	3150.0	
				4.1	305.0	3050.0	ave
32	01	4550	8207	3.9	193.3	2900.0	
32	01	4551	8207	4.1	305.0	610.0	
				4.0	249.2	1755.0	ave
32	02	4850	8207	4.3	2133.3	3200.0	
32	02	4851	8207	3.9	295.0	2950.0	
				4.1	1214.2	3075.0	ave
				4.0	855.8	2391.6	ave

Figure A.5-3

--> MONTHLY VEHICLE TYPE SUMMARY - JULY, 1982

DV	VT	DESC	MPG	MPQ	MPQT	
31	01	76 AMG 35 V8	4.1	554.5	508.3	
31	02	76 GMC 40 V8	4.1	305.0	3050.0	
32	01	76 AMG 35 V8	4.0	238.0	991.7	
32	02	76 GMC 40 V8	4.1	534.8	3075.0	
			4.1	408.1	1906.2	ave

--> VEHICLE TYPE SUMMARY FOR 1982

DV	VT	DESC	MPG	MPQ	MPQT	
31	01	76 AMG 35 V8	4.0	316.6	1480.0	
31	02	76 GMC 40 V8	4.1	283.4	1473.7	
32	01	76 AMG 35 V8	4.0	288.7	2092.9	
32	02	76 GMC 40 V8	4.1	227.4	3025.0	
			4.1	279.0	2017.9	ave

Figure A.5-4

```
-->              PM DUE REPORT                    9/30/82

DV VEHN  YRMO      MPG       MPQ       MPQT       APM

31 4500  8209      4.0     225.0     3600.0    7200.0
31 4801  8209      4.2     340.0      566.7    6800.0
32 4550  8209      3.9     325.0     3250.0    6500.0
32 4850  8209      4.2     345.0     3450.0    6900.0

   no of observations:      4
```

```
-->          PM DUE REPORT FOR 28,000 MILES       9/30/82

DV VEHN  YRMO      MPG       MPQ       MPQT       BPM

31 4501  8209      4.1     296.0     2760.0   27600.0
31 4800  8209      4.1     298.4     2775.0   27750.0
32 4551  8209      4.2     304.3     2830.0   28300.0
32 4851  8209      4.2     145.0     2900.0   29000.0

   no of observations:      4
```

```
-->          PM DUE REPORT FOR DIVISION 32        9/30/82

DV VEHN  YRMO      MPG       MPQ       MPQT       BPM

32 4551  8209      4.2     304.3     2830.0   28300.0
32 4851  8209      4.2     145.0     2900.0   29000.0

   no of observations:      2
```

Figure A.5-5

```
-->          VEHICLE INVENTORY
DV VEHN  VT DESC                    START DATE

31 4500  01 76 AMG 35 V8           01/01/1982
31 4501  01 76 AMG 35 V8           01/01/1982

   no of observations:     2

31 4800  02 76 GMC 40 V8           01/01/1982
31 4801  02 76 GMC 40 V8           01/01/1982

   no of observations:     4


   no of observations:     2

32 4550  01 76 AMG 35 V8           01/01/1982
32 4551  01 76 AMG 35 V8           01/01/1982

   no of observations:     2

32 4850  02 76 GMC 40 V8           01/01/1982
32 4851  02 76 GMC 40 V8           01/01/1982

   no of observations:     4


   no of observations:     2


   no of observations:     8
```

Figure A.5-6

```
-->      MECHANIC INVENTORY BY DIVISION                    JULY 31, 1982

MECH MECHNAME                  DV

0001 BOCHER,AL                 31
0002 PHILLIPS,MARY             31
0006 RICHARDSON,JANE           31
9999 COMPONENT REBUILD         31
0003 THOMPSON,AL               32
0004 MARTINEZ,EMANUAL          32
0005 SMITH,BOB                 32

   no of observations:         7

-->        MECHANIC SENORITY REPORT                        JULY 31, 1982

MECH MECHNAME                  DV HIREDATE

0004 MARTINEZ,EMANUAL          32 11/25/1980
0003 THOMPSON,AL               32 10/12/1981
0006 RICHARDSON,JANE           31 10/16/1981
0002 PHILLIPS,MARY             31 12/23/1981
0001 BOCHER,AL                 31 01/01/1982
0005 SMITH,BOB                 32 11/25/1982
9999 COMPONENT REBUILD         31 01/01/1999

   no of observations:         7
```

Figure A. 5-7

--> REBUILT SUMMARY FOR T100 JUNE 24, 1982

RBL	DATE	MECHNAME	RON	TIME
T100	01/03/1982	BOCHER,AL	10450	7.
T100	01/05/1982	BOCHER,AL	10613	7.
T100	01/04/1982	BOCHER,AL	10501	7.
				21. sum

Figure A.5-8

--> MONTHLY CONSUMMABLES AUDIT REPORT

YRMO	DV	VT	MILES	FUEL	OIL	
8207	31	01	12200	3000	46	
8207	31	02	12200	3000	40	
			24400	6000	86	sum
8207	32	01	11900	3000	74	
8207	32	02	12300	3000	47	
			24200	6000	121	sum
			48600	12000	207	sum

Figure A.5-9

ROAD CALL REPORT FOR MONTH OF JULY, 1982

VEHN	SY	DATE	MILES		WORK DONE		MECH	TIME	RON
4500	44	07/16/1982	126250	RPL RBLT	FUEL SYS	ALL	0006	4	71295
4500	44	07/15/1982	126250	RPL RBLT	FUEL INJECTOR	ALL	0006	6	71280
4500	45	07/23/1982	127890	RPL NEW	1 OR 2 LINER KIT	#6CYL	0006	6	71384
4500	45	07/22/1982	127890	RPL NEW	1 OR 2 LINER KIT	#6CYL	0006	7	71361
4500	45	07/11/1982	125100	ADJUST	ENGINE		0006	7	71244
			633380					30	

um

--> REASON FOR REPAIR = WARRANTY

VEHN	SY	DATE	MILES		WORK DONE		MECH	TIME	RON
4500	13	08/30/1982	132000	OVERHAUL	BRAKES	REAR	0005	7	80179
4500	13	05/10/1982	116207	OVERHAUL	BRAKES	FRONT	0005	6	50106
4500	13	05/10/1982	116207	RPL NEW	S CAM	RT FT	0005	1	50106
4500	16	05/11/1982	116207	ADJUST	SUSPENSION SYS	LF FT	0005	1	50132
4500	27	03/10/1982	100850	RPL RBLT	AUTO TRANS		0003	24	T101
4500	27	03/06/1982	100300	RPL RBLT	AUTO TRANS		9999	21	T100
4500	32	03/07/1982	100482	RPL RBLT	ELECTRIC STARTER		0003	4	30905
4500	44	07/18/1982	126970	RPL NEW	FUEL INJECTOR	#6CYL	0006	5	70315
			933223					69	

um

--> PM HISTORY ON VEHICLE NUMBER 4500

VEHN	SY	DATE	MILES		WORK DONE	MECH	TIME	RON
4500	40	08/25/1982	131300	PM "C"	PREVENTIVE MAINT	0004	7	80099
4500	40	08/25/1982	131300	PM "C"	PREVENTIVE MAINT	0004	6	80103
4500	40	05/22/1982	117100	PM "B"	PREVENTIVE MAINT	0004	7	50200
4500	40	01/20/1982	102200	PM "B"	PREVENTIVE MAINT	0004	7	10300
			481900				27	

um

Figure A.5-10

--> FRONT BRAKE RELINING 8/25/82

VEHN	SY	DATE	MILES	WORK DONE	MECH	TIME	RON
8144	13	05/24/1982	72300	RPL NEW BRAKE LINING(S) FRONT	0004	4	4612
8144	13	05/02/1982	70152	RPL NEW BRAKE LINING(S) FRONT	0006	4	4295
8144	13	03/15/1982	66000	RPL NEW BRAKE LINING(S) FRONT	0006	5	4000
			208452			14	

um

--> GMC V8 FUEL CONSUMPTION FOR 1982 12/31/82

DV	VT	DESC	MPG	MPQ	MPQT	
33	07	01 GMC 40 V6T	4.1	227.4	3025.0	
34	07	01 GMC 40 V6T	4.0	295.6	1636.6	
			4.1	261.5	2330.0	ave

--> PM DUE FOR SPECIAL VEHICLE CODE 9 7/31/82

DV	VEHN	YRMO	MPG	MPQ	MPQT	APM
33	8101	8207	4.3	2133.3	3200.0	6900.0
34	8107	8207	4.0	3000.0	272.7	7200.0
34	8109	8207	3.9	193.3	2900.0	6500.0
34	8112	8207	4.2	315.0	3150.0	6800.0

no of observations: 4

Figure A.5-11

--> THREE MONTH SUMMARY OF FUEL CONSUMPTION

DV	VT	VEHN	YRMO	MPG	MPQ	MPQT	
32	01	4550	8207	3.9	193.3	2900.0	
32	01	4550	8208	3.7	290.0	2900.0	
32	01	4550	8209	3.9	325.0	3250.0	
				3.8	269.4	3016.7	ave
32	01	4551	8207	4.1	305.0	610.0	
32	01	4551	8208	3.9	305.0	3050.0	
32	01	4551	8209	4.2	304.3	2030.0	
				3.9	287.1	2590.0	ave
				4.1	304.0	2163.3	ave
32	02	4850	8207	4.3	2133.3	3200.0	
32	02	4850	8208	4.1	2133.3	3200.0	
32	02	4850	8209	4.2	345.0	3450.0	
				4.2	1537.2	3283.3	ave
32	02	4851	8207	3.9	295.0	2950.0	
32	02	4851	8208	3.8	295.0	2950.0	
32	02	4851	8209	4.2	145.0	2900.0	
				4.1	891.1	3108.3	ave
				4.0	245.0	2933.3	ave
				4.0	589.1	2849.2	ave

--> MECHANICS, DIVISION 32 9/23/82

MECH	MECHNAME	DV	HIREDATE
0004	MARTINEZ,EMANUAL	32	11/25/1980
0003	THOMPSON,AL	32	10/12/1981
0005	SMITH,BOB	32	11/25/1982

Figure A.5-12

A.6 MTD PROJECT SERVICES

TRANS-PAC

1. Introduction
2. Description of the System
   - 2.1 Vehicle Maintenance
   - 2.2 Inventory Control
3. Hardware
4. References

A.6 TRANS-PAC

1. Introduction

At the time TRANS-PAC was developed, microcomputers were not available and minis were the smallest, least expensive systems. Their only real competitors were service bureaus and time share systems. These were undesirable for many transit authorities because of the lack of timeliness and accuracy of information.

MTD Project Services Company, a subsidiary of MDS Qantel, Inc., a corporation specializing in business computer systems, developed a business system for small to medium sized transit authorities that would assist the limited clerical staff of a typical transit authority in performing the ever increasing record-keeping function and operational processing. Much of the development was done in collaboration with Arthur Andersen & Co., which was involved in Project FARE (Financial Accounting and Reporting Elements), an UMTA funded, transit industry sponsored effort to define a uniform external reporting system. The objective of FARE was to specify key financial and operating data, which could be uniformly reported to allow for aggregate industry analyses, and provide a basis for meaningful comparisons between transit systems. In addition to describing this system for external reporting, the FARE Task Report (Reference A.6-1) also recognized an urgent need to improve the internal management information system. It was determined that relevant information is often not available to assist transit management in fulfilling their responsibilities: establishing goals and objectives; developing implementation strategies and plans; monitoring actual performance; and evaluating alternatives for corrective action. In response to these needs, UMTA sponsored an extension of Project FARE, which resulted in the framework for many of the current management information systems. TRANS-PAC is among these systems.

TRANS-PAC is designed to meet all operational needs of small to medium size transit authorities with between 20 and 500 vehicles. In its smallest configuration it is operational on a Quantel System 20 minicomputer. In addition to vehicle maintenance and inventory control, the system provides other operational, administrative, and Section 15 reporting functions including the following:

- Revenue and ridership reporting
- Payroll;
- Personnel attendance records processing;
- Processing of claims and safety records;
- Accounting and financial reporting;
- Accounts payable;
- Accounts receivable;
- Fixed asset accounting,
- Section 15 passenger trip sampling, and level B and C reporting;
- Generation uf user-defined reports.

2. Description of the System

2.1 Vehicle Maintenance

The primary objectives of the Vehicle Maintenance software component are: cost accumulation for labor, parts, and overhead by vehicle; tire control; and fuel and oil usage monitoring. To provide these, the system performs the following specific functions:

1. Preventive Maintenance Scheduling
   The schedule for preventive maintenance is updated daily for all vehicles within a user specified number of miles or days of requiring an inspection or service. A vehicle remains on this schedule until all work has been performed.

2. Fuel and Oil Consumption Monitoring
   Fuel consumption, oil consumption, and vehicle mileage are monitored daily. Miles per gallon and miles per quart are determined daily and those vehicles with consumption rates autside user specified limits are reported in a daily exception report.

3. Work Order Accounting
   Each task performed by a mechanic is recorded on a work order, examples of which are shown in Figures A.6-1, -2, and -3. The vehicle number, the operator and the defect are indicated in Figure A.6-1. This information is carbon copied directly onto Figure A.6-2, the Work Order, which shows the Work Order Number, the date when the work order was opened and closed, the material used, and the work performed. The Classification and Operation Codes and the labor detail are on the back side of the Work Order, shown in Figure A.6-3. From this form the cost of work performed can be allocated to the most appropriate categories including either to a vehicle or a major component. The Work Order is the principal input to the system.

4. Road Call Reporting
   All work performed as a result of a road call is identified and the reason for the roadcall recorded. Repairs as a result of vandalism are similarly identified.

5. Vehicle Maintenance History
   All parts, labor, and overhead costs are accumulated from Work Orders by vehicle on a month-to-date, year-to-date, and life-to-date basis. A detailed history of work performed on each vehicle is produced monthly and accumulated over the life of the vehicle.

6. Tire Inventory and Usage Reporting
   A record of each tire is maintained, which includes tire class (owned, or leased), manufacturer, serial number, size, status (new, regrooved, or retired), life milage, and vehicle identi-fication number. Tire usage is reported monthly by life-to-date miles and status. Tire changes are also reported monthly.

7. Vehicle and Fleet Maintenance Costs
   The maintenance costs in terms of labor, overhead, and parts costs by vehicle and fleet are maintained monthly, yearly, and over the life of the vehicle. Parts costs information is automatically generated as parts are issued by the inventory system.

8. Labor Variance (budget vs. actual)
   For each work operation, corresponding to an operation code shown in Figure A.6-3, a standard or budget number of hours can be user defined. Actual times can be compared with this standard and differences reported.

9. On-line Inquiry
   All master files, including vehicle, fleet, tire, and work order files can be accessed for inquiry purposes.

A.6 TRANS-PAC

Output Reports for Maintenance Management

A brief description of the output reports including some examples are given below.

1. Vehicle Master Listing
   Current information relating to each vehicle type, identification number, capacity, fuel and oil consumption, and direct and overhead costs for the month, year, and life of the vehicle are provided. The date of the last inspection and the limits of inspection in terms of both miles and days are also included in this output report (see Figure A.6-4).

2. Vehicle Exception Report
   Any vehicle which has exceeded the user specified fuel and oil consumption limits is listed in this daily report. (see Figure A.6-5).

3. Fuel and Oil Report
   A daily report of fuel and engine and transmission oil consumption is shown in Figure A.6-6. The monthly fuel and oil averages are shown in Figure A.6-7. Also given are year to date comparisons as well as life-to-date mileage. The totals for the fleet, and the averages for the fleet are also provided. In addition, the number of mechanical and other road calls, the number of vandalisims, and the average miles per road call are recorded on this report.

4. Vehicle Repair Audit Listing
   All work performed during the month, including total labor cost, and the cost of any parts issued from inventory, for each vehicle are reported in detail. The following figures show examples of: the work order entry activity audit listing, Figures A.6-8A and B; the work order classification listing, Figure A.6-9; the operation code listing, Figure A.6-10; the work order master listing, Figure A.6-11; a work order record, Figure A.6-12A and B; the work order general ledger detail audit, Figure A.6-13; and finally, a recap of the work order general ledger labor cost, Figure A.6-14.

5. Employee Labor Report
   Provides a report, by employee number, of the transactions in the labor report file (see Figure A.6-15).

6. Work Order Detail by Vehicle
   Provides a report, of the transactions by vehicle, in the current work order line item file (see Figure A.6-16).

7. Work Order by Customer
   Provides a report, by customer, of work orders in the current work order master file (see Figure A.6-17).

8. Work Order Detail by Finished Inventory
   Provides a report, by finished item, of transactions in the current work order line item file (see Figure A.6-18).

9. Work Order Detail by Inventory Issue
   Provides a report,by inventory items issued, of transactions in the current line item file (see Figure A.6-19). Work Order detail by other items are shown in Figure A.6-20.

10. Work Orders by Class Code
    Provides a report, by class code, of work orders in the current work order master file (see Figure A.6-21).

11. Work Order Detail by Operation Code
    Provides a report, by operation code, of transactions in the current line item file (see Figure A.6-22).

12. Closed Work order Listing
    Provides a report of all closed work orders in the current work order files (see Figure A.6-11 above).

13. Tire File Listing
    Provides a list of all tires including tire I.D. number, manufacturer, tire class, size, and status, life-to-date mileage, vehicle number, and position on vehicle (see Figure A.6-23).

14. Report of Tire Changes
    Provides a listing by date of tires changed. The listing includes the vehicle number, position, mileage, identification of the replacement tire, the mechanic, and the reason for the change (see Figure A.6-24).

15. Tire Cost and Overhead Distribution Report
    Provides a report, by vehicle, of month-to-date mileage and associated tire lease cost (see Figure A.6-25). The cost per mile is specified by the transit authority.

16. Monthly Mileage Variance Report
    For each vehicle, the total mileage read from the hubodometer is compared with total mileage entered through the non-financial statistics system. The variance between these is reported by vehicle, by fleet, and by total mileage (see Figure A.6-26).

17. Tire Purge Audit
    Lists all tires removed from service (see Figure A.6-27).

18. Vehicle Maintenance Schedule
    Provides a list of all vehicles in need of maintenance (see Figure A.6-28).

19. Inspection Due Master Listing
    Provides a list of all vehicles due for inspection (see Figure A.6-29).

Other desired vehicle maintenance reports can be produced on demand using the Report Generator.

2.2 Inventory Control

The purpose of the Inventory Control System is to process and to track purchases, issues from, and receipts and adjustments to inventory. Usage reports, physical to book comparisons, and costing are also supported by the system. The system provides the following functions:

1. Processing of Purchases, Receipts, Issues, and Adjustments to Inventory
   The current inventory level is determined after each change, and, when it falls below a preestablished reorder point, a purchase order is initiated. Inventory can be tracked at multiple locations.

2. Comparison of Physical Inventory to Book Inventory
   The book inventory can be compared to the physical inventory and the necessary adjustments made.

3. Historical Usage Reporting
   Provides analyses of usage by month for the current year and by year for past years.

4. Automatic Interface to General Ledger
   All inventory issues are charged to the appropriate general ledger expense account, and relieved from the appropriate general ledger inventory account. The vehicle maintenance work order system directly ties inventory issues to specific work orders for the monthly work order audit list.

5. Average Cost Method
   A weighted average cost, computed automatically by the system, is used to determine the cost of inventory issues. The procedure used is standard throughout the transit industry.

6. Automatic Interface to the Vehicle Maintenance System
   The issue of inventory automatically updates the month-to-date, year-to-date, and life-to-date costs for each vehicle to which the part was issued.

7. On-line Inquiry
   The inventory master file and inventory history (usage) file can be accessed to obtain information such as on-hand balances, and quantities on-order.

8. Exception Reporting
   Out-of-stock and over stock items can be identified.

A.6 TRANS-PAC

Output Reports for Inventory Management

A brief description of available inventory output reports is given along with some examples.

1. Inventory Master Status History
   Provides all master file information by part number and includes the vendor, substitute vendors, minimum and maximum stock level, order lead time, bin location, last cost and average cost (see Figure A.6-30).

2. Inventory History Report
   Provides a listing of inventory usage for each month during the current year, in addition to total current month-to-date and previous year-to-date quantity and cost (see Figure A.6-31).

3. Inventory Analysis Listing
   Provides an analysis of inventory including amount on-hand, amount on-order, minimum and maximum levels, last purchase order date, lead time in days, average use per month, average turnover in days, and the number of days of supply on-hand and amount to be ordered during the current period (see Figure A.6-32).

4. Physical Inventory Book
   Provides a listing of all parts in the inventory master file sorted by warehouse location. As can be seen in Figure A.6-33, space is available for inserting the physical count. Any deviations are reported in the Physical Inventory Deviation Report shown in Figure A.6-34.

5. Extended Inventory Price Book
   Provides a listing of all parts, including number on-hand, average cost, and extension. The foremat of this report is shown in Figure A.6-35.

6. Inventory Purchase, Receipts, and Adjustments Transactions Listing
   Provides a listing of all transactions involving purchase, receipt, or adjustments to the inventory. This report shown in Figure A.6-36 includes the date, quantity of the invoice, quantity pruchased, quantity received, quantity adjusted, current on-hand, last unit cost, average unit cost, and the value of inventory.

A.6 TRANS-PAC

3. Hardware

TRANS-PAC operates on the Qantel System 20, the smallest of the Qantel family of multi-user, interactive business computers. The Qantel hardware is modular. All applications software is compatible throughout their computer systems. System 20 has 96K bytes of main system memory, a video terminal controller, and a 12 slot I/O card cage. It may be expanded to include:

1. Up to 256K bytes of main system memory in increments of 32 K bytes.
2. Up to 32 intelligent video work stations.
3. Up to 4 disc drives with storage capacity in any combination of 18, 36, 75 and 150 Megabytes and up to a total capacity of 600 Megabytes.
4. Up to 2 flexible disc drives, each with a capacity of 1.3 Megabytes.
5. Up to 30 printers ranging from 30 CPS letter quality printers to 300 LPM line printers.
6. Up to 8 data communications ports, supporting the following protocols and general capabilities: HASP, 2780, 3780, 3270, 3740; General asynchronous; and General bisynchronous.
7. BEST/NET, a local area network for transparent sharing of data files and peripherals among users of attached Qantel systems.

System 20 operates under the control of Qantel's BEST (Business Executive System for Timesharing) operating system, a priority driven, interactive multi-user operating system with fixed size user partitions, distributed network handling, and disc file management. BEST includes dynamic allocation of disc storage area, indexed direct and sequential data files, and multiple file directories on a single disc. To achieve better performance and more flexibility, BEST/AOS (Advanced Operating System) may be used to achieve dynamic memory allocation among users, and disc cache in main memory.

The programming languages available are COBOL AND QUICBASIC, a proprietary high-level language developed to provide support for interactive programming of business oriented applications. The Report Generator is conversational and can produce special or unique reports from any number of data files. The Automatic Program Generator (APG) permits the automated generation of computer programs.

System 20 has a data communications capability that allows video workstations and printers to be physically separated. It also supports a local area network with two to sixteen computers. Access to data files between computers is possible.

Qantel has developed applications software packages, two of which may have application in the transit industry. SOLUTIONS is a set of general business accounting applications with an eight volume library that includes: order processing, accounts receivable, inventory analysis, sales analysis, accounts payable, purchase orders, payroll, and general ledger. The second package is a financial planning and forecasting system, QICPLAN.

4. References

A.6-1 TRANS-PAC Public Sector Overview, MTD Project Services, 1983.

A.6-2 Selected notes and computer listings, MTD Project Services, 1983.

COTPA
WORK ORDER

VEHICLE #	
Operator Show Coach / Vehicle Defects Below	
Operator Badge #	Date:

Figure A.6-1

COTPA
WORK ORDER

VEHICLE #		
Prepared by: Date:	Reviewed by: Date:	Page of

Work Order #	Class #	Billing #
Mileage	Date Open / /	Date Closed / /

If Road Call : Mechanical ☐ Other ☐ Vandalism ☐

Quantity Completed (If For Inventory)

Destination : Inventory ☐ Vehicle ☐ Other ☐

Operator Show Coach/Vehicle Defects Below

MATERIAL USED

Parts #	Description	Quantity	Unit Price

Total Labor	$	
Total Material		
Total Outside Repair		
Job Total	$	

OUTSIDE WORK

Date	Operation Code	Description	Hours	Mark-Up	Hourly Rate

Figure A.6-2

Classification Codes

1 VEHICLE MAINTENANCE (GENERAL)
1B BRAKES, SUSPENSION, STEERING, AXLES
1E ELECTRICAL SYSTEM
1K BODY, GLASS, SEATS
1L LIFT, FAIRINGS, RADIO
1M ENGINE, FUEL, COOLING, EXHAUST
1T TRANSMISSION

3 DRIVER DEFECT CARDS
4 BUILDING, GROUNDS & EQUIPMENT
5 FLEET SUPPORT
6 VEHICLE SERVING (FUEL, OIL, WASH)
7 INVENTORY REPAIRS
8 ACCIDENT
9 SERVICE VEHICLES

Operation Codes

00000 SCHEDULED INSPECTIONS
00100 3,000 MILE INSPECTION
00200 6,000 MILE INSPECTION
00300 10,000 MILE INSPECTION
00400 12,000 MILE INSPECTION
00600 4,000 MILE INSPECTION

A0000 AXLES*
A1000 FRONT END (GENERAL)
A1500 REAR AXLE (GENERAL)
A3501 DIFFERENTIAL, REMOVE&REPLACE
A3502 DIFFERENTIAL, REPAIR
A3506 AXLE, REAR, DIFF. OVERHAUL
A4001 SPINDLE/KING PIN-REMOVE&REPL
A4002 SPINDLE/KING PIN REPAIR

B0000 BRAKING SYSTEM
B0002 MAJOR FRNT BRAKE OVERHAUL
B0502 MAJOR REAR BRAKE OVERHAUL
B1001 FRONT BRAKE RELINE
B1501 REAR BRAKE RELINE
B2001 DRUM, HUB, WHEELS, FRT BAR
B2101 DRUM, HUB, WHEELS, REAR BAR
B4001 AIR SYSTEM FRONT REM & REP
B4002 AIR SYSTEM, FRONT REPAIR
B4101 AIR SYSTEM, REAR, REMV REPLC
B4102 AIR SYSTE, REAR, REPAIR
B6001 AIR COMPRESSOR, REMV&REPLCE
B6002 AIR COMPRESSOR, REPAIR

C000 COOLING SYSTEM
C0006 COOLING, GENERAL, INSPECT
C1001 RADIATOR REMOVE & REPLACE.
C1002 RADIATOR RECORE
C2001 COOLING, WATER PUMP-REMV&R
C2002 COOLING, WATER PUMP-REPAIR
C3001 WATER HOSES, REM & REPLACE
CA001 COOLING, FAN DRIVE, REMV&RPL
CA006 COOLING, FAN DRIVE-OVERHAUL
C5001 THERMOSTAT-REMOVE & REPLC
C5002 THERMOSTAT REPAIR

E0000 ELECTRICAL SYSTEM
E0001 ELEC. SYSTEM-WIRING-REMV&RP
E0002 ELEC. SYSTEM REPAIR
E0006 ELEC. SYSTEM-WIRING-INSPECT
E1001 GENERATOR-REMOVE&REPLCE
E1002 GENERATOR-REPAIR
E1006 GENERATOR-OVERHAUL
E2001 STARTER-REMOVE&REPLC
E2005 STARTER-OVERHAUL
E3001 INTERIOR LIGHTS-REMV&RPLCE
E3002 INTERIOR LIGHTS-REPAIR
E4001 EXTER. LIGHTS-REMV&RPL
E5001 BATTERY-REMOVE&REPLACE
EA001 WIPERS/MOTOR REMRP
EA002 WIPERS/MOTOR-REPAR
E7001 SPEEDOMETER/REMV&RPLC
E7002 SPEEDOMETER-REPAIR
E8001 ELEC. DASH PANEL-REMV&RPLC
F0000 FUELING SYSTEM
F0006 FUEL SYSTEM-INSPECT
F1001 FUEL, LINES, REMOVE&REPLC
F1002 FUEL, LINES-REPAIR
F1006 FUEL, LINES-INSPECT
F2001 FUEL, PUMP-REMOVE&REPLACE
F2005 FUEL, PUMP-OVERHAUL
F3001 FUEL, TANK-REMOVE&REPLACE
F4001 FUEL, INJECTORS-REMVE&REPL

G1002 FAIRING-REPAIR (MAJOR)
G1005 FAIRING-OVERHAUL

H0000 BODY, SEATS, DOORS & GLASS
H0006 BODY-INSPECT
H1001 GLASS REPLACE
H2001 FRNT PANEL/BUMPER R&R
H2501 FRNT, PANEL/BUMPER REPAIR
H2502 REAR PANEL/BUMPER R&R
H2901 BODY,SIDES, PANELS-RMV&RPL
H2902 BODY, SIDES, PANELS-REPAIR
H3001 DOORS REMOVE AND REPLACE
H3002 DOORS-REPAIR
H3501 MIRRORS/TRIM-REMOVE&REPLCE
H3502 MIRROR/TRIM REPAIR
H7001 SEATS-REMOVE&REPLACE
H7002 SEATS-REPAIR

L0002 WHEELCHAIR LIFT REPAIR

M0000 ENGINE
M0001 ENGINE, ASSY, R&R
M0002 ENGINE, ASSY-REPAIR
M0005 ENGINE, ASSY-OVERHAUL
M1001 BLOWER/DRIVE-REMRP
M1002 BLOWER/DRIVE-REPAIR
M1005 BLOWER/DRIVE-OVERHAUL
M2001 HEAD/VALVE R & R
M2002 HEAD/VALVE REPAIR
M2005 HEAD/VALVE OVERHAUL
M3001 GEARS, CAM, CRANK R&R
M3002 GEARS, CAM, CRANK REPAIR
M4001 OIL COOLER-RMV-RPL
M4002 OIL COOLER-REPAIR
M5001 OIL PUMP-REMOVE&RPLC
M5002 OIL PUMP-REPAIR
M5005 OIL PUMP-OVERHAUL
M6001 PISTONS/RINGS-RMV&RPL
M7001 TURBO-REMV&RPLCE
M7002 TURBO-REPAIR
M7005 TURBO-OVERHAUL
M8001 ENGINE GOVERNOR R&R
M8002 ENGINE GOVERNOR REPAIR

S000 STEERING SYSTEM
S1001 STEERING, LOW BOX-REMV&RPLC
S1002 STEERING-LOW BOX-REPAIR
S2001 STEERING, UPPER BOX-REMV&RPLC
S2002 STEERING, UPPER BOX-REPAIR, REMV
S3001 STEERING, SHAFT-REMV&RPLC
S3002 STEERING, SHAFT-REPAIR

S000 SUSPENSION
S0006 SUSPENS, FRT, GEN-INSPECT
S0506 SUSPENS R, GEN-INSPECT
S1001 FRONT U ELLONG-REMV&RP
S1501 REAR BELLOWS REMV&RPL
S3001 BAR, ROD, BUSH, FRONT-RMV&RP
S3002 BAR, ROD, BUSH FRONT REPAIR
S3501 BAR, ROD, BUSH REAR-REMV&RPL
S3502 BAR, ROD, BUSH, REAR REPAIR
S4001 AIR VALVES & LINE FRT BAR
S4002 AIR VALVE & LINE FRT REPAIR
S4501 AIR VALVE & LINE REAR REMRP
S4502 AIR VALVE & LINE REAR REPR

T0000 TRANSMISSION
T0001 TRANSMISSION, ASSY-REMV&RPL
T0002 TRANSMISSION, ASSY-REPAIR
T0005 TRANSMISSION, ASSY-OVERHL
T1001 TURBINE, CLUTCH-R&R
T1002 TURBINE, CLUTCH, REPR
T1005 TURBINE, CLUTCH, OVHL
T2001 TRANS, GOVERNOR-REMV&RPLC
T2002 TRANS, GOVERNOR REPAIR
T2005 TRANS, GOVERNOR OVERHAUL
T4001 HEAT EXCHANGER-R&R
T4002 HEAT EXCHANGER-REPR
T4005 HEAT EXCHANGER-OVRL

X1001 EXHAUST, MUFF/PIPES-RMV&RPL
X1002 EXHAUST, MUFF/PIPE-REPAIR

BRAKE BRAKE ADJUSTING
EQUIP SHOP EQUIPMENT REPAIR
FLEET MISCELLANEOUS
GROUNDS GROUNDSKEEPING
TIRES MOUNTING TIRES
TOWED TOWED BUS

LABOR DETAIL

Operation Performed	Operation Code	Mechanic's Signature & ID	Hrs In	
			Out	
			In	
			Out	
			In	
			Out	
			In	
			Out	
			In	
			Out	
			In	
			Out	
			In	
			Out	
			In	
			Out	
			In	
			Out	
			In	
			Out	
			Hrs.	Min.

Foreman Sign_____ **Date Completed**_____

Figure A.6-3

FRIDAY APRIL 22,1983 — MTD PROJECT SERVICES INC. — PAGE 1

V E H I C L E M A S T E R F I L E L I S T I N G

VEHICLE #: 100
MAKE/MODEL: 350 GMC
CHASSIS #: 5409-U8G-5045
YEAR 1983
DATE RECEIVED: 01/01/83
GROSS WEIGHT: 7890
RADIO: Y
VEHICLE TYPE: 0

SEATING CAPACITY: 66
STANDING CAPACITY: 10
FUEL TANK CAPACITY: 50
NUMBER OF TIRES: 7
MILES SINCE LAST INSPECTION: 25
INSPECTION #: 1 LIMIT: 5000
FLEET ID:
NEXT INSPECTION DUE: 5000

DATE LAST INSPECTION: 01/01/83
INSPECTION LIMIT(DAYS): 30
HUBODOMETER: 25
FUEL TYPE: A - DIESEL
DATE LAST UPDATE: 01/01/83
VEHICLE STATUS: A
ASSET #:
OWNERSHIP FLAG: A

	MILES	FUEL QTY	FUEL COST	MPG	OIL QTY	OIL COST	MPG	PARTS	LABOR	DIRECT COST	DIRECT CPM	OVERHEAD	TOTAL COST	TOTAL CPM
M	25	0	.00	.00	0	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y	0	0	.00	.00	0	.00	.00	.00	.00	.00	.00	.00	.00	.00
L	0	0	.00	.00	0	.00	.00	.00	.00	.00	.00	.00	.00	.00

VEHICLE #: 200
MAKE/MODEL: 350 GMC
CHASSIS #: 3P35-JK-345E
YEAR 1983
DATE RECEIVED: 01/01/83
GROSS WEIGHT: 7890
RADIO: Y
VEHICLE TYPE: 0

SEATING CAPACITY: 66
STANDING CAPACITY: 10
FUEL TANK CAPACITY: 50
NUMBER OF TIRES: 7
MILES SINCE LAST INSPECTION: 26
INSPECTION #: 1 LIMIT: 5000
FLEET ID: 01
NEXT INSPECTION DUE: 5000

DATE LAST INSPECTION: 01/01/83
INSPECTION LIMIT(DAYS): 30
HUBODOMETER: 26
FUEL TYPE: A - DIESEL
DATE LAST UPDATE: 01/01/83
VEHICLE STATUS: A
ASSET #:
OWNERSHIP FLAG: A

	MILES	FUEL QTY	FUEL COST	MPG	OIL QTY	OIL COST	MPG	PARTS	LABOR	DIRECT COST	DIRECT CPM	OVERHEAD	TOTAL COST	TOTAL CPM
M	26	0	.00	.00	0	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y	0	0	.00	.00	0	.00	.00	.00	.00	.00	.00	.00	.00	.00
L	0	0	.00	.00	0	.00	.00	.00	.00	.00	.00	.00	.00	.00

VEHICLE #: 300
MAKE/MODEL: 350 GMC
CHASSIS #: 7S32-FJ-749C
YEAR 1983
DATE RECEIVED: 19/83/
GROSS WEIGHT: 7890
RADIO: Y
VEHICLE TYPE: 0

SEATING CAPACITY: 66
STANDING CAPACITY: 10
FUEL TANK CAPACITY: 50
NUMBER OF TIRES: 7
MILES SINCE LAST INSPECTION: 30
INSPECTION #: 1 LIMIT: 5000
FLEET ID: 01
NEXT INSPECTION DUE: 5000

DATE LAST INSPECTION: 01/01/83
INSPECTION LIMIT(DAYS): 30
HUBODOMETER: 30
FUEL TYPE: A - DIESEL
DATE LAST UPDATE: 01/01/83
VEHICLE STATUS: A
ASSET #:
OWNERSHIP FLAG: A

	MILES	FUEL QTY	FUEL COST	MPG	OIL QTY	OIL COST	MPG	PARTS	LABOR	DIRECT COST	DIRECT CPM	OVERHEAD	TOTAL COST	TOTAL CPM
M	30	0	.00	.00	0	.00	.00	.00	.00	.00	.00	.00	.00	.00
Y	0	0	.00	.00	0	.00	.00	.00	.00	.00	.00	.00	.00	.00
L	0	0	.00	.00	0	.00	.00	.00	.00	.00	.00	.00	.00	.00

Figure A.6-4

VEHICLE MASTER FILE LISTING

VEHICLE #: 00101
MAKE/MODEL: GMC 3302
CHASSIS #: TDH 3302 A-070
YEAR 1973
DATE RECEIVED: 03/20/73
GROSS WEIGHT: 15245
RADIO: Y
VEHICLE MODE: B

SEATING CAPACITY: 33
STANDING CAPACITY: 0
FUEL TANK CAPACITY: 95
NUMBER OF TIRES: 6
MILES SINCE LAST INSPECTION: 169
INSPECTION LIMIT(MILES): 3000
INTERNAL FLEET ID: 01
NEXT INSPECTION: 21000

DATE LAST INSPECTION: 03/14/79
INSPECTION LIMIT(DAYS): 30
ODOMETER: 220004
FUEL TYPE: A - DIESEL
DATE LAST UPDATE: 03/19/79
VEHICLE STATUS: A
ASSET #: 373-37
OWNERSHIP FLAG: 0

	MILES	FUEL QTY	FUEL COST	MPG	OIL QTY	OIL COST	MPO	PARTS	LABOR	DIRECT COST	DIRECT CPM	OVERHEAD	TOTAL COST	TOTAL CPM
M	1991	235	104.08	8.47	13	5.20	153.15	13.22	78.22	200.72	.10	.00	200.72	.10
Y	19779	2578	1017.85	7.67	162	64.80	122.09	998.98	382.59	2464.22	.10	2097.97	4562.19	.23
L	238015		1017.85			64.80		998.98	382.59	2464.22	.01	2097.97	4562.19	.02

VEHICLE #: 00102
MAKE/MODEL: GMC 3302
CHASSIS #: TDH 3302 A-079
YEAR 1973
DATE RECEIVED: 04/02/73
GROSS WEIGHT: 15245
RADIO: Y
VEHICLE MODE: B

SEATING CAPACITY: 33
STANDING CAPACITY: 0
FUEL TANK CAPACITY: 95
NUMBER OF TIRES: 6
MILES SINCE LAST INSPECTION: 0
INSPECTION LIMIT(MILES): 3000
INTERNAL FLEET ID: 01
NEXT INSPECTION: 24000

DATE LAST INSPECTION: 03/17/79
INSPECTION LIMIT(DAYS): 30
ODOMETER: 246000
FUEL TYPE: A - DIESEL
DATE LAST UPDATE: 03/19/79
VEHICLE STATUS: A
ASSET #: 373-38
OWNERSHIP FLAG: 0

	MILES	FUEL QTY	FUEL COST	MPG	OIL QTY	OIL COST	MPO	PARTS	LABOR	DIRECT COST	DIRECT CPM	OVERHEAD	TOTAL COST	TOTAL CPM
M	2122	311	134.97	6.82	9	3.60	235.78	82.32	100.88	321.77	.15	.00	321.77	.15
Y	22254	3311	1304.97	6.72	139	55.60	160.18	2142.32	535.85	4038.54	.15	2097.97	6136.51	.28
L	240381		1304.97			55.60		2142.32	535.85	4038.54	.02	2097.97	6136.51	.02

VEHICLE #: 00103
MAKE/MODEL: GMC 3302
CHASSIS #: TDH 3302 A-080
YEAR 1973
DATE RECEIVED: 03/23/78
GROSS WEIGHT: 15245
RADIO: Y
VEHICLE MODE: B

SEATING CAPACITY: 33
STANDING CAPACITY: 0
FUEL TANK CAPACITY: 95
NUMBER OF TIRES: 6
MILES SINCE LAST INSPECTION: 0
INSPECTION LIMIT(MILES): 3000
INTERNAL FLEET ID: 01
NEXT INSPECTION: 9000

DATE LAST INSPECTION: 03/17/79
INSPECTION LIMIT(DAYS): 30
ODOMETER: 30988
FUEL TYPE: A - DIESEL
DATE LAST UPDATE: 03/19/79
VEHICLE STATUS: A
ASSET #: 373-39
OWNERSHIP FLAG: 0

	MILES	FUEL QTY	FUEL COST	MPG	OIL QTY	OIL COST	MPO	PARTS	LABOR	DIRECT COST	DIRECT CPM	OVERHEAD	TOTAL COST	TOTAL CPM
M	2089	308	170.83	7.45	14	5.60	206.36	4.90	52.51	233.84	.08	.00	233.84	.08
Y	24290	3248	1266.23	7.48	111	44.40	218.83	2318.62	599.87	4249.12	.08	2097.97	6347.09	.26
L	252390		1266.23			44.40		2318.62	599.87	4249.12	.02	2097.97	6347.09	.03

Figure A.6-4 (continued)

MONDAY APRIL 30, 1979 — MID PROJECT SERVICES, INC. — PAGE 1

DAILY VEHICLE EXCEPTION REPORT

VEH #	DATE	GAL.	MPG	FUEL UNIT COST	FUEL TOTAL COST	OIL QTS	OIL UNIT COST	OIL TOTAL COST	TRANS LUBE QTS	TRANS LUBE UNIT COST	TRANS LUBE TOTAL COST	ODOMETER	DAILY MILEAGE	TOTAL COST	COST/ MILE	MECH ID
01 00101	04/14/79	14	9 86	.53	7 42	1	.40	.40	0	.27	.00	231053	138	7 82	.06	
	21000 MILE INSPECTION DUE															
	HIGH FUEL MPG															
01 00105	04/14/79	30	6 77	.53	15 90	3	.40	1.20	0	.27	.00	294036	203	17 10	.08	
	12000 MILE INSPECTION DUE															
01 00107	04/14/79	26	7 38	.53	13 78	2	.40	.80	0	.27	.00	139385	192	14 58	.08	
	6000 MILE INSPECTION DUE															
01 00108	04/14/79	25	8 68	.53	13 25	1	.40	.40	0	.27	.00	106156	217	13 65	.06	
	3000 MILE INSPECTION DUE															
01 00109	04/14/79	30	5 67	.53	15 90	2	.40	.80	0	.27	.00	282165	170	16 70	.10	
	LOW FUEL MPG															
01 00111	04/14/79	12	10 92	.53	6 36	1	.40	.40	0	.27	.00	47827	131	6 76	.05	
	HIGH FUEL MPG															
01 00112	04/14/79	27	9 63	.53	14 31	1	.40	.40	0	.27	.00	6180	260	14 71	.06	
	HIGH FUEL MPG															
01 00117	04/14/79	20	8 10	.53	10 60	0	.40	.00	0	.27	.00	12975	162	10 60	.07	
	15000 MILE INSPECTION DUE															
01 00121	04/14/79	15	6 00	.53	7 95	0	.40	.00	0	.27	.00	52979	90	7 95	.09	
	12000 MILE INSPECTION DUE															

FUEL MPG HIGH LIMIT 9 00
FUEL MPG LOW LIMIT 6 00
OIL CONSUMPTION LIMIT 3
OIL MPG HIGH LIMIT 350 00
9 VEHICLES

FRIDAY APRIL 22,1983 — MID PROJECT SERVICES INC.

DAILY VEHICLE EXCEPTION REPORT

VEH #	DATE	GAL	MPG	FUEL UNIT COST	FUEL TOTAL COST	OIL QTS	OIL UNIT COST	OIL TOTAL COST	TRANS LUBE QTS	TRANS LUBE UNIT COST	TRANS LUBE TOTAL COST	ODOMETER	DAILY MILEAGE	TOTAL COST	COST/ MILE	MECH ID

FUEL MFG HIGH LIMIT .00
FUEL MFG LOW LIMIT .00
OIL CONSUMPTION LIMIT 0
OIL MFG HIGH LIMIT .00
0 VEHICLES

Figure A.6-5

FRIDAY APRIL 22,1983 MTD PROJECT SERVICES INC. PAGE 1

D A I L Y F U E L A N D O I L C O N S U M P T I O N R E P O R T

		FUEL			OIL			TRANS LUBE						
VEH #	DATE	GAL	MPG	UNIT COST	TOTAL COST	QTS	UNIT COST	TOTAL COST	QTS	UNIT COST	TOTAL COST	HUB-ODOMETER	DAILY MILEAGE	TOTAL COST	COST/MILE	MECH ID
TOTALS		0	.00		.00	0		.00	0		.00		0	.00	.00	
0 VEHICLES																

Figure A.6-6

FRIDAY APRIL 22,1983

MTD PROJECT SERVICES INC.

M C N T H L Y F U E L & C I L A V E R A G E S

	VEH #	MTD FUEL	MTD OIL	MTD MILES	MTD M.P.G.	MTD M.P.G.	YTD FUEL	YTD OIL	YTD MILES	YTD M.P.G.	YTD M.P.G.	LTD MILES
01	1C0	0	0	25	.00	.00	0	0	0	.00	.00	0
01	2C0	0	0	26	.00	.00	0	0	0	.00	.00	0
01	3C0	0	0	30	.00	.00	0	0	0	.00	.00	0
01	4C0	0	0	28	.00	.00	0	0	0	.00	.00	0
01	5C0	0	0	24	.00	.00	0	0	0	.00	.00	0
01	6C0	0	0	23	.00	.00	0	0	0	.00	.00	0
01	7C0	0	0	30	.00	.00	0	0	0	.00	.00	0
FLEET C1		7 VEHICLES										
TOTALS		0	0	186	.00	.00	0	0	0	.00	.00	0
AVERAGES		0	0	27			0	0	0			0

	MTD	YTD
MECHANICAL ROAD CALLS	5	30
OTHER ROAD CALLS	4	9
VANDALISM	1	1
AVERAGE MILES PER ROAD CALL	21	0

Figure A.6-7

WORKORDER ENTRY ACTIVITY AUDIT LISTING

WO #	OPEN DATE	CLOSE DATE	BILLING FREQUENCY	SAVE HISTORY	DESTINATION	ROADCALL	VANDALISM	FINISHED QUANTITY	MILEAGE	CLASS CODE	CUST ACCT#
0000022	10/21/82	/ /	M	Y	V 101		N		123546	C100	

LINE ITEM ACTIVITY

DATE	LINE	DESCRIPTION	QTY	UNIT COST	EXTENSION	OVH %	OVERHEAD	TOTAL
0000022 10/21/82	CC1	1 TRANSMISSION	.00	500.0000	.00	.00	.00	.00
				MATERIAL TOTAL	.00		.00	.00
				WORKORDER # 0000022 TOTAL	.00		.00	.00

WO #	OPEN DATE	CLOSE DATE	BILLING FREQUENCY	SAVE HISTORY	DESTINATION	ROADCALL	VANDALISM	FINISHED QUANTITY	MILEAGE	CLASS CODE	CUST ACCT#
0000100	03/01/83	/ /		N	V 101		N		654894	C103	00014

LINE ITEM ACTIVITY

DATE	LINE	DESCRIPTION	QTY	UNIT COST	EXTENSION	OVH %	OVERHEAD	TOTAL
0000100 03/01/83	CC1	00103 ENGINE OVERHAUL A0200 LUIS AGUILAR	6.00	6.2000	37.20	40.70	15.14	52.34
0000100 03/01/83	CC2	00107 MISCELLANEOUS A0200 LUIS AGUILAR	2.00	6.2000	12.40	40.70	5.05	17.45
				LABOR TOTAL	49.60		20.19	69.79
0000100 03/01/83	CC1	10100 XORD ORING	1.00	10.0000	10.00	.00	.00	10.00
0000100 03/01/83	CC2	200 ENGINE REBUILDING KIT FOR 310F	1.00	100.0000	100.00	.00	.00	100.00
				MATERIAL TOTAL	110.00		.00	110.00
				WORKORDER # 0000100 TOTAL	159.60		20.19	179.79

LINE ITEM BILLING ACTIVITY

DATE	LINE	DESCRIPTION	CUST ACCT#	QTY	TOTAL COST	BILLING CODE	BILLING RATE	BILLING AMOUNT
0000100 03/01/83	CC1	00103 ENGINE OVERHAUL A0200 LUIS AGUILAR	00014	6.00	52.34		.00	.00
0000100 03/01/83	CC2	00107 MISCELLANEOUS A0200 LUIS AGUILAR	00014	2.00	17.45		.00	.00
				LABOR TOTAL	69.79			.00
0000100 03/01/83	CC1	10100 XORD ORING	00014	1.00	10.00		.00	.00
0000100 03/01/83	CC2	200 ENGINE REBUILDING KIT FOR 310F	00014	1.00	100.00		.00	.00
				MATERIAL TOTAL	110.00			.00
				WORKORDER # 0000100 TOTAL	179.79			.00

WO #	OPEN DATE	CLOSE DATE	BILLING FREQUENCY	SAVE HISTORY	DESTINATION	ROADCALL	VANDALISM	FINISHED QUANTITY	MILEAGE	CLASS CODE	CUST ACCT#
0000101	03/01/83	03/02/83		N	V 101		N		645897	C103	** CLOSED **

Figure A.6-8A

WORKORDER ENTRY ACTIVITY AUDIT LISTING

LINE ITEM ACTIVITY

DATE	LINE	DESCRIPTION	QTY	UNIT COST	EXTENSION	OVH %	OVERHEAD	TOTAL
CCCC1C1 C3/C1/83 CC1		CC1C7 MISCELLANECUS	3.CC	6.2CCC	18.60	40.7C	7.57	26.17
		AL2CC LUIS ACUILAR						
				LABCR TOTAL	18.60		7.57	26.17
CCCC1C1 C3/C1/83 CC1		CIL MOTOR CIL	3.00	1.2500	3.75	.CC	.00	3.75
				MATERIAL TOTAL	3.75		.00	3.75
				WORKORDER # CCCC1C1 TOTAL	22.35		7.57	29.92

WO #	OPEN DATE	CLOSE DATE	BILLING FREQUENCY	SAVE HISTORY	DESTINATION	ROADCALL	VANDALISM	FINISHED QUANTITY	MILEAGE	CLASS CODE	CUST ACCT#
CCCC1C2 C3/C1/83		/ /		A	1	2CC	N	1		C1C3	

LINE ITEM ACTIVITY

DATE	LINE	DESCRIPTION	QTY	UNIT COST	EXTENSION	OVH %	OVERHEAD	TOTAL
CCCC1C2 C3/C1/83 CC1		CC1C7 MISCELLANECUS	2.CC	6.2000	12.40	40.7C	5.05	17.45
		A02CC LUIS ACUILAR						
				LABCR TOTAL	12.4C		5.05	17.45
				WORKORDER # CCCC1C2 TOTAL	12.40		5.05	17.45

Figure A.6-8B

MTD PROJECT SERVICES, INC

WORKORDER CLASSIFICATION LISTING

CLASS CODE	DESCRIPTION	LABOR OVERHEAD %	MATERIAL OVERHEAD %	SAVE HISTORY	MATERIAL BILLING H/P	MATERIAL BILLING RATE	LABOR BILLING H/P	LABOR BILLING RATE	BILL MONTHLY/ WHEN CLOSED
0101	ACCIDENT REPAIRS REV VEH	40.00	.00	Y		.00		.00	
					MATERIAL				
					DEBIT	005049906200			DUMMY ACCOUNT- WORKORDERS
					CREDIT	001030100000			DUMMY ACCOUNT-WORKORDERS
					LABOR				
					DEBIT				ACCOUNT NOT ON FILE
					CREDIT				ACCOUNT NOT ON FILE
					MATERIAL OVERHEAD				
					DEBIT				
					CREDIT				
					LABOR OVERHEAD				
					DEBIT				ACCOUNT NOT ON FILE
					CREDIT				ACCOUNT NOT ON FILE
					BILLING				
					DEBIT				
					CREDIT				
					OUTSIDE SERVICES				
					DEBIT				
					CREDIT				
0102	REBUILD ENGINE-IN HOUSE	.00	.00	Y		.00		.00	M
					MATERIAL				
					DEBIT	001050200014			WORK IN PROGRESS-BUSSES
					CREDIT	001030100010			BUS PARTS
					LABOR				
					DEBIT	001050200014			WORK IN PROGRESS-BUSSES
					CREDIT	005010204110			MECHANICS
					MATERIAL OVERHEAD				
					DEBIT				
					CREDIT				
					LABOR OVERHEAD				
					DEBIT				
					CREDIT				
					BILLING				
					DEBIT				
					CREDIT				
					OUTSIDE SERVICES				
					DEBIT				
					CREDIT				

Figure A.6-9

THURSDAY SEPTEMBER 30,1982 MTD PROJECT SERVICES, INC PAGE 1

OPERATION CODE LISTING

OPERATION CODE	DESCRIPTION	OPERATION COUNT	OPERATION HOURS	OPERATION COST	CALC STANDARD	ACTUAL STANDARD
00100	VEHICLE INSPECTION	1	5.00	75.00	5.00	8.50
10000	REBUILD ENGINE	0	.00	.00	.00	4.00
99999	SERVICE VEH WORKORDER TES	0	.00	.00	.00	8.00
AG001	AXLE,FRONT,GENERAL-REP	0	.00	.00	.00	.00
AG002	AXLE,FRONT,GENERAL-REPAIR	0	.00	.00	.00	.00
AG003	AXLE,FRONT,GENERAL-REMOVE	0	.00	.00	.00	4.00
AG004	AXLE,FRONT,GENERAL-REPLAC	0	.00	.00	.00	.00
AG005	AXLE,FRONT,GENERAL-OVERHA	0	.00	.00	.00	.00
AG006	AXLE,FRONT,GENERAL-INSPEC	0	.00	.00	.00	1.60
AG007	AXLE,FRONT,GENERAL-CLEAN	0	.00	.00	.00	2.00
EG002	ELEC,SYSTEM&WIRING-REPAIR	0	.00	.00	.00	1.50
MG004	ENGINE ASSEMBLY-INSTALL	0	.00	.00	.00	8.00
MG005	ENGINE ASSEMBLY-OVERHAUL	0	.00	.00	.00	8.50
SG002	SUSPENSION,FRONT,GENERAL	0	.00	.00	.00	2.50

Figure A.6-10

THURSDAY SEPTEMBER 30,1982 — MTD PROJECT SERVICES, INC — PAGE

WORK ORDER MASTER LISTING

WORK ORDER	CLASS CODE	CUSTOMER ACCOUNT #	OPEN DATE	CLOSE DATE	BILL FREQ	SAVE HIST	DEST FLAG	DESTINATION NUMBER	ROAD CALL	VAND	FINISHED INVENTORY	MILEAGE
0000C01	01C0		08/16/82	/ /		Y	0			N	C	0
CE0CC02	01CC		0?/29/81	/ /		Y	V	001C2		N	C	64123
00C0C03	01C0		09/29/81	/ /		Y	V	00103		N	C	647241
C000C04	01C0		09/29/81	/ /		Y	V	00104	M	N	0	78412
C0CGC06	01CC		06/03/81	/ /		Y	V	00102		N	0	65211
GLCCCC5	C1C0		04/09/82	/ /		Y	0			N	0	0
0CC01C0	01C0		03/05/82	/ /		Y	V	001C1		N	0	C
GLCC101	01CC		04/23/82	/ /		Y	V	00101		N	0	0
0LCG1C2	01CG		04/23/82	/ /		Y	V	00102		N	0	0
CCC02C0	01CC		04/22/82	/ /		Y	V	00101		N	0	0
00G1G00	C1C1		04/05/82	/ /		Y	V	C01C1		N	0	126L0C
9955595	C1C3		09/27/82	/ /		N	V	00101		N	0	0

TOTAL RECORDS: 12

Figure A.6-11

W O R K C R D E R # 0000001

DATE OPENED	DATE CLOSED	CLASSIFICATION	CUSTOMER	BILLING FREQUENCY	SAVE HISTORY	ROADCALL	VANDALISM
08/16/82	/ /	C1CO INSPECTION&MAINT REV VEH			Y		N

M A T E R I A L

DATE	LINE	DESCRIPTION	QTY	UNIT COST	EXTENSION	OVERHEAD	TOTAL	BILL AMT
08/16/82	001	100 DIESEL FUEL	1.00	.2500	.25	.CC	.25	.00
					.25	.00	.25	.00

DESTINATION	FINISHED MILEAGE	NEW QUANTITY	UNIT COST		CURRENT PERIOD	TO DATE
C			.0C	MATERIAL	.CC	.25
				MATERIAL OVERHEAD	.00	.00
				LABOR	.CC	.00
				LABOR OVERHEAD	.CC	.00
				OUTSIDE	.CC	.00
				TOTAL	.00	.25
				BILLING	.CC	.00

W O R K C R D E R # 0000101

DATE OPENED	DATE CLOSED	CLASSIFICATION	CUSTOMER	BILLING FREQUENCY	SAVE HISTORY	ROADCALL	VANDALISM
03/01/83	03/02/83	C1C3 GENERAL REPAIRS			N		N

L A B O R

DATE	LINE	DESCRIPTION	QTY	UNIT COST	EXTENSION	OVERHEAD	TOTAL	BILL AMT
03/01/83	001	CC1L7 MISCELLANEOUS AC2CC LUIS ALLILAR	3.0C	6.2CCO	18.6C	7.57	26.17	.CC
					18.60	7.57	26.17	.00

M A T E R I A L

DATE	LINE	DESCRIPTION	QTY	UNIT COST	EXTENSION	OVERHEAD	TOTAL	BILL AMT
03/01/83	001	OIL MOTOR OIL	3.0C	1.25CC	3.75	.CO	3.75	.CC
					3.75	.0C	3.75	.CC

DESTINATION	FINISHED MILEAGE	NEW QUANTITY	UNIT COST		TO DATE
W	101	645657	.0C	MATERIAL	3.75
				MATERIAL OVERHEAD	.00
				LABOR	18.6C
				LABOR OVERHEAD	7.57
				OUTSIDE	.CC
				TOTAL	29.92
				BILLING	.CC

Figure A.6-12

Work Order General Ledger Detail Audit

WORK ORDER #	TRANS	DATE	LINE	GL ACCOUNT #	DESCRIPTION	DEBITS	CREDITS
C0C0C23	L	10/21/82	CC1	CC5C1C2C6CCC	INVALID ACCOUNT #	9.3C	
CCCCC23	L	1C/21/82	CC1	CC5C1C2C6000	INVALID ACCOUNT #		9.30
CCCCC23	M	10/21/82	CC1	CC1C3C10CCCC	PARTS		500.00
CCCCC23	M	1C/21/82	CC1	CC5C49906CCC	OTHER MAT&SUPP INSP&MAINT RV	500.00	
						509.30	509.30
C0CC100	L	C3/01/83	0C1	CC5C10206000	INVALID ACCOUNT #	37.20	
C0CC1CC	L	C3/01/83	CC1	CC5C1C2C6CCC	INVALID ACCOUNT #		37.20
C0CC1CC	L	C3/C1/83	CC2	CC5C1C2C6000	INVALID ACCOUNT #	12.40	
C0CC10C	L	03/01/83	0C2	CC5C10206000	INVALID ACCOUNT #		12.40
C0CC1CC	M	C3/C1/83	CC1	CC1C3C1CCCCC	PARTS		10.00
C0CC100	M	03/01/83	0C1	CC5C49906000	OTHER MAT&SUPP INSP&MAINT RV	10.00	
C0CC1CC	M	C3/C1/83	CC2	CC1C3C10CCCC	PARTS		100.00
C0CC10C	M	C3/C1/83	0C2	CC5C49906000	OTHER MAT&SUPP INSP&MAINT RV	100.00	
						159.60	159.60
C0CC1C1	L	C3/C1/83	0C1	CC5C1C2C6000	INVALID ACCOUNT #	18.60	
C0CC1C1	L	03/01/83	0C1	CC5C10206000	INVALID ACCOUNT #		18.60
C0CC1C1	M	C3/C1/83	CC1	CC1C3C1CCCCC	PARTS		3.75
C0C0101	M	C3/01/83	0C1	CC5C49906000	OTHER MAT&SUPP INSP&MAINT RV	3.75	
						22.35	22.35
C0CC1C2	L	C3/C1/83	CC1	CC5C1C2C6CCC	INVALID ACCOUNT #	12.40	
C0CC1C2	L	03/01/83	0C1	CC5C10206000	INVALID ACCOUNT #		12.40
						12.40	12.40
C0CC123	L	11/01/82	0C1	CC5C10216CCC	OTH SAL&WAGES-GENERAL ADMIN	31.00	
C0CC123	L	11/01/82	CC1	CC5C1C216CCC	OTH SAL&WAGES-GENERAL ADMIN		31.00
C0C0123	L	11/01/82	0C1	CC5C21500CCC	DISTRIBUTION-FRINGE BENEFITS	12.62	
C0CC123	L	11/C1/82	0C1	CC5C215CCCCC	DISTRIBUTION-FRINGE BENEFITS		12.62
C0CC123	M	11/01/82	CC1	CC1C3010CCCC	PARTS		1.53
C0CC123	M	11/C1/82	0C1	CC5C49906CCC	OTHER MAT&SUPP INSP&MAINT RV	1.53	
						45.15	45.15
						748.80	748.80

24 RECORDS

Figure A.6-13

THURSDAY SEPTEMBER 30,1982 — MTD PROJECT SERVICES, INC — PAGE 1

W/C GENER'L LEDGER LABOR RECAP

GL ACCOUNT #	WORK ORDER #	DATE	LINE	EMPLOYEE #	RATE	HOURS	EXTENDED COST
	0000100	09/27/82	001	100	.0000	.03	.00
	0000100	09/27/82	002	100	.0000	.05	.00
	0000100	09/27/82	003	50	10.0000	.02	.20
	0000100	09/27/82	004	50	10.0000	.20	2.00
					ACCOUNT TOTALS	.30	2.20
0030102C4110	0000777	09/27/82	001		10.0000	2.50	25.00
					ACCOUNT TOTALS	2.50	25.00
					SYSTEM TOTALS	2.80	27.20

Figure A.6-14

[illegible] SEPTEMBER 30,1982

MTD PROJECT SERVICES, INC
W/O EMPLOYEE LABOR RECAP

EMPLOYEE #	DATE	WORKORDER #	LINE	GL ACCOUNT #	RATE	HOURS	EXTENDED COST
50	09/27/82	00CU1GC	003		10.0000	.02	.20
50	09/27/82	00CC1CC	CC4		10.CCCC	.20	2.0C
					09/27/82 TOTALS	.22	2.20
					EMPLOYEE TOTALS	.22	2.20
100	09/27/82	0000100	001		.0000	.03	.0C
100	09/27/82	0CLL1L0	002		.0000	.05	.00
					09/27/82 TOTALS	.08	.00
					EMPLOYEE TOTALS	.08	.00
	09/27/82	00C0777	001	005010204110	10.0000	2.50	25.00
					09/27/82 TOTALS	2.5C	25.0C
					EMPLOYEE TOTALS	2.5C	25.00
					SYSTEM TOTALS	2.8C	27.2C

Figure A.6-15

THURSDAY SEPTEMBER 30,1982 — MTD PROJECT SERVICES, INC — PAGE 1

WORK ORDER DETAIL
FOR
VEHICLE 00101

WO #	DATE	LINE	DESCRIPTION	QUANTITY	UNIT COST	EXTENSION	OVERHEAD	TOTAL COST	BILL AMOUNT
[illegible]	09/27/82	001	001CL 001CC	.03	.0000	.00	.00	.00	.00
			100 DANGERCUS DAN MCGREW						
[illegible]	09/27/82	002	001CL 001CC	.05	.0000	.00	.00	.00	.00
			100 DANGERCUS DAN MCGREW						
001L100	09/27/82	003	001CC 001CC	.07	10.0000	.20	.00	.00	.00
			50 JOHN DOE						
0C001CO	09/27/82	004	00100 00100	.20	10.0000	2.00	.00	.00	.00
			5L JOHN DOE						
					LABOR TOTAL	2.20	.00	.00	.00
0000100	09/27/82	001	100 DIESEL FUEL	1.00	.0500	.05	.00	.00	.00
0000100	09/27/82	002	200 OIL	2.00	.0000	.00	.00	.00	.00
					MATERIAL TOTAL	.05	.00	.00	.00
					VEHICLE TOTAL	2.25	.00	.00	.00

Figure A.6-16

FRIDAY APRIL 21, 1989

MID PROJECT SERVICES
WORK ORDERS BY CUSTOMER LISTING

CUSTOMER	WO #	CLASS	OPEN DATE	CLOSE DATE	BILL	DESTINATION	MATERIALS TO - DATE	MAT OVHD TO - DATE	LABOR TO - DATE	LAB OVHD TO - DATE	OUTSIDE TO - DATE	BILLING TO - DATE
CCC14	CCCC1C0	C103	03/C1/89	/ /	Y	1C1	11C.CC	.CC	49.6C	2C.19	.CC	.CC
						CUSTOMER TCTAL	110.CC	.CC	49.6C	2C.19	.CC	.CC
						SYSTEM TCTAL	11C.CC	.CC	49.6C	2C.19	.CC	.CC

Figure A.6-17

[illegible] [illegible]

WORK ORDER DETAIL BY FINISHED INVENTORY

WC #	DATE	LINE	DESCRIPTION	QUANTITY	UNIT COST	EXTENSION	OVERHEAD	TOTAL COST	MILL AMOUNT
ITEM #: 2CC									
CCCC1C2	C3/C1/83	C01	OC107 MISCELLANEOUS AC2CL LLIS ACLILAR	2.00	6.2000	12.40	5.05	17.45	.CO
			LABOR TOTAL			12.40	5.05	17.45	.00
			INVENTORY ITEM TOTAL			12.40	5.05	17.45	.00
			SYSTEM TOTAL			12.40	5.05	17.45	.00

Figure A.6-18

MID PROJECT SERVICES
WORK ORDER DETAIL BY INVENTORY ISSUES

DESCRIPTION	WO #	DATE	LINE	QUANTITY	UNIT COST	EXTENSION	OVERHEAD	TOTAL COST	BILL AMOUNT
2CC ENGINE REBUILDING KIT FOR 31CF	CCC01CC	03/01/83	CC2	1.CC	1CC.CCCC	1CC.CC	.CC	1CC.CC	.CC
INVENTORY ISSUE TOTAL				1.CC		1CC.CC	.CC	1CC.CC	.CC
CIL MOTOR OIL	CCC0101	03/01/83	CC1	3.CC	1.25CC	3.75	.CC	3.75	.CC
INVENTORY ISSUE TOTAL				3.CC		3.75	.CC	3.75	.CC
LASTIC CORD CRING	CCCC100	03/01/83	CC1	1.CC	1C.CCCC	1C.CC	.CC	1C.CC	.CC
INVENTORY ISSUE TOTAL				1.CC		1C.CC	.CC	1C.CC	.CC
					SYSTEM TOTAL	113.75	.CC	113.75	.CC

Figure A.6-19

WORK ORDER DETAIL BY OTHER ITEMS

WO #	DATE	ITM	DESCRIPTION	QUANTITY	UNIT COST	EXTENSION	OVERHEAD	TOTAL COST	BILL AMOUNT
ITEM #									
00001C3	03/01/83	001	CC1C7 MISCELLANEOUS A02CC LUIS AGUILAR	3.50	6.2000	21.70	8.83	30.53	.00
			LABOR TOTAL			21.70	8.83	30.53	.00
			OTHER ITEM TOTAL			21.70	8.83	30.53	.00
			SYSTEM TOTAL			21.70	8.83	30.53	.00

Figure A.6-20

WORK ORDERS BY CLASS CODE LISTING

CLASS	WO #	CUSTOMER	OPEN DATE	CLOSE DATE	BILL	DESTINATION	MATERIALS TO - DATE	MAT OVHD TO - DATE	LABOR TO - DATE	LAB OVHD TO - DATE	OUTSIDE TO - DATE	BILLING TO - DATE
01CC	6000601		08/16/82	/ /	C		.25	.00	.00	.00	.00	.00
01CC	CCLLC02		09/29/81	/ /	V	00102	913.54	.00	1011.28	22.45	125.00	.00
C1CC	0000003		09/29/81	/ /	V	CC1C3	.00	.00	71.36	.00	.00	.00
C1CC	CCCCLC4		09/29/81	/ /	V	CC1C4	.00	.00	115.96	.00	.00	.00
C1CC	CCLOCC6		08/03/81	/ /	V	CC1C7	35.89	.00	17.84	.00	.00	.00
C1CC	CCCCCC7		04/09/82	/ /	O		479.00	.00	5.02	.00	.00	.00
C1CC	0C001C6		03/05/82	/ /	V	CC1C1	1917.55	.00	396.92	81.51	.00	.00
C1CC	CLCC1C1		04/23/82	/ /	V	0C1C1	5C7.25	.00	186.54	.00	.00	.00
C1CC	CCCC1C2		04/23/82	/ /	V	CC1C2	121.40	.00	22.55	.00	.00	.00
01CC	0C00200		04/22/82	/ /	V	0C1C1	5CC.CC	.00	.00	.00	.00	.00
						CLASS CODE TOTAL	4474.68	.00	1831.47	103.96	125.00	.00
C1C1	CCC1CCC		04/05/82	/ /	V	CC1C1	128.99	.00	71.85	29.24	.00	.00
						CLASS CODE TOTAL	128.99	.00	71.85	29.24	.00	.00
C1C1	9999999		09/27/82	/ /	V	0C101	.00	.00	.00	.00	.00	.00
						CLASS CODE TOTAL	.00	.00	.00	.00	.00	.00
						SYSTEM TOTAL	4603.87	.00	1903.32	133.20	125.00	.00

Figure A.6-21

WORK ORDER DETAIL BY OPERATION CODE

DESCRIPTION	WO #	DATE	LINE	QUANTITY	UNIT COST	EXTENSION	OVERHEAD	TOTAL COST	BILL AMOUNT
CC10C INSPECTION OF REV VEH AC2CC LUIS AGUILAR	CFCC123	11/01/82	CC1	5.CC	6.2CCC	31.CC	12.62	43.62	.CC
				OPERATION CODE TOTAL		31.CC	12.62	43.62	.CC
CC1C2 TRANSMISSION OVERHAUL BC2CC TED L HOLMES	CFCOC23	1C/21/82	CC1	1.5C	6.2CCC	9.3C	3.79	13.09	.CC
				OPERATION CODE TOTAL		9.30	3.79	13.09	.CC
CC103 ENGINE OVERHAUL AC2CC LUIS AGUILAR	CFCO1CC	C3/01/83	CC1	6.0C	6.2CCC	37.2C	15.14	52.34	.CC
				OPERATION CODE TOTAL		37.20	15.14	52.34	.00
CC107 MISCELLANEOUS AC2CC LUIS AGUILAR	OCCO1CC	C3/C1/83	CC2	2.0C	6.2CCO	12.4C	5.05	17.45	.0C
CC1C7 MISCELLANEOUS AC2CC LUIS AGUILAR	OFCO1C1	C3/01/83	CC1	3.0C	6.2000	18.6C	7.57	26.17	.CC
CO107 MISCELLANEOUS AC2CC LUIS AGUILAR	OCCO1C2	C3/01/83	CO1	2.00	6.2000	12.4C	5.05	17.45	.CC
				OPERATION CODE TOTAL		43.4C	17.67	61.07	.CC
				SYSTEM TOTAL		12C.90	49.22	170.12	.CC

Figure A.6-22

FRIDAY APRIL 22,1983

MTD PROJECT SERVICES INC.

T I R E F I L E L I S T I N G

TIRE CLASS	PART ID	TIRE ID	TIRE SIZE	TIRE STATUS	NEW TIRE MILES	REGROOVED TIRE MILES	RECAPPED TIRE MILES	TOTAL TIRE MILES	VEH #	LTD MILES	POSITION
L	GY	WT10	12.225	N	1450	0	0	1450	102	14835	LF
L	GY	WT11	12.225	N	350	0	0	350	102	14835	RF
L	GY	WT115	12.225	N	0	0	0	0	101	21698	LF
L	GY	WT119	12.225	N	5712	0	0	5712	101	21698	RF
L	GY	WT121	12.225	N	0	0	0	0	101	21698	RRO
L	GY	WT123	12.225	N	0	0	0	0	102	14835	RRI
L	GY	WT124	12.225	N	0	0	0	0	101	21698	LRO
L	GY	WT128	12.225	N	0	0	0	0	101	21698	RRI
L	GY	WT129	12.225	N	7423	0	0	7423	101	21698	LRI
L	GY	WT130	12.225	N	12478	0	0	12478	102	14835	RRO
L	GY	WT139	12.225	N	0	0	0	0	102	14835	LRI
L	GY	WT140	12.225	N	0	0	0	0	102	14835	LRO
L	GY	WT151	12.225	N	0	0	0	0		0	
L	GY	WT152	12.225	N	0	0	0	0		0	
	TIRE SIZE TOTALS				27413	0	0	27413			

NEW TIRES: 14
REGROOVED TIRES: 0
RECAPPED TIRES: 0
DEAD TIRES: 0
OUT OF INV. TIRES: 0
LEASED TIRES: 14
OWNED TIRES: 0

	MANUFACTURER TOTALS				27413	0	0	27413			

NEW TIRES: 14
REGROOVED TIRES: 0
RECAPPED TIRES: 0
DEAD TIRES: 0
OUT OF INV. TIRES: 0
LEASED TIRES: 14
OWNED TIRES: 0

	TIRE CLASS TOTALS				27413	0	0	27413			

NEW TIRES: 14
REGROOVED TIRES: 0
RECAPPED TIRES: 0
DEAD TIRES: 0
OUT OF INV. TIRES: 0
LEASED TIRES: 14
OWNED TIRES: 0

Figure A.6-23

FRIDAY APRIL 22,1983

MTD PROJECT SERVICES INC.

REPORT OF TIRE CHANGES

TIRE SIZE	DATE	VEH NUMBER	WH POS	TIRE OFF	SEQ	TIRE ON	TIRE MILEAGE	VEHICLE MILEAGE	CHANGED LOC	CHANGED BY	REMARKS
12.225	05/31/83	102	RF	GYWT1C	1	GYWT11	536-	13949	GAR	SEH	TIRE ROTATION
12.225	05/31/83	102	LF	GYWT1C	1	GYWT11	564	13949	GAR	SEH	TIRE ROTATION
12.225	05/31/83	102	RF	GYWT11	1	GYWT1C	536-	13949	GAR	SEH	TIRE ROTATION

Figure A.6-24

MONDAY DECEMBER 31,1979 MTD PROJECT SERVICES, INC PAGE 1

TIRE COST AND OVERHEAD DISTRIBUTION REPORT

VEHICLE NUMBER	MTD MILEAGE	NUMBER OF TIRES	PARTS COST	PARTS TIRES	PARTS TOTAL	OVERHEAD PREVIOUS	OVERHEAD PLUS	OVERHEAD CURRENT
00101	1200	6	85.55	17.11	102.66	159.29	4.55	163.84
00102	0	6	.00	.00	.00	159.29	4.55	163.84
00103	0	6	.00	.00	.00	159.29	4.55	163.84
00104	0	6	.00	.00	.00	159.29	4.55	163.84
00105	0	6	.00	.00	.00	159.29	4.55	163.84
00106	0	6	.00	.00	.00	159.29	4.55	163.84
00107	0	6	.00	.00	.00	159.29	4.55	163.84
00108	0	6	.00	.00	.00	159.29	4.55	163.84
00109	0	6	.00	.00	.00	159.29	4.55	163.84
00110	0	6	.00	.00	.00	159.29	4.55	163.84
00111	0	6	.00	.00	.00	159.29	4.55	163.84
00112	0	6	.00	.00	.00	159.29	4.55	163.84
00113	0	6	.00	.00	.00	159.29	4.55	163.84
00114	0	6	.00	.00	.00	159.29	4.55	163.84
00115	0	6	.00	.00	.00	159.29	4.55	163.84
00116	0	6	.00	.00	.00	159.29	4.55	163.84
00117	0	6	.00	.00	.00	159.29	4.55	163.84
00118	0	6	.00	.00	.00	159.29	4.55	163.84
00119	0	6	.00	.00	.00	159.29	4.55	163.84
00120	0	6	.00	.00	.00	159.29	4.55	163.84
00121	925	6	65.23	13.19	78.42	75.47	4.55	80.02
10000	0	0	.00	.00	.00	4.45	4.45	8.90

FLEET 01 FLEET TIRE COST: 30.30 FLEET OVERHEAD: 100.00

TOTAL TIRE COST: 30.30 TOTAL OVERHEAD: 100.00

Figure A.6-25

MTD PROJECT SERVICES INC.
MONTHLY VEHICLE MILEAGE REPORT

DATE 04/22/83 PAGE 1

FLEET ID	VEHICLE NUMBER	VEHICLE MILEAGE
C1	100	25
C1	200	26
C1	300	30
C1	400	28
C1	500	24
C1	600	23
C1	700	30
FLEET C1 TOTAL MILEAGE		186
BB	000	0
BB	079	0
BB	080	0
BB	081	0
BB	082	0
BB	083	0
BB	084	0
BB	085	0
BB	086	0
BB	087	0
BB	088	0
BB	089	0
BB	090	0
BB	091	0
BB	092	0
BB	093	0
BB	095	0
BB	096	0
BB	097	0
BB	098	0
BB	099	0
BB	101	0
BB	102	0
BB	103	0
BB	104	0
FLEET BB TOTAL MILEAGE		0
DG	13	0
DG	0001	0
DG	0002	0
DG	0003	0
DG	0004	0
DG	0005	0
FLEET DG TOTAL MILEAGE		0
GM	050	0
FLEET GM TOTAL MILEAGE		0
FINAL TOTAL MILEAGE		186

Figure A.6-26

MONDAY NOVEMBER 5,1979 MTB PROJECT SERVICES, INC PAGE 1

TIRE PURGE AUDIT

TIRE CLASS	MANF ID	TIRE SERIAL #	TIRE SIZE	TIRE STATUS	MILEAGE DATA NEW	REGROOVED	RECAPPED	TOTAL
L	GY	1	22-11.5	0	7000	0	0	7000

*** TIRE SIZE TOTALS ***
TOTAL TIRES: 1
TOTAL MILEAGE: 7000
AVG MILES PER TIRE: 7000

*** MANUFACTURER TOTALS ***
TOTAL TIRES: 1
TOTAL MILEAGE: 7000
AVG MILES PER TIRE: 7000

*** TIRE CLASS TOTALS ***
TOTAL TIRES: 1
TOTAL MILEAGE: 7000
AVG MILES PER TIRE: 7000

Figure A.6-27

V E H I C L E M A I N T E N A N C E S C H E D U L E

FLEET	VEH #	MILES SINCE LAST INSPECTION	INSPECTION NO.	INSPECTION LIMIT	DUE	DATE LAST INSPECTED	MILEAGE M-T-D	MILEAGE Y-T-D	FUEL L-T-D	FUEL M-T-D	FUEL MPG	OIL M-T-D	OIL MPG	INSPECTION DAY LIMIT
01	100	25	1	5000	5000	01/01/83	25	0	0	0	.00	0	.00	30
		**** W A R N I N G **** INSPECTION DUE * LOW FUEL MPG												
01	200	26	1	5000	5000	01/01/83	26	0	0	0	.00	0	.00	30
		**** W A R N I N G **** INSPECTION DUE * LOW FUEL MPG												
01	300	30	1	5000	5000	01/01/83	30	0	0	0	.00	0	.00	30
		**** W A R N I N G **** INSPECTION DUE * LOW FUEL MPG												
01	400	28	1	5000	5000	01/01/83	28	0	0	0	.00	0	.00	30
		**** W A R N I N G **** INSPECTION DUE * LOW FUEL MPG												
01	500	24	1	5000	5000	01/01/83	24	0	0	0	.00	0	.00	30
		**** W A R N I N G **** INSPECTION DUE * LOW FUEL MPG												
01	600	23	1	5000	5000	01/01/83	23	0	0	0	.00	0	.00	30
		**** W A R N I N G **** INSPECTION DUE * LOW FUEL MPG												
01	700	35	1	5000	5000	01/01/83	30	0	0	0	.00	0	.00	30
		**** W A R N I N G **** INSPECTION DUE * LOW FUEL MPG												

01 FUEL MPG HIGH LIMIT 6.00
FUEL MPG LOW LIMIT 4.00
OIL MPG HIGH LIMIT 155.42

Figure A.6-28

INSPECTION DUE MASTER LISTING

ID		LIMIT	INSPECTION		LIMIT	INSPECTION		LIMIT	INSPECTION		LIMIT	INSPECTION
01												
	1	5000	5000	10			19			28		37
	2	5000	10000	11			20			29		38
	3	5000	15000	12			21			30		39
	4	5000	20000	13			22			31		40
	5	5000	25000	14			23			32		41
	6			15			24			33		42
	7			16			25			34		43
	8			17			26			35		44
	9			18			27			36		45
88												
	1	5000	5000	10			19			28		37
	2	5000	10000	11			20			29		38
	3	5000	15000	12			21			30		39
	4	5000	20000	13			22			31		40
	5	5000	25000	14			23			32		41
	6			15			24			33		42
	7			16			25			34		43
	8			17			26			35		44
	9			18			27			36		45
DG												
	1	5000	5000	10			19			28		37
	2	5000	10000	11			20			29		38
	3	5000	15000	12			21			30		39
	4	5000	20000	13			22			31		40
	5			14			23			32		41
	6			15			24			33		42
	7			16			25			34		43
	8			17			26			35		44
	9			18			27			36		45
MB												
	1	5000	5000	10			19			28		37
	2	5000	10000	11			20			29		38
	3	5000	15000	12			21			30		39
	4	5000	20000	13			22			31		40
	5	5000	25000	14			23			32		41
	6			15			24			33		42
	7			16			25			34		43
	8			17			26			35		44
	9			18			27			36		45

Figure A.6-29

MTD PROJECT SERVICES, INC

INVENTORY MASTER/STATUS LISTING

DATE 03/23/79 FRIDAY MARCH 23,1979 PAGE 1

ITEM NUMBER / ITEM DESCRIPTION	UN	UR	LOCATION	LAST COST	AVERAGE COST	QUANTITIES			
282 CLUTCH STARTER	EA		SMB2	18.93	18.93	MINIMUM	0	ON HAND	2
SUBSTITUTE : 1965350						MAXIMUM	3	COMMITTED	0
PRODUCT CLASS : 07 MODEL 1 BN470 MODEL 2 3302A MODEL 3						LEAD TM	10	ON ORDER	0
BUYER : BD MODEL 4 MODEL 5 MODEL 6						QTY/PKG	1	AVAILABLE	2
VENDOR # : VENDOR ITEM # : DESCRIPTION :									
460 BEARING	EA		SAB4	8.74	8.63	MINIMUM	2	ON HAND	2
SUBSTITUTE : 187291						MAXIMUM	4	COMMITTED	0
PRODUCT CLASS : 00 MODEL 1 3302A MODEL 2 MODEL 3						LEAD TM	10	ON ORDER	3
BUYER : BD MODEL 4 MODEL 5 MODEL 6						QTY/PKG	1	AVAILABLE	2
VENDOR # : VENDOR ITEM # : DESCRIPTION :									
493 BEARINGS	EA		SAB5	4.56	4.56	MINIMUM	1	ON HAND	10
SUBSTITUTE : 125670						MAXIMUM	2	COMMITTED	0
PRODUCT CLASS : 00 MODEL 1 MODEL 2 MODEL 3						LEAD TM	10	ON ORDER	3
BUYER : BD MODEL 4 MODEL 5 MODEL 6						QTY/PKG	1	AVAILABLE	10
VENDOR # : 4266 VENDOR ITEM # : DESCRIPTION :									
530 BELT	EA		SPB2	6.59	6.58	MINIMUM	0	ON HAND	30
SUBSTITUTE :						MAXIMUM	1	COMMITTED	0
PRODUCT CLASS : 00 MODEL 1 MODEL 2 MODEL 3						LEAD TM	10	ON ORDER	10
BUYER : BD MODEL 4 MODEL 5 MODEL 6						QTY/PKG	1	AVAILABLE	30
VENDOR # : VENDOR ITEM # : DESCRIPTION :									
612 CONE	EA		SAB4	3.04	3.35	MINIMUM	1	ON HAND	4
SUBSTITUTE : 142321						MAXIMUM	2	COMMITTED	0
PRODUCT CLASS : 00 MODEL 1 MODEL 2 MODEL 3						LEAD TM	10	ON ORDER	3
BUYER : BD MODEL 4 MODEL 5 MODEL 6						QTY/PKG	1	AVAILABLE	4
VENDOR # : VENDOR ITEM # : DESCRIPTION :									
623 BEARING	EA		SAB4	10.38	10.19	MINIMUM	1	ON HAND	4
SUBSTITUTE : 116434						MAXIMUM	2	COMMITTED	0
PRODUCT CLASS : 00 MODEL 1 3302A MODEL 2 MODEL 3						LEAD TM	10	ON ORDER	5
BUYER : BD MODEL 4 MODEL 5 MODEL 6						QTY/PKG	1	AVAILABLE	4
VENDOR # : 4266 VENDOR ITEM # : DESCRIPTION :									
841 RELAY	EA			6.48	6.48	MINIMUM	0	ON HAND	0
SUBSTITUTE :						MAXIMUM	1	COMMITTED	0
PRODUCT CLASS : 00 MODEL 1 MODEL 2 MODEL 3						LEAD TM	10	ON ORDER	1
BUYER : BD MODEL 4 MODEL 5 MODEL 6						QTY/PKG	1	AVAILABLE	0
VENDOR # : 1666 VENDOR ITEM # : DESCRIPTION :									
895 BEARING - U JOINT	EA		SBB4	23.00	23.00	MINIMUM	0	ON HAND	1
SUBSTITUTE :						MAXIMUM	1	COMMITTED	0
PRODUCT CLASS : 00 MODEL 1 3302A MODEL 2 MODEL 3						LEAD TM	10	ON ORDER	0
BUYER : BD MODEL 4 MODEL 5 MODEL 6						QTY/PKG	1	AVAILABLE	1
VENDOR # : 1866 VENDOR ITEM # : DESCRIPTION :									
896 BEARING - U JOINT	EA		SBB4	28.95	28.95	MINIMUM	1	ON HAND	0
SUBSTITUTE : 667502						MAXIMUM	2	COMMITTED	0
PRODUCT CLASS : 00 MODEL 1 3302A MODEL 2 MODEL 3						LEAD TM	10	ON ORDER	4
BUYER : BD MODEL 4 MODEL 5 MODEL 6						QTY/PKG	1	AVAILABLE	0
VENDOR # : 1866 VENDOR ITEM # : DESCRIPTION :									

Figure A.6-30

MTO PROJECT SERVICES, INC

INVENTORY HISTORY REPORT

THURSDAY SEPTEMBER 30,1982 PAGE 1

ITEM # DESCRIPTION	PREV Y-T-D	CURR Y-T-D	CURR M-T-D	MONTHLY ACTIVITY OCT82	SEP82	AUG82	JUL82	JUN82	MAY82	APR82	MAR82	FEB82	JAN82	DEC81	NOV81
1 TEST															
QUANTITY:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$ COST:		13735.50	13735.50												
2 TEST															
QUANTITY:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$ COST:		.00	.00												
100 DIESEL FUEL															
QUANTITY:	15000	908	56	852	1200	0	0	0	0	0	0	0	0	0	0
$ COST:		342385.00	74410.00												
200 OIL															
QUANTITY:	0	68	2	66	0	0	0	0	0	0	0	0	0	0	0
$ COST:		2095.60	.00												
300 LUBE															
QUANTITY:	0	13	0	13	0	0	0	0	0	0	0	0	0	0	0
$ COST:		3498.60-	.00												
400 GASOLINE															
QUANTITY:	0	176	0	176	0	0	0	0	0	0	0	0	0	0	0
$ COST:		2468.40	.00												
500 BRAKE LINING															
QUANTITY:	80	108	0	104	4	0	24	4	0	32	12	4	10	0	0
$ COST:		685.74	.00												
ANAN ANANASE															
QUANTITY:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$ COST:		57.12	.00												
LAST10 XORD ORING															
QUANTITY:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$ COST:		16.00	.00												
C5555884 STARTER SWITCH															
QUANTITY:	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$ COST:		.00	.00												
1000000C00000 TEST ITEM # 1															
. . . . .	.	.	.	10	0	0	0	0	0	0	0	0	0	0	0

Section 7.2 R-1

Figure A.6-31

MTD PROJECT SERVICES, INC

I N V E N T O R Y A N A L Y S I S L I S T I N G

DATE 03/23/79 FRIDAY MARCH 23,1979 PAGE 1

ON HAND	CMTD	ON ORDER	LAST P/O DATE	MIN LEVEL	MAX LEVEL	DAYS LEAD	ORDER PACK	#MO ACTV	AVG USE /MO	YTD AVG USE /MO	TIMES D/O YTD	TIMES D/O MTD	DAYS TURN AROUND MNMX	DAYS SFLY ONHD	DAYS SFLY AVAIL	REACCOM PUNCH QTY	PUNCH REASON MIN LT STK	LT TM
OIL 30WD					QT													
0	0	0		0L	1600R	3	1	3	1142	1169			21			1600	MIN	LT
9425 BELT					EA													
0	0	0		2R	5R	10	1	13	2	2						5	MIN	LT
9630 BELTS					EA													
0	0	0		3R	9R	10	1	15	3	2						9	MIN	LT
P634 BOLTS					EA													
0	0	0		10	25	10	1	9	39	36			18			25	MIN	LT
82918 NUT					EA													
0	0	0		0	3R	10	1	1								3	MIN	LT
P1146 FILTER FOAM					EA													
0	0	0		0	6R	10	1	4	1							6	MIN	LT
P1147 FILTER FOAM					EA													
0	0	0		0	6R	10	1	4	1							6	MIN	LT
104179 MOTOR A/C					EA	SM87												
0	0	0		0	1R	10	1	7	1	1						1	MIN	LT
121753 WASHER					EA													
0	0	0		0	4R	10	1	1								4	MIN	LT
140415 BEARING					EA													
0	0	0		0	1R	10	1	1								1	MIN	LT
260877 BUSHING					EA													
0	0	0		0	4R	10	1	1								4	MIN	LT
455271 CAM					EA													
0	0	0		0	1R	10	1	4								1	MIN	LT

Figure A.6-32

A.9 Maintenance and Inventory System

1. Introduction

In mid 1980, six western transit authorities formed a consortium (The Western Transit Maintenance Consortium) to design a computerized maintenance and inventory system. The consortium includes the following members:

- o Denver Regional Transportation District (RTD)
- o Orange County Transit District (OCTD)
- o Sacremento Regional Transit District (RT)
- o Santa Clara County Transit District (SCCTD)
- o Municipality of Metropolitan Seattle (METRO)

A sixth member, the San Diego Transit Corporation, contributed significantly to the design phase of the project, but, because of particular computer requirements and software development priorities, decided not to participate in the later project phases.

The objective of this project was to design a Maintenance Management Information System that is operable on a modern minicomputer, easily transferable, and economically implementable at each authority. The functional requirements for the system were developed after evaluation of each members current maintenance, inventory, and data processing system. The following functions are included in the system:

- o Preventive Maintenance
- o Work Order
- o Inventory Management
- o Failure Monitoring
- o Equipment Status Tracking
- o Management Reporting
- o Planning

The system programs are written in COBOL. After an evaluation of available software, it was determined that software developed by a major trucking firm could meet most of the inventory and work order requirements of the system. This software was modified and included.

To date, implementation of the inventory control system has been completed at the Orange County Transit District. Implementation of the work order system is nearing completion at the Seattle METRO.

A.9 WESTERN TRANSIT MAINTENANCE CONSORTIUM

MAINTENANCE AND INVENTORY SYSTEM

RUN DATE: 04/01/82

CITY OF SAMPLEVILLE
PTI EQUIPMENT MANAGEMENT INFORMATION SYSTEM

PAGE NO: 1

*** PUMP RECONCILATION REPORT ***

PUMP NO.	PUMP READING ON	PUMP READING OFF	PUMP READING PERIOD	GALLONS DISPENSED	GALLONS REPORTED ON FUEL TICKETS	GALLONS DIFFERENCE	FUEL TYPE
101	1000.0	1200.0	01/01/82 - 01/01/83	200.0	134.0	-66.0	REGULAR
102	1000.0	1200.0	01/01/82 - 01/01/83	200.0	57.0	-143.0	UNLEADED
103	1000.0	1200.0	01/01/82 - 01/01/83	200.0	57.0	-143.0	PREMIUM
104	NONE REPORTED			0.0	0.0	0.0	DIESEL
105	NONE REPORTED			0.0	0.0	0.0	KEROSENE
			** TOTALS **	600.0	248.0	-352.0	

Figure A.8-19

RUN DATE: 04/01/82

CITY OF RAMPLEVILLE
PTI EQUIPMENT MANAGEMENT INFORMATION SYSTEM

PAGE NO: 2

*** FUEL TYPE RECONCILATION REPORT ***

COMMODITY TYPE	REPORTING UNIT	QUANTITY DISPENSED	QUANTITY REPORTED ON FUEL TICKETS	QUANTITY DIFFERENCE	PERCENT DIFFERENCE	COST PER UNIT	COST OF QUANTITY DISPENSED	COST OF QUANTITY REPORTED ON FUEL TICKETS	COST OF DIFFERENCE
REGULAR	GALLONS	200.0	134.0	-66.0	-49.8	$1.10	$220.00	$147.54	$-72.46
UNLEADED	GALLONS	200.0	57.0	-143.0	-251.4	$1.10	$220.40	$62.82	$-157.58
PREMIUM	GALLONS	200.0	57.0	-143.0	-251.4	$1.10	$220.60	$62.88	$-157.72
DIESEL	GALLONS	0.0	0.0	0.0	0.0	$0.00	$0.00	$0.00	$0.00
KEROSENE	GALLONS	0.0	0.0	0.0	0.0	$0.00	$0.00	$0.00	$0.00
					** FUEL TOTALS **		$661.00	$273.24	$-387.76

Figure A.8-18

RUN DATE: 09/01/82

CITY OF BAMPLEVILLE
PTI EQUIPMENT MANAGEMENT INFORMATION SYSTEM

PAGE NO: 2

COST-BILLED REPORT

MONTH OF AUGUST

ORGANIZATION: 012204 - PA&B PLAN & DEVL

EQUIP. NUMBER	DESCRIPTION	CLASS CODE	CHARGE TYPE	THIS PERIOD MI/HR USED	% DOWN TIME	OPER COST	MAINT COST	DEPREC + INS	TOTAL COSTS	TOTAL BILLED	DIFFERENCE COST VS BILLED $	DIFFERENCE COST VS BILLED %	YEAR TO DATE DIFFERENCE COST VS BILLED $	YEAR TO DATE DIFFERENCE COST VS BILLED %
000711	1/2 TON PICKUP	2LA2FC2A	DIRECT	40 M	9	8	197	0	205	205	0	100	0	100
000940	4 DR 81A WAG	1BA4FC3B	DIRECT	980 M	1	65	1868	0	1933	1933	0	100	0	100
						ORGANIZATION TOTALS			2138	2138	0	100	0	100

Figure A.8-17

RUN DATE: 09/01/82 CITY OF SAMPLEVILLE PTI EQUIPMENT MANAGEMENT INFORMATION SYSTEM PAGE NO: 1

EQUIPMENT EXCEPTION CONDITION REPORT

MONTH OF AUGUST

CLASS CODE: 20 - PICKUP TRUCK

EQUIP. NUMBER	MAKE	DESCRIPTION	ORGAN. NUMBER	TOTAL MILEAGE	EXCEPTION TYPE	EXCEPTION LIMIT	EXCEPTION VALUE	MAINT. AND OPER. THIS MO.	MAINT. AND OPER. TOTAL LIFE
000711	FORD	1/2 TON PICKUP	012204	61531.0	NO. OF ACCIDENTS	0	1	206.34	11387.08
					LOW MILEAGE	200	40.0		
					CPM/CPH	1.5	5.158		
					NO. OF REPAIRS	1	2		
					DOWNTIME HOURS	8	16.0		
					MPG/MPG	13	5.714		
001001	DODG	1/2 TON PICKUP	016007	55668.9	HIGH MILEAGE	500	1218.0	548.04	10773.36
					OIL CONSUMPTION	1	2		
					DOWNTIME HOURS	8	16.0		
					# LIMIT ON REPAIRS	200	463.8		
					GASOLINE USAGE	30	137.9		
					MPG/MPG	13	8.832		

Figure A.8-16

CITY OF SAMPLEVILLE

RUN DATE: 09/01/82 PTI EQUIPMENT MANAGEMENT INFORMATION SYSTEM

FLEET SUMMARY REPORT

MONTH OF AUGUST

EQUIPMENT INVENTORY TOTALS

TOTAL UNITS OF EQUIPMENT	4
EQUIPMENT ADDED	0
EQUIPMENT RETIRED	0
NET VALUE OF FLEET	84894

EQUIPMENT INVENTORY BY CLASS

CLASS 1 - AUTOS, MOTORCYCLES & SCOOTERS	2
CLASS 2 - TRUCKS, GENERAL PURPOSE	2
CLASS 3 - TRUCKS, SPECIAL PURPOSE	0
CLASS 4 - TRACTORS	0
CLASS 5 - CONSTRUCTION & MAINTENANCE EQUIPMENT	0
CLASS 6 - AIRCRAFT, WATERCRAFT & SPEC TERRAIN	0
CLASS 7 - MISC.	0
CLASS 8 - TRAILERS	0
CLASS 9 - OTHER NONSELF-PROPELLED EQUIPMENT	0

	CURRENT MONTH	YEAR TO DATE
MAINTENANCE PROGRAM		
NUMBER OF SHOP EMPLOYEES	2	N/A
LABOR HOURS AVAILABLE	320.0	N/A
INDIRECT LABOR HOURS	254.9	N/A
LABOR HOURS - TOTAL	65.1	973.6
SCHEDULED - HOURS	3.0	248.8
- PERCENT	4	25
UNSCHEDULED - HOURS	62.1	724.8
- PERCENT	95	74
AVERAGE DOWNTIME - HOURS	8.6	12.6
- PERCENT	4.90	7.17
EQUIPMENT OPERATION DATA		
MILES OPERATED	2930.6	24930.0
NO OF VEHICLES REPORTING MILES	4	N/A
HOURS OPERATED	0	0
NO OF VEHICLES REPORTING HOURS	0	N/A
FUEL CONSUMED - GALLONS		
REGULAR	64.0	1137.0
UNLEADED	57.2	265.8
PREMIUM	18.9	240.0
DIESEL	0	0
KEROSENE	0	0
ADDED OIL - QUARTS	7	9
EQUIPMENT COST DATA		
FUEL	196.37	1809.50
ADDED OIL	7.00	9.00
LABOR	2182.14	18663.65
PARTS	291.87	2593.92
COMMERCIAL	56.00	349.88
INSURANCE	0	0
DEPRECIATION	133.48	1617.78
TOTAL COSTS	2866.86	25043.73
EQUIPMENT EARNINGS DATA		
DIRECT BILLED	2355.87	14024.21
RENTAL BILLED	190.20	1711.39
TOTAL BILLED	2546.07	15735.61
COST/BILLED RATIO	1.12	1.59

RUN DATE: 09/01/82 PTI EQUIPMENT MANAGEMENT INFORMATION SYSTEM PAGE NO: 3

EQUIPMENT / ORGANIZATION PERFORMANCE REPORT

MONTH OF AUGUST

CLASS CODE: 2L - PICKUP TRUCK

EQUIPMENT NUMBER DESCRIPTION	MILE/ HOUR CODE	MILES/ HOURS USED	PERCENT DOWN TIME	TOTAL REPAIR COST	TOTAL REPAIR ORDERS	MPG OR MPH	CPM/CPH OPER.	CPM/CPH MAINT.	CPM/CPH TOTAL	TOTAL $ OPER. + MAINT.
		TOP LINE = THIS PERIOD *** BOTTOM LINE = LIFE TO DATE								
ORGANIZATION: 012204 - PARKS PLAN & DEVL										
000711 FORD 1/2 TON PICKUP	M	40.0 61531.0	9 N/A	197.64 5041.19	2 64	5.714 7.596	.2175 .1031	4.941 .0819	5.158 .185	206.34 11387.08
ORGANIZATION - TOTALS		40 61531	N/A N/A	197.64 5041.19	2 64	N/A N/A	N/A N/A	N/A N/A	N/A N/A	206.34 11387.08
- AVERAGES		40 61531	9 N/A	197.64 5041.19	2 64	5.71 7.6	.22 .1	4.94 .08	5.16 .19	206.34 11387.08
ORGANIZATION: 016007 - BBA BLDG MAINT										
001001 DODG 1/2 TON PICKUP	M	1218.0 55668.9	9 N/A	463.8 4407.8	1 47	64.44 8.930	.0532 .1139	.3807 .0791	.4339 .193	528.68 10754
ORGANIZATION - TOTALS		1218 55668.9	N/A N/A	463.8 4407.8	1 47	N/A N/A	N/A N/A	N/A N/A	N/A N/A	528.68 10754
- AVERAGES		1218 55668	9 N/A	463.8 4407.8	1 47	64.44 8.93	.05 .11	.38 .08	.43 .19	528.68 10754
CLASS - TOTALS		1258 117199.9	N/A N/A	661.44 9448.99	3 111	N/A N/A	N/A N/A	N/A N/A	N/A N/A	735.02 22141.08
- AVERAGES		629 58599	9 N/A	330.72 4724.49	1 55	35.08 8.26	.14 .11	2.66 .08	2.8 .19	367.51 11070.54

Figure A.8-14

RUN DATE: 09/01/82 CITY OF SAMPLEVILLE PAGE NO: 2

PTI EQUIPMENT MANAGEMENT INFORMATION SYSTEM

DEPARTMENTAL BILLING - DIRECT AND RENTAL CHARGES

MONTH OF AUGUST

ORGANIZATION: 012204 - PARKS PLAN & DEVL

EQUIPMENT NO - 000711 FORD 1977 1/2 TON PICKUP - DIRECT CHARGE

REPAIR NUMBER	SHOP NO.	LABOR COST	PARTS COST	COMM. COST	TOTAL COST OF REPAIR	FUEL GALLONS	FUEL COST	OIL QUARTS	OIL COST	FUEL + OIL TOTAL COST
						7.0	7.70	1	1.00	8.7
000711	0001	101.04	30.74	0	131.78					
000712	0002	55.11	16.76	0	71.87					
VEHICLE SUBTOTALS		156.15	47.5	0	203.65	7.0	7.70	1	1.00	

VEHICLE TOTAL 212.35

****

EQUIPMENT NO - 000940 PLYM 1978 4 DR STA WAG - DIRECT CHARGE

REPAIR NUMBER	SHOP NO.	LABOR COST	PARTS COST	COMM. COST	TOTAL COST OF REPAIR	FUEL GALLONS	FUEL COST	OIL QUARTS	OIL COST	FUEL + OIL TOTAL COST
						57.2	63.03	2	2.00	65.03
000940	0001	22.04	44.5	0	66.54					
000941	0001	88.18	152.07	0	240.25					
VEHICLE SUBTOTALS		110.22	196.57	0	306.79	57.2	63.03	2	2.00	

VEHICLE TOTAL 371.82

****

ORGAN SUBTOTALS		266.37	244.07	0	510.44	64.2	70.73	3	3	

ORGAN TOTAL 584.17

Figure A.8-13

RUN DATE: 03/17/82-03/17/82

CITY OF SAMPLEVILLE
PTI EQUIPMENT MANAGAMENT INFORMATION SYSTEM

*** MAINTENANCE AND REPAIR ACTIVITY LISTING ***

HISTORICAL REPAIRS BY EQUIPMENT NUMBER

EQUIPMENT NUMBER: 000940 DATE RANGE: 01/01/82 - 01/01/83 REPAIR TYPE: 18

-SERVICE DATES- FROM - TO	METER READING	REPAIR NUMBER	SHOP NO	REPAIR TYPE	REPAIR DESCRIPTION	EMPLOYEE NUMBER	*-----LABOR-----* HOURS	COST	PARTS COST	COMM COST	TOTAL COST
03/17/82-03/17/82	1200.0	000940	0001	18	WHEELS/BOBIES	101010000	1.2	$12.00	$44.50	$	$56.50
									REPAIR ORDER TOTAL		$56.50
									EQUIPMENT TOTAL		$56.50

****

Figure A.8-12

RUN DATE: 09/01/82

CITY OF SAMPLEVILLE
PTI EQUIPMENT MANAGEMENT INFORMATION SYSTEM

PAGE NO: 1

*** MAINTENANCE AND REPAIR ACTIVITY LISTING ***
OPEN REPAIRS BY EQUIPMENT NUMBER

EQUIP. NUMBER	MAKE	DESCRIPTION	CLASS CODE	BILL CODE	DATE IN SERVICE	ESTIMATED LIFE	CURRENT VALUE	ORGANIZATION	CURRENT METER	METER USAGE CURRENT MO.
000940	PLYM	4 DR STA WAG	1DA4FC3B	D	04/03/78	60 MONTHS	$850	PARKS PLAN & DEVL	46784.3 M	988.6

SHOP ACTIVITY

$-SERVICE DATE$- FROM - TO	METER READING	REPAIR NUMBER	SHOP NO	REPAIR TYPE	REPAIR DESCRIPTION	EMPLOYEE NUMBER	$----LABOR----$ HOURS	$----LABOR----$ COST	PARTS COST	COMM COST	TOTAL COST
08/30/82	46785.0	000941	0001	06	CAB METAL	103030000	3.0	$55.11	$128.30	$0.00	$183.41
				15	STEERING	105050000	1.8	$33.07	$23.77	$0.00	$56.84
									REPAIR ORDER TOTAL		$240.25
										EQUIPMENT TOTAL	$240.25

****

Figure A.8-11

RUN DATE: 09/01/82

CITY OF SAMPLEVILLE
PTI EQUIPMENT MANAGEMENT INFORMATION SYSTEM

PAGE NO: 1

*** MAINTENANCE AND REPAIR ACTIVITY LISTING ***
ALL OPEN REPAIRS

EQUIP. NUMBER	MAKE	DESCRIPTION	CLASS CODE	BILL CODE	DATE IN SERVICE	ESTIMATED LIFE	CURRENT VALUE	ORGANIZATION	CURRENT METER	METER USAGE CURRENT MO.
000711	FORD	1/2 TON PICKUP	2LA2FC2A	D	09/22/77	72 MONTHS	$909	PARKS PLAN & DEVL	61539.0 M	40.0

SHOP ACTIVITY

$-SERVICE DATES-$ FROM - TO	METER READING	REPAIR NUMBER	SHOP NO	REPAIR TYPE	REPAIR DESCRIPTION	EMPLOYEE NUMBER	$----LABOR----$ HOURS	COST	PARTS COST	COMM COST	TOTAL COST
08/29/82	61547.0	000712	0002	15	STEERING	101010000	3.0	$55.11	$16.76	$0.00	$71.87
									REPAIR ORDER TOTAL		$71.87
									EQUIPMENT TOTAL		$71.87

****

EQUIP. NUMBER	MAKE	DESCRIPTION	CLASS CODE	BILL CODE	DATE IN SERVICE	ESTIMATED LIFE	CURRENT VALUE	ORGANIZATION	CURRENT METER	METER USAGE CURRENT MO.
000940	PLYM	4 DR STA WAG	1BA4FC3B	D	04/03/78	60 MONTHS	$850	PARKS PLAN & DEVL	46784.3 H	988.6

SHOP ACTIVITY

$-SERVICE DATES-$ FROM - TO	METER READING	REPAIR NUMBER	SHOP NO	REPAIR TYPE	REPAIR DESCRIPTION	EMPLOYEE NUMBER	$----LABOR----$ HOURS	COST	PARTS COST	COMM COST	TOTAL COST
08/30/82	46785.0	000941	0001	06	CAB METAL	103030000	3.0	$55.11	$128.30	$0.00	$183.41
				15	STEERING	105050000	1.8	$33.07	$23.77	$0.00	$56.84
									REPAIR ORDER TOTAL		$240.25
									EQUIPMENT TOTAL		$240.25

****

Figure A.8-10

RUN DATE: 09/01/82 CITY OF SAMPLEVILLE PTI EQUIPMENT MANAGEMENT INFORMATION SYSTEM PAGE NO: 1

*** MAINTENANCE AND REPAIR ACTIVITY LISTING ***
CLOSED REPAIRS BY EQUIPMENT NUMBER

EQUIP. NUMBER	NAME	DESCRIPTION	CLASS CODE	BILL CODE	DATE IN SERVICE	ESTIMATED LIFE	CURRENT VALUE	ORGANIZATION	CURRENT METER	METER USAGE CURRENT MO.
000711	FORD	1/2 TON PICKUP	2LA2FC2A	D	09/22/77	72 MONTHS	$909	PARKS PLAN & DEVL	61539.0 M	40.0

SHOP ACTIVITY

$-SERVICE DATES-$ FROM - TO	METER READING	REPAIR NUMBER	SHOP NO	REPAIR TYPE	REPAIR DESCRIPTION	EMPLOYEE NUMBER	$----LABOR----$ HOURS	COST	PARTS COST	COMM COST	TOTAL COST
08/15/82-08/17/82	61507.4	000711	0001	34	LIGHTING SYSTEM	102020000	5.5	$101.04	$30.74	$0.00	$131.78
									REPAIR ORDER TOTAL		$131.78
									EQUIPMENT TOTAL		$131.78

****

Figure A.8-9

RUN DATE: 09/01/82 — CITY OF SAMPLEVILLE — PAGE NO: 1

PTI EQUIPMENT MANAGEMENT INFORMATION SYSTEM

*** MAINTENANCE AND REPAIR ACTIVITY LISTING ***
ALL CLOSED REPAIRS

EQUIP. NUMBER	MAKE	DESCRIPTION	CLASS CODE	BILL CODE	DATE IN SERVICE	ESTIMATED LIFE	CURRENT VALUE	ORGANIZATION	CURRENT METER	METER USAGE CURRENT MO.
000711	FORD	1/2 TON PICKUP	2LA2FC2A	D	09/22/77	72 MONTHS	$909	PARKS PLAN & DEVL	61539.0 M	40.0

SHOP ACTIVITY

$-SERVICE DATES-$ FROM - TO	METER READING	REPAIR NUMBER	SHOP NO	REPAIR TYPE	REPAIR DESCRIPTION	EMPLOYEE NUMBER	$----LABOR----$ HOURS	$----LABOR----$ COST	PARTS COST	COMM COST	TOTAL COST
08/15/82-08/17/82	61507.4	000711	0001	34	LIGHTING SYSTEM	102020000	5.5	$101.04	$30.74	$0.00	$131.78
								REPAIR ORDER TOTAL			$131.78
								EQUIPMENT TOTAL			$131.78

****

EQUIP. NUMBER	MAKE	DESCRIPTION	CLASS CODE	BILL CODE	DATE IN SERVICE	ESTIMATED LIFE	CURRENT VALUE	ORGANIZATION	CURRENT METER	METER USAGE CURRENT MO.
000940	PLYM	4 DR STA WAG	1BA4FC3B	D	04/03/78	60 MONTHS	$850	PARKS PLAN & DEVL	46784.3 M	988.6

SHOP ACTIVITY

$-SERVICE DATES-$ FROM - TO	METER READING	REPAIR NUMBER	SHOP NO	REPAIR TYPE	REPAIR DESCRIPTION	EMPLOYEE NUMBER	$----LABOR----$ HOURS	$----LABOR----$ COST	PARTS COST	COMM COST	TOTAL COST
08/17/82-08/17/82	46335.8	000940	0001	18	WHEELS/BOGIES	101010000	1.2	$22.04	$44.50	$0.00	$66.54
								REPAIR ORDER TOTAL			$66.54
								EQUIPMENT TOTAL			$66.54

****

EQUIP. NUMBER	MAKE	DESCRIPTION	CLASS CODE	BILL CODE	DATE IN SERVICE	ESTIMATED LIFE	CURRENT VALUE	ORGANIZATION	CURRENT METER	METER USAGE CURRENT MO.
001001	DODG	1/2 TON PICKUP	2LA2FC2B	R	08/18/78	72 MONTHS	$1241	08A BLDG MAINT	53423.6 M	1218.0

SHOP ACTIVITY

$-SERVICE DATES-$ FROM - TO	METER READING	REPAIR NUMBER	SHOP NO	REPAIR TYPE	REPAIR DESCRIPTION	EMPLOYEE NUMBER	$----LABOR----$ HOURS	$----LABOR----$ COST	PARTS COST	COMM COST	TOTAL COST
08/05/82-08/09/82	53570.6	001001	0001	01	HEATING/VENTILATION	104040000	9.6	$176.35	$23.80	$56.00	$256.15
								REPAIR ORDER TOTAL			$256.15
								EQUIPMENT TOTAL			$256.15

****

Figure A.8-8

RUN DATE: 09/01/82 CITY OF SANFLEVILLE PAGE NO: 1

PTI EQUIPMENT MANAGEMENT INFORMATION SYSTEM

*** PREVENTIVE MAINTENANCE SCHEDULING FOR SEPTEMBER 1982 ***

THE FOLLOWING VEHICLES ARE DUE FOR -A- TYPE PM AT FACILITY: FACILITY NO. 0002

VEHICLE DESCRIPTION	ASSIGNED ORGANIZATION	TYPE LAST PM	DATE LAST PM	METER READING LAST PM	PM SCHEDL BASIS	WEEK IN WHICH DUE	DATE PM PERFORMED	DATE NEXT STATE INSP
EQUIP NO. 000940 1978 PLYM 4 DR STA WAG	PARKS PLAN & DEVL 012204	B	06/19/82	44100.0 MI	3000 MI 3 MO	FOURTH	(/ /)	09/03/82*
EQUIP NO. 001001 1978 DODG 1/2 TON PICKUP	BSA BLDG MAINT 016007	B	06/05/82	50850.2 MI	3000 MI 3 MO	FIRST	(/ /)	09/12/82*
EQUIP NO. 001016 1978 JEEP 4 WHL DR/WINCH	PW ENG SERVICES 011106	B	06/08/82	35425.3 MI	3000 MI 3 MO	FOURTH	(/ /)	09/01/82*

TOTAL VEHICLES DUE FOR -A- TYPE PM AT FACILITY: FACILITY NO. 0002 = 3

* - DUE NOW FOR STATE INSPECTION ** - OVERDUE FOR STATE INSPECTION N/A - NOT APPLICABLE

Figure A.8-7

CITY OF SAMPLEVILLE

DATE: 04/01/82 PTI EQUIPMENT MANAGEMENT INFORMATION SYSTEM PAGE NO: 1

HISTORICAL FUEL TRANSACTIONS BY PUMP NUMBER

DATE RANGE: 01/01/82 - 01/01/83

EQUIP. NUMBER	FUELING DATE	PUMP NUMBER	METER READING	GALLONS DISPENSED	FUEL COST	ADDED OIL	OIL COST
000711	03/01/82	101	920.0	19	020.92		
000711	03/02/82	101	1140.0	20	022.02	1	01.00
000711	03/03/82	101	1360.0	19	020.92	1	01.00
001016	03/01/82	101	1250.0	19	020.92		
001016	03/02/82	101	1480.0	19	020.92	1	01.00
001016	03/03/82	101	1700.0	19	020.92	1	01.00
000711	03/04/82	101	1600.0	19	020.92	1	01.00
			TOTALS:	134	014754	5	05.00

Figure A.8-6

CITY OF SAMPLEVILLE

DATE: 07/01/82 PTI EQUIPMENT MANAGEMENT INFORMATION SYSTEM PAGE NO: 1

FUEL TRANSACTIONS BY PUMP NUMBER

EQUIP. NUMBER	FUELING DATE	PUMP NUMBER	METER READING	GALLONS DISPENSED	FUEL COST	ADDED OIL	OIL COST
000940	08/01/82	102	46793.2	5.0	$5.51		
000940	08/12/82	102	46848.8	19	$20.94	1	$1.00
000940	08/23/82	102	47050.1	19	$20.94	1	$1.00
			TOTALS:	43	$47.39	2	$2.00

Figure A.8-5

CITY OF SHAPLEVILLE

DATE: 04/01/82 PTI EQUIPMENT MANAGEMENT INFORMATION SYSTEM PAGE NO: 1

HISTORICAL FUEL TRANSACTIONS BY EQUIPMENT NUMBER

DATE RANGE: 03/01/82 - 03/03/82

EQUIP. NUMBER	FUELING DATE	PUMP NUMBER	METER READING	GALLONS DISPENSED	FUEL COST	ADDED OIL	OIL COST
000711	03/01/82	101	920.0	19	$20.92		
000711	03/02/82	101	1140.0	20	$22.02	1	$1.00
000711	03/03/82	101	1360.0	19	$20.92	1	$1.00
			TOTALS:	58	$63.86	2	$2.00

Figure A.8-4

CITY OF SAMPLEVILLE

DATE: 09/01/82 PIT EQUIPMENT MANAGEMENT INFORMATION SYSTEM PAGE NO: 1

FUEL TRANSACTIONS BY EQUIPMENT NUMBER

EQUIP. NUMBER	FUELING DATE	PUMP NUMBER	METER READING	GALLONS DISPENSED	FUEL COST	ADDED OIL	OIL COST
000940	08/01/82	102	46793.2	5.0	$5.51		
000940	08/12/82	102	46848.8	19	$20.94	1	$1.00
000940	08/23/82	102	47050.1	19	$20.94	1	$1.00
			TOTALS:	43	$47.39	2	$2.00

Figure A.8-3

RUN DATE: 09/01/82

CITY OF SAMPLEVILLE
PTI EQUIPMENT MANAGEMENT INFORMATION SYSTEM

PAGE NO: 1

*** EQUIPMENT INVENTORY SUMMARY REPORT ***

EQUIP. NUMBER	MAKE	DESCRIPTION	CLASS CODE	ASSIGNED ORGANIZATION	ORGAN. NUMBER	CURRENT METER	CURRENT VALUE	MILES PER GALLON-CM	COST PER MILE-CM
000711	FORD	1/2 TON PICKUP	2LA2FC2A	PARKS PLAN & DEVL	012204	61539.0	$909	5.714	$6.715
000940	PLYM	4 DR STA WAG	1BA4FC3B	PARKS PLAN & DEVL	012204	46784.3	$850	17.28	$1.988
001001	DODG	1/2 TON PICKUP	2LA2FC2B	BSA BLDG MAINT	016007	53423.6	$1241	8.832	$.4499
001016	JEEP	4 WHL DR/WINCH	1CA1HC3C	PW ENG SERVICES	011106	37895.8	$1894	12	$.1228

Figure A.8-2

RUN DATE: 09/01/82

CITY OF SAMPLEVILLE
PTI EQUIPMENT MANAGEMENT INFORMATION SYSTEM

PAGE NO: 1

*** EQUIPMENT INVENTORY DETAIL REPORT ***

EQUIP. NUMBER	NAME	DESCRIPTION	CLASS CODE	ASSIGNED ORGANIZATION	ORGAN. NUMBER	CURRENT METER	CURRENT VALUE	MILES PER GALLON-CM	COST PER MILE-CM
000711	FORD	1/2 TON PICKUP	2LA2FC2A	PARKS PLAN & DEVL	012204	61539.0	$909	5.714	$6.715

MISCELLANEOUS DESCRIPTIVE

CHASSIS MANUFACTURER: FORD
CHASSIS MODEL NUMBER: F100
CHASSIS SERIAL NUMBER: F1019A-21774
CHASSIS MODEL YEAR: 1977
BODY MANUFACTURER:
BODY MODEL NUMBER:
BODY SERIAL NUMBER:
BODY MODEL YEAR:
HIGHWAY CODE: CITY
DOMICILE LOCATION: FACILITY NO. 1115

FUND NUMBER:
BILLING BASIS: DIRECT CHARGE
ESTIMATED LIFE: 72 MONTHS
PURCHASE ORDER AMOUNT: $4582.90
SALVAGE VALUE: $100
DEPRECIATION AMOUNT: $62.26/MONTH
BILL ACCIDENT REPAIRS: NO
INSURANCE COST:
IMPROVEMENTS ADDED-CM: $0
IMPROVEMENTS ADDED-LTD: $0

DATE RECEIVED: 09/22/77
LICENSE NUMBER: 2938
TITLE NUMBER: 184308
METER UNIT: MILES
NORMAL MONTHLY DUTY HOURS: 176
PURCHASE ORDER NUMBER:
PROPERTY CONTROL NUMBER:
GROSS VEHICLE WEIGHT RATING: 4000

OPERATIONS

METER READING LAST MONTH: 61499.0
METER UNITS OPERATED-CM: 40.0
METER UNITS OPERATED-LM: 151.0
METER UNITS OPERATED-YTD: 889.0
METER UNITS OPERATED-LTD: 61531.0
DEPRECIATION-CM: $62.26
DEPRECIATION-YTD: $498.08
DEPRECIATION-LTD: $3673.34
INSURANCE COST-YTD: $0
INSURANCE COST-LTD: $0

FUEL USED-CM: 7.0 GALLONS
FUEL USED-YTD: 154.0 GALLONS
FUEL USED-LTD: 8100.0 GALLONS
FUEL COST-CM: $7.70
FUEL COST-YTD: $169.56
FUEL COST-LTD: $6337.70
FUEL TANK CAPACITY: 20 GALLONS
FUEL TYPE: A - REGULAR
MILES PER GALLON-YTD: 5.772
MILES PER GALLON-LTD: 7.596

ADDED OIL-CM: 1 QUARTS
ADDED OIL-YTD: 3 QUARTS
ADDED OIL-LTD: 6 QUARTS
OIL COST-CM: $1.00
OIL COST-YTD: $3.00
OIL COST-LTD: $8.19

TOTAL OPERATING COST-CM: $70.96
TOTAL OPERATING COST-YTD: $670.64
TOTAL OPERATING COST-LTD: $10019.23

MAINTENANCE

DOWNTIME HOURS-CM: 16.0
DOWNTIME HOURS-YTD: 32.0
DOWNTIME HOURS-LTD: 76.0
NUMBER REPAIR ORDERS-CM: 2
NUMBER REPAIR ORDERS-YTD: 14
NUMBER REPAIR ORDERS-LTD: 64
NUMBER ROAD CALLS-CM: 0
NUMBER ROAD CALLS-YTD: 2
NUMBER ROAD CALLS-LTD: 5
ACCIDENT COST-CM: $0
ACCIDENT COST-YTD: $0
ACCIDENT COST-LTD: $131.00
WARRANTY COST-CM: $0
WARRANTY COST-YTD: $0
WARRANTY COST-LTD: $23.00

SCHEDULED LABOR HOURS-CM: 3.0
SCHEDULED LABOR HOURS-YTD: 24.0
SCHEDULED LABOR HOURS-LTD: 120.0
TOTAL LABOR HOURS-CM: 8.5
TOTAL LABOR HOURS-YTD: 17.0
TOTAL LABOR HOURS-LTD: 203.0
LABOR COST-CM: $156.14
LABOR COST-YTD: $312.30
LABOR COST-LTD: $3264.24
PARTS COST-CM: $41.50
PARTS COST-YTD: $80.80
PARTS COST-LTD: $1718.95
COMMERCIAL COST-CM: $0
COMMERCIAL COST-YTD: $0
COMMERCIAL COST-LTD: $58.00

SERVICE LOCATION: FACILITY NO. 0001
PM-LOCATION: FACILITY NO. 0002
PM-MONTH INTERVAL: 3 MONTHS
PM-USAGE INTERVAL: 3000 MILES
PM-SEQUENCE: ABABABAC
DATE LAST PM: 06/19/82
METER READING LAST PM: 59285.4
TYPE LAST PM: A-1
STATE INSPECTION FREQUENCY: 12 MONTHS
DATE LAST STATE INSPECTION: 06/03/82
COST PER MILE-YTD: $.4421
COST PER MILE-LTD: $.0819
TOTAL MAINTENANCE COST-CM: $197.64
TOTAL MAINTENANCE COST-YTD: $393.1
TOTAL MAINTENANCE COST-LTD: $5041.19

RENTAL

FLAT RATE:

BASIC USE RATE:

BILLED AMOUNT-CM: $389.88
BILLED AMOUNT-YTD: $2058.22
BILLED AMOUNT-LTD: $8781.35

STATUS: ACTIVE

STATUS DATE: 04/01/82

*** CM = CURRENT MONTH *** YTD = YEAR TO DATE *** LTD = LIFE TO DATE ***

Figure A.8-1

A.8 MICRO EMIS

3. Hardware

MICRO EMIS operates on either the Apple II t or Apple IIe with 48K bytes of main memory. Included in the optional hardware package is: a monochrome monitor, a 132 character printer, a VISTA V1100 Trimline 8-inch disk drive, and a 5 1/4 inch disk drive. A 5 megabyte Winchester hard disc drive backed up by two floppy disc drives is also available.

4. References

A.8-1 MICRO EMIS: The Fleet Management Solution, Public Technology Inc., 1983.

A.8-2 Computerized Fleet Management, Public Technology Inc., 1983.

2. Fleet Summary Report
For each fleet provides a summary, for the current month and year-to-date, of the maintenance program, personnel and facilities, maintenance and operating expenses, and earnings. of equipment cost, and equipment earnings information. Included in this report are: total labor hours, scheduled and unscheduled labor hours, average downtime, usage data, fuel and oil consumed, and earnings from direct billing of maintenance expenses. (See Figure A.3-15).

3. Equipment Exception Condition Report
Contains data on equipment that has exceeded user specified parameters, such as high or low usage, excessive cost per mile, low miles per gallon, excessive use of oil, and excessive downtime (see Figure A.8-16).

4. Cost versus Billed
Summarizes all expenses billed to one organizational unit within one month. Differences between the actual cost and the billed amount for the month and year-to-date are also given (see Figure A.8-17).

5. Fuel Type Reconciliation
Shows, by type of fuel, the difference between reported usage and dispensed amounts (see Figure A.8-18).

6. Pump Reconciliation
Contains fuel reconciliation data by fuel type and by pump (see Figure A.8-19).

A.8 MICRO EMIS

Repairs

1. Preventive Maintenance Scheduling
   Contains for each vehicle the type and mileage of the last PM event, the type of the next PM event and the week when it will be due, and the due date of the next state inspection (see Figure A.8-7).

2. All Closed Repairs Maintenance and Repair Activity Listing (current month)
   Summarizes information from the repair order including summary data from the Equipment Detail Report, and shop activity data such as, dates of service, mileage, repair number, shop number, description of repairs, number of the employee performing the work, labor time and cost, parts costs, and total cost (see Figure A.8-8).

3. Closed Repairs by Equipment Number (current month)
   Contains all closed repair orders against a single vehicle (see Figure A.8-9).

4. All Open Repairs Maintenance and Repair Activity Listing (current month)
   Contains all repair order data for equipment with work not completed (see Figure A.8-10).

5. Open Repairs by Equipment Number (current month)
   Contains the same information as All Open Repairs for a single vehicle (see Figure A.8-11).

6. Historical Repairs by Equipment Number
   Summarizes shop activity data including repair type and cost for any specified time period (see Figure A.8-12).

Billing

1. Department Billing
   Contains direct billing and rental charges for the current month and includes such data as equipment number, assigned or billing organization, repair order number, shop number, labor and parts costs, and total cost of repairs (see Figure A.8-13).

Management

1. Equipment/Organization Performance
   Contains data on the total operating and maintenance cost for the current month and over the life of the vehicle. It also includes the miles or hours of equipment use, percent down time, total repair cost, and miles per gallon, as well as the cost of operations and maintenance, in total and on a per mile or per hour basis (see Figure A.8-14).

A.8 MICRO EMIS

Output Reports

MICRO EMIS produces a set of output reports listed below. Examples of these reports are also provided for added detail.

Inventory

1. Equipment Inventory Detail
   Contains the following information:
   - A description of the vehicle, the date received, its assignment, serial number, usage rate, and value.
   - Operations data including, mileage, insurance costs, fuel and oil usage, and performance characteristics.
   - Maintenance data including downtime, number of road calls, accident costs, total labor and parts costs, preventive maintenance schedule data, and total maintenance cost.

   (See Figure A.8-1).

2. Equipment Inventory Summary
   Contains a compilation of the top line of the Equipment Inventory Detail Report i.e., equipment I.D. numbers and description, assigned organization, mileage, value, and performance characteristics (see Figure A.8-2).

3. Equipment Removed from Fleet
   Contains the same data as the Equipment Inventory Detail Report (refer to Figure A.8-1).

Fuel

1. Fuel Transactions by Equipment Number (current month)
   Contains the for each equipment number the date fueled, pump number, mileage, fuel and oil dispensed, and fuel and oil costs (see Figure A.8-3).

2. Historical Fuel Transactions by Equipment Number
   Contains the same data as the Fuel Transactions by Equipment Number report for specified past periods (see Figure A.8-4).

3. Fuel Transactions by Pump Number
   Contains the same information provided by the Fuel Transactions by Equipment Number report for a single pump (see Figure A.8-5).

4. Historical Fuel Transactions by Pump Number
   Contains the same data as the Fuel Transactions by Pump Number for any specified time period. (see Figure A.8-6).

A.8 MICRO EMIS

Files

MICRO EMIS contains seven primary files:

1. Equipment Inventory Master File
   Contains an inventory record for each piece of equipment. The inventory record is equivalent to the birth certificate for the equipment, plus accumulated data on performance and costs. Up to 102 data items may be included on each equipment inventory record.

2. Fuel Transaction Master File
   Contains the fuel transactions for each piece of equipment for the current month. Fuel tickets are the manual counterpart for this file.

3. Repair Header Master File
   Contains the repair order data for each piece of equipment for the current month. It contains such information as: repair order number, shop and equipment identifiers, warranty and billing information, and date and reason of repairs.

4. Repair Activity Master File
   Contains information on each type of repair performed on a piece of equipment, including parts and labor costs. It is always coupled with a repair header record.

5. Historical Fuel Transaction File
   Contains the same information as the Fuel Transaction Master File for past months.

6. Historical Repair Header File
   Is the historical counterpart of the Repair Header Master File.

7. Historical Repair Activity File
   Is the historical counterpart of the Repair Activity Master File.

In addition to these seven primary files, the system contains several secondary files including an index file to locate records and several files of codes and descriptive labels used by the system. These include: repair type codes, repair reason codes, organization identifiers, pump numbers, fuel prices, employee I.D. numbers, wage rates, American Public Work Association equipment class codes, and facility or repair shop codes.

7. End of Month Processing Module
Is used after all operational data for the month has been entered into the computer. It accumulates all repair and fuel data for the month and adds that information to an inventory master file. End of month processing is also used to delete vehicles sold or otherwise removed from the fleet. Finally, end of month processing is used to update billing data for direct charge vehicles and to issues the departmental billing reports.

A.8 MICRO EMIS

2. Description of the System

MICRO EMIS is a fleet management system designed for use with fleets of up to 500 pieces of equipment, 65 vehicle or equipment classes, 26 organizational units or departments, and 10 repair or maintenance shops. 37 separate computer programs are contained in MICRO EMIS. 20 different reports can be produced.

Modules

MICRO EMIS is organized into seven functional modules:

1. Master File Maintenance Module
   Manages modification and deletions of data in the equipment inventory, fuel, and repair files. For example, this module is used to add a new piece of equipment to the inventory, open a repair order, or modify a previously entered fuel transaction.

2. History File Processing Module
   Maintains fuel and repair history files. The repair and fuel history of any piece of equipment can be reviewed quickly and easily. Historical reports are printed.

3. Detail Reports Module
   Prints the following detail reports:
   - o Inventory detail and summary reports (3 reports)
   - o Fuel detail by equipment or pump (2 reports)
   - o Repair detail (open and close repairs (4 reports)

4. Management Report Module
   Prints the following management reports:
   - o Preventive Maintenance Schedule
   - o Equipment Summary by Organization or Class
   - o Equipment Exception Conditions
   - o Fleet Summary
   - o Fuel Reconciliation
   - o Pump Reconciliation
   - o Cost vs. Billed

5. Table Maintenance Module
   Is used to add, modify or delete records contained in the table files or to print the table files. The table files are the various codes and titles that are used throughout the system. Some examples are: Vehicle class codes and titles, organization codes and titles, employee I.D. numbers and wage rates, and fuel prices.

6. End of Day Processing Module
   Is operated at the end of each day to maintain the internal calendar.

A.8 MICRO EMIS

1. Introduction

Public Technology, Inc. (PTI), a non-profit corporation, is the applied science and technical arm of the National League of Cities and the International City Management Association. Their Micro[computerbased] Equipment Management Information System (MICRO EMIS) is a turnkey fleet managment system. It is derived from the mainframe Equipment Management Information System (EMIS), that was developed jointly with local government representatives and the American Public Works Association (APWA). EMIS is currently in operation in over 30 U.S. cities and has been licensed for use by municipalities in England and Germany. It has been installed on IBM, Honeywell, Burroughts, DEC, Sperry-Univac, NCR, and other makes of hardware. The programming language of EMIS is COBOL.

EMIS maintains an equipment inventory, tracks repair activities and fuel transactions, schedules and monitors preventive maintenance, and produces a variety of management reports. It can also be used for billing of operating and maintenance costs.

MICRO EMIS operates on an Apple II microcomputer. It can handle fleets of up to 500 vehicles. EMIS is interactive and can be used by individuals without extensive training in data processing. Internal procedures help prevent entry of inaccurate data. Data in the various files of MICRO EMIS are updated immediately after entry. Hence, up-to-date reports on repair and fuel activity can be prepared.

With MICRO EMIS it is possible to:

1. Maintain a detailed history for each vehicle in the fleet.
2. Schedule all preventive maintenance inspections.
3. Trace and reconcile all fuel disbursements and usage by pumps and by vehicle.
4. Review the repair history of any vehicle.
5. Prepare monthly summaries of fleet operations.
6. Produce financial audit trail data and billing reports.
7. Identify costly and inefficient vehicles through exception reporting.

The purchase price of MICRO EMIS includes on-site training and technical assistance; hardware is optional. PTI will install and test the system software and hardware on site. They also train user staff in the operation of the system and provide guidancance in the conversion. The fleet management staff of PTI will review current operations and provide a plan of action to improve operations through the use of the newly installed MICRO EMIS. The system can be installed, tested, and the user staff trained in approximately one week.

A.8 PUBLIC TECHNOLOGY INC.

MICRO EMIS

1. Introduction
2. Description of the System
3. Hardware
4. References

CLARA COUNTY VEHICLE
REPORTING SYSTEM

PREVENTATIVE MAINTENANCE SCHEDULE

WEEK OF	VEHICLE #	EXPECTED MAINTENANCE DESCRIPTION	OIL CHANGE	TIRE ROTATION	COOLANT CHANGE	LUBRICATION	EXPECTED MANHOUR
10/15/82	23092	CHANGE TRANSMISSION FLUID	YES	NO	NO	YES	2.5
		REPLACE HEADLAMPS					1.0
		REPLACE AIR & OIL FILTERS					1.0
						TOTAL	4.5
	AP-A-94	CHECK BATTERY	NO	YES	YES	NO	2.2
		REPAIR FRONT LEFT FENDER					5.5
						TOTAL	7.7
					WEEKLY GRAND TOTAL		12.2

CLARK COUNTY VEHICLE
REPORTING SYSTEM

PARTS INVENTORY REPORT

PART #	DESCRIPTION	UNITS	QUANTITY	SUPPLIER	STOCK #	LAST ORDER DATE
0F4567	OIL FILTER DODGE	FILTERS	34	AUPAR, COLUMBUS OHIO	A-876	7/6/82
31001	10W-40 OIL	QTRS.	75	MOBIL, 23 MAIN ST	10W-40	9/15/82
3033	SPARK PLUGS	AE15-4	5	CHAMPION	T-17	6/6/82

Figure A.7-5

CLARK COUNTY VEHICLE
REPORTING SYSTEM

VEHICLE #	LICENSE #	LOCATION AT PRESENT	ASSIGNED PERSON	MILEAGE PRESENT	YEAR	MAKE	PURCHASE DATE	ENGINE TYPE	TRANSMISSION TYPE	TYPE
23042	NEV-879	SCHOOL BLDG # 34	G.FREEMAN	56743	76	GM	4/12/76	318-2BBL	MANUAL	STA.WAGON
AP-4-87	5678	COUNTY BLDG.	F. ROLLINS	24356	79	DOD.ASPEN	5/23/80	287-1BBL	MANUAL	4 DOOR
AP-4-94	3509	PERSONNEL OFFICE	S. SHERMAN	15678	78	DOD.ASPEN	5/23/80	318-2BBL	AUTOMATIC	SEDAN

Could replace with APWA Equipment Codes

CLARK COUNTY VEHICLE
REPORTING SYSTEM

VEHICLE #	GAS GAL.	OIL QTS.	FUEL COST	LABOR	MATERIAL	TOTAL COST MONTHLY	TOTAL COST TO DATE	COST/MIL MONTHLY	COST/MIL TO DATE	MILEAGE MONTHLY	MILEAGE TO DATE	MPG	MIL/TIRE	ODOMETER
23042	45.3	8	260.70	301.30	78.95	640.95	6578.25	.529	.767	1250	8575	5.3	24567	56743
AP-4-87	47.5	4	201.50	156.25	26.75	384.5	5647.50	.439	.859	875	6578	4.7	14564	24356
AP-4-94	245	0	278.5	564.87	165.75	1009.12	6785.75	.898	.859	1124	7896	4.6	25653	15678

Figure A.7-4

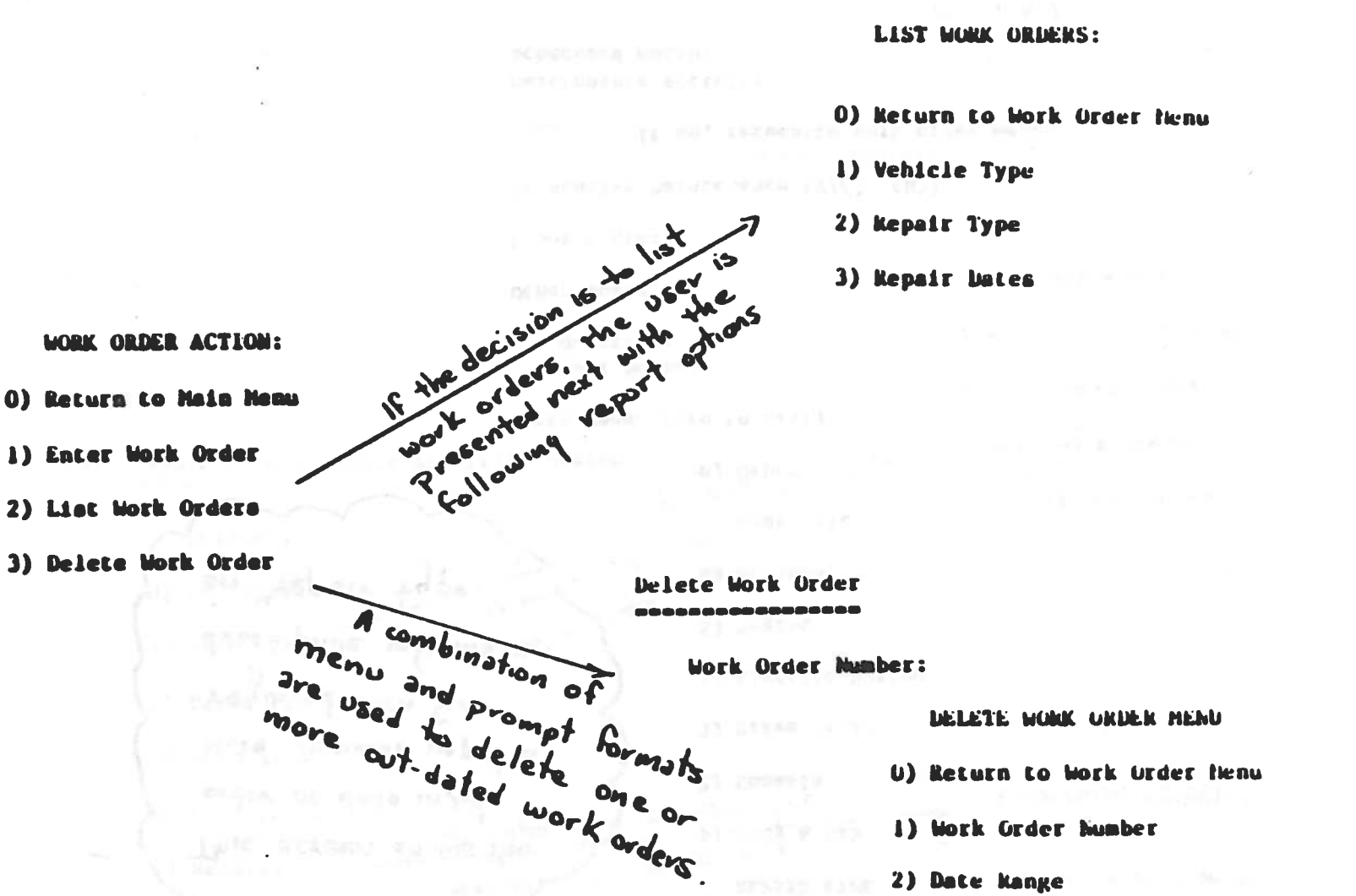

LIST WORK ORDERS:
0) Return to Work Order Menu
1) Vehicle Type
2) Repair Type
3) Repair Dates
If the decision is to list work orders, the user is presented next with the following report options
WORK ORDER ACTION:
0) Return to Main Menu
1) Enter Work Order
2) List Work Orders
3) Delete Work Order
A combination of menu and prompt formats are used to delete one or more out-dated work orders.
Delete Work Order
Work Order Number:
DELETE WORK ORDER MENU
0) Return to Work Order Menu
1) Work Order Number
2) Date Range
Display of Vehicle Number, Work Order #, Date
Delete (Y/N) <N>?
Return to Work Order Menu

Figure A.7-3

A.7 Vehicle Maintenance System

2. Description of the System

The Vehicle Maintenance Monitoring System tracks maintenance schedules for each vehicle, records vehicle operating expenses and updates inventory files. VEMM includes the following functions:

1. Vehicle Maintenance
2. Parts Inventory Control
3. Purchasing Control
4. Receiving Control
5. Work Order Processing
6. Fuel Usage Management
7. Tire and Battery Usage Management
8. Operational and Management Reporting.

VEMM is an interactive menu driven system designed to be user friendly.

A.7 Vehicle Maintenance System

1. Introduction

VEMM is based on an interactive menu driven data base management system, developed by Modeling System Inc. (MSI). It tracks maintenance cost and schedules for each vehicle in the fleet and processes parts and labor transactions. VEEM produces a number of standard maintenance and inventory reports. Additional reports may be designed by means of ISDATA, a data base management system with extensive report formatting capabilities. MSI markets VEMM as a turnkey system using Digital Equipment Corporation's (DEC) micro and mini computers. The smallest multi-user configuration uses a PDP 11/23 with 128K RAM (Random Access Memory) and can handle about 150 vehicles. A configuration with a VAX 11/750 or 780 can handle fleets of 1500 and more vehicles. VEMM may also be implemented on the DEC Personal Computer in a single user configuration.

In addition to VEMM, Modeling Systems Inc. has developed TRANSIT, a system for routing transit vehicles and reporting transit operations.

A.7 MODELING SYSTEMS INC.

VEHICLE MAINTENANCE MONITORING SYSTEM (VEMM)

1. Introduction
2. Description of the System
3. Hardware
4. References

THURSDAY SEPTEMBER 30,1982

MTD PROJECT SERVICES, INC
INVENTORY PURCHASES/RECEIPTS/ADJUSTMENTS
TRANSACTION LISTING

ITEM NUMBER	REFERENCE	DATE	QTY INVOICE	QTY PURCHASED	QTY RECEIVED	QTY ADJUSTED	CURRENT ON-HAND	LAST UNIT COST	AVERAGE UNIT COST	AMOUNT
10C		09/30/82			7500		1958	.98	.98	7350.00
1CC		09/30/82	7425				1958	.92	.75	6831.00
10L	AFTER PROGRAM CHANGE	09/30/82			7500		1958	.98	.98	7350.00
100	AFTER PROGRAM CHANGE	09/30/82	7425				1958	.92	.75	6831.00
10C	AVG COST IS $.75/GAL	09/30/82			7500		9458	.92	.88	6900.00
1CC		09/30/82	7425				9458	.98	.96	7276.50

	QTY	AMOUNT
INVOICED	22275	20938.50
PURCHASED		.00
RECEIVED	22500	21600.00
ADJUSTED		.00

Figure A.6-36

INVENTORY MASTER FILE

EXTENDED INVENTORY PRICE BOOK BY PRODUCT CLASS

PROD CLS	ITEM NO	DESCRIPTION	VENDOR NO	UNIT	ON-HAND	AVG COST	EXTENSION
	1	TEST	100		1958	.92	1801.36
	2	TEST			0	.00	.00
	200	OIL	100	QT	2-	.00	.00
	300	LUBE	100	LB	0	.00	.00
	400	GASOLINE	100	GL	0	.00	.00
	ANAN	ANANASE		EA	976	.12	117.12
	05955884	STARTER SWITCH	AC400	EA	0	.00	.00
	100000000000	TEST ITEM # 1			200	.00	.00
	200000000000	TEST ITEM # 2	12345		70	7.68	537.60
	300000000000	TEST ITEM # 3			2	.00	.00
	400000000000	TEST ITEM # 1			8	.00	.00
	500000000000	TEST ITEM # 2			9	.00	.00
****							2456.08
CC	500	BRAKE LINING	100	EA	8	5.00	40.00
CC	LAST10	XORD ORING	12345	1	32	1.00	32.00
****							72.00
01	100	DIESEL FUEL	100	EA	9458	.96	9079.68
****							9079.68
****	**********	**********	******	****	********	**********	11607.76

Figure A.6-35

PHYSICAL INVENTORY DEVIATION REPORT

ITEM #	DESCRIPTION	DATE COUNTED	AVERAGE UNIT COST	PHY COUNT	ON-HAND	DEV	DEV %	PHYSICAL EXT COST	ON-HAND EXT COST	DEVIATION EXT COST
80C	WINDSHIELD WIPER REFILLS 18'	/ /	.00	0	0	0	.0	.00	.00	.00
10C	REBUILT ENGINE DIESEL 31C-F	/ /	.00	0	0	0	.0	.00	.00	.00
20C	ENGINE REBUILDING KIT FOR 31CF	/ /	.00	0	0	0	.0	.00	.00	.00
120C	BATTERY 12-VOLT 55C AMPS	/ /	.00	0	0	0	.0	.00	.00	.00
220C	MOTOR OIL 10W-30	/ /	.00	0	0	0	.0	.00	.00	.00
70C	GLASS, WINDSHIELD CNTR.	/ /	.00	0	0	0	.0	.00	.00	.00
90C	HEADLIGHT LOW BEAM 6E-1209	/ /	.00	0	0	0	.0	.00	.00	.00
100C	RADIATOR HOSE 27"	/ /	.00	0	0	0	.0	.00	.00	.00
40C	BEARINGS MAIN 31C-F ENGINE	/ /	.00	0	0	0	.0	.00	.00	.00
60C	FRNT END REBLONG KIT 35C-GMC	/ /	.00	0	0	0	.0	.00	.00	.00
110C	ALTERNATOR BELT 15"	/ /	.00	0	0	0	.0	.00	.00	.00
130C	SIDE MIRROR 12" RECT.	/ /	.00	0	0	0	.0	.00	.00	.00
200C	GAS UNLEADED	/ /	.00	0	0	0	.0	.00	.00	.00
210C	DIESEL FUEL #2	/ /	.00	0	0	0	.0	.00	.00	.00
230C	GEAR OIL 90W	/ /	.00	0	0	0	.0	.00	.00	.00
240C	TRANS LUBE	/ /	.00	0	0	0	.0	.00	.00	.00
250C	BRAKE FLUID	/ /	.00	0	0	0	.0	.00	.00	.00
260C	AIR FILTER 310-F ENGINE	/ /	.00	0	0	0	.0	.00	.00	.00
270C	OIL FILTER FOR 310-F	/ /	.00	0	0	0	.0	.00	.00	.00
50C	WATER PUMP FOR 31C-F ENGINE	/ /	.00	0	0	0	.0	.00	.00	.00
30C	MUFFLER FOR 350-GMC BUS	/ /	.00	0	0	0	.0	.00	.00	.00
21 RECORDS							.0	.00	.00	.00

Figure A.6-34

FRIDAY APRIL 22,1983 MTD PROJECT SERVICES PAGE 1

PHYSICAL INVENTORY BOOK

WH-LOCATION	ITEM #.	DESCRIPTION	UNIT	ONHAND	REMARKS
10-14	800	WINDSHIELD WIPER REFILLS 18"	EA	------	----------
C2-5	1C0	REBUILT ENGINE DIESEL 310-F	EA	------	----------
C2-7	2C0	ENGINE REBUILDING KIT FOR 310F	EA	------	----------
02-4	12C0	BATTERY 12-VOLT 550 AMPS	EA	------	----------
10-5	22CC	MOTOR OIL 10W-30	QT	------	----------
C2-13	7CC	GLASS, WINDSHIELD CNTR.	EA	------	----------
1C-9	9CC	HEADLIGHT LOW BEAM GE-1209	EA	------	GE-1210
C2-1	1CCC	RADIATOR HOSE 27"	EA	------	----------
10-32	4CC	BEARINGS MAIN 31C-F ENGINE	EA	------	----------
1C-25	6CC	FRNT END REBUDNG KIT 35C-GMC	EA	------	----------
C2-3	11C0	ALTERNATOR BELT 15"	EA	------	----------
10-23	13CC	SIDE MIRROR 12" RECT.	EA	------	----------
1C-0C	2C0C	GAS UNLEADED	GL	------	----------
1C-CC	21C0	DIESEL FUEL #2	GL	------	----------
C2-8	23CC	GEAR OIL 90W	QT	------	----------
C2-9	24CC	TRANS LUBE	QT	------	----------
10-1C	25CC	BRAKE FLUID	QT	------	----------
1C-3	26CC	AIR FILTER 31C-F ENGINE	EA	------	----------
C2-7	27CC	OIL FILTER FOR 31C-F	EA	------	----------
10-1C	5C0	WATER PUMP FOR 31C-F ENGINE	EA	------	----------
C2-55	3CC	MUFFLER FOR 35C-GMC BUS	EA	------	----------

Figure A.6-33

A.9 Maintenance and Inventory System

2. Description of the System

An overall system schematic of the Maintenance and Inventory System is shown in Figures A.9-1 and -2. The following modules are identified:

1. Preventive Maintenance
2. Work Order
3. Inventory Management
4. Status Tracking
5. Failure Monitoring
6. Planning
7. Management Reporting

These modules are integrated and provide a comprehensive monitoring, control, and reporting system. All inquiries are done on-line. In addition, timely analyses, and exception and summary reports are provided. The system is designed to be "user-oriented".

A.9 Maintenance and Inventory System

2.1 Work Order Processing

The Work Order module is the central data collection and processing element of the Maintenance System. As shown in Figure A.9-3, most other modules interact with each other through this module. Completed inspections are submitted from the Preventive Maintenance Module. Inventory Transactions are reported from the Inventory Module and are linked to work orders and vehicles. The information is passed on from the Work Order module to the five reporting modules, Labor, Cost, History, Warranty, and Work Orders (WO).

The Work Order Processing Module differentiates between Work Initiators and Work Orders in the following way.

- For any problem identified, and not corrected immediately, during operations and inspection of vehicles, a Work Initiator (WI) is entered into the system. These WI's include trouble calls, driver defect reports and vehicle defects noted during inspections. It is intended that the WI be short-lived. Open WI's are therefore reviewed each day. When work is scheduled to deal with items identified on a WI, a Work Order is opened. A WI is closed out when either all items identified on it have been assigned work orders, or when it is determined that no further work is required.

- Work orders can also be entered on-line without initiation by a WI. The labor hours of open work orders are updated as work progresses. When the work is completed, the work order will be closed and the information contained on it transferred to a repair history file. Information from closed WIs is also transferred to the repair history file. The cost of labor and parts consumed is determined when workorders are closed out. Both, work initiators and work orders, update the status information of a vehicle, providing up-to-date information on vehicle availability.

Warranty tracking and reporting is another feature of the Work Order module. Possible warranty conditions are checked when work is performed on vehicles or components. If the vehicle or component is under warranty, a report on the warranty costs is generated.

In addition to the current vehicle status and repairs history that is provided on-line through the Work Order module, key labor performance reporting, vehicle and component analyses, reimbursable cost reporting, and the required audit trail reports are generated.

A.9 Maintenance and Inventory System

2.2 Preventive Maintenance Module

The Preventive Maintenance module tracks vehicle and support equipment usage and mileage to schedule inspections and preventive maintenance (PM). Consumables are also tracked in this module. The functions of this module are shown in Figure A.9-4. Reports are generated for projections of inspections, preventive maintenance, and consumables usage.

Inspection intervals are established by subfleets. Actual or scheduled mileage, fuel usage, or hours of usage may be used as the basis for scheduling vehicle PM. Special service type inspections, and interior cleanings can be scheduled by elapsed time (days), mileage, or specific dates. Mileage or hours of usage is the basis for component inspections. Elapsed time (days) or specific dates is used for scheduling support equipment PM.

Inspections and PM events due are reported periodically. PM events are considered due if their due time falls within a user-defined range. In addition, vehicle and component usage may be projected further out into the future based on historical averages of subfleet usage. This provides a long-term projection of PM requirements that can be used to smooth workloads. This long-term projection may be particularly useful for component PM.

The peformance of preventive maintenance is analysed and reported. The report includes inspections which were performed early, on-time, and late, as well as the work backlog. A report indicating the types of inspections performed is also generated.

2.3 Status Tracking and Reporting Module

The Status Tracking and Reporting Module provides fleet inventory reporting and sub-fleet assignment. This module, shown in Figure A.9-5, will assign sub-fleets to particular routes before peak pull-out. Assignment is based on the characteristics of the route, the availability of vehicles within the sub-fleets and the operating characteristics of the sub-fleets.

Vehicle availability information is provided by both on-line inquiry and hardcopy reports. Fleet inventory information is similarly provided.

2.4 Inventory Management

The Inventory Management module, shown schematically in Figure A.9-6, has been designed to provide three major functions: inventory control, purchase requisition and order processing, and purchase order tracking. Transaction and adjustments are made on-line. This module will generate status and analysis reports, as well as the required audit trail reports.
A perpetual inventory based on weighted moving average costs is maintained. Inventory receipts, issues, transfers, and returns are recorded as the transactions occur. Thus, inquiries can be made on up-to-date balances for all inventory items. The Inventory Management module interfaces with the Work Order module and supplies information to the Management Reporting and Planning modules. It also interfaces with the accounting system to supply appropriate inventory value and parts costs.

Parts costs are charged to vehicles and support equipment through the work order number. Costs are determined using moving averages.

Based on a user specified model, the system determines when a part should be reordered. A suggested reorder report is generated. In this report transfers of inventory between divisions or garages may also be suggested.
When the suggested reorder is acted on, the purchase order information is entered into the Inventory Management Module. The Inventory Management Module will not actually prepare purchase orders. However, purchase orders and requisition will be monitored.

Special inventory requirements above normal usage and campaign requirements can also be entered into the system to influence ordering times and quantities. This includes "Bill-of-Materials" type processing, for instance when a component requires rebuild for a campaign. In addition to impacting the reorder process, the "Bill-of-Materials" feature can be used for long-term parts planning.

Component tracking is provided by automatically recording a component as being changed-out when a new component is issued from inventory. The changed-out component is considered a "Repair Cycle Part" (RCP). The location and status of these RCP's is tracked until they are either returned to finished inventory or disposed.

The system uses either the manufacturer's part numbers or an internal part numbering scheme. These part numbering schemes may be cross-referenced.

Several type of inventory analyses and vendor performance reports can be generated by the system. Information from these reports allows inventory and purchasing managers to monitor inventory needs and vendor responsiveness.

2.5 Failure Monitoring

The Failure Monitoring module shown schematically in Figure A.9-7 uses driver defect, trouble call history, and the data from the transportation log to produce failure analysis reports. These reports are classified in three categories: driver defect analysis, trouble call analysis, and combined failure analysis. Both, periodic and on-request, parameter driven reports can be produced.

For trouble call analysis, the dispatcher's log is entered directly on-line. This information is matched to the related trouble call reports. Failure analysis of support equipment can be reported separately.

2.6 Planning

The Planning module provides short-term work scheduling and long-term planning. The system schematic for short-term scheduling is shown in Figure A.9-8. Short-term scheduling is primarily oriented to personnel control, matching skills with job requirements and making work assignments. It involves tracking employee schedules, skills and general personnel information (e.g., seniority), and identifying excessive absences. Scheduled vacations and holidays are entered along with the employees' normal schedules. This input allows the system to project available resources by shift and position. It also monitors actual to scheduled personnel availability.

For short-term work scheduling, the Work Order and Preventive Maintenance modules supply work requirements in order of their priority, based on the criticality of the work. This includes both inquiry and reporting on work order backlog, maintenance scheduling, and work and skill requirements.

An after-the-fact daily summary of outstanding work, new work requirements, work performed, and actual manpower availability is also reported to closely monitor progress in relieving backlogs, actual work performance relative to actual labor hours available, and excessive absences.

The long-term planning system schematic is shown in Figure A.9-9. The long-term planning portion of the system provides an analytical modeling tool for projecting resource requirements for budgeting purposes, siting and building new maintenance facilities, acquisition of new vehicles, or changes in fleet assignment to divisions caused by a "shake-up."

Using historical performance or work standards as a base, various parameters (e.g., projected mileage, usage, overhead adjustments, etc., by garage or division) can be entered to yield total work requirements by task. By varying the assumptions, the impact of differring conditions on projected resource requirements can be evaluated.

2.7 Management Reporting

The Management Reporting module, shown schematically in Figure A.9-10, provides maintenance and inventory performance reports by authority, division or garage, and subfleet. Project cost is also included in this module.

Each authority can establish performance indicators parametrically. The calculations required to derive the indicators and desired plans are entered into the module. On an established frequency or on-request, the system will extract information from the Work Order, Preventive Maintenance, and Inventory modules to compare the plans against calculated factual performance.

The performance indicators defined by the Consortium can be classified into the following groups: consumables and mileage, preventive maintenance, work order repairs, costing, trouble call and defect analysis, status tracking, inventory, and labor performance.

Project costs accumulated by the Work Order system are also reported in this module by current month and over the project.

A.9 Maintenance and Inventory System

3. Hardware

The system is to be implemented at five sites on different minicomputers. The exact hardware configurations has not been determined at this time.

4. References

A.9-1 "A Program for Improving Transit Industry Management Information Systems, Volume 1 Information Systems Improvement Plan Summary; and Vol III Systems Design Reference Manual. UMTA-IT-06-0094-77-5; Arthur Andersen & Co., Washington, DC; September 1976.

A.9-2 Vehicle Maintenance Reporting Standards Handbook; American Trucking Association, Inc.; revised December 1982.

A.9-3 Western Transit Maintenance Consortium - Maintenance/Inventory System Summary Narative, 1983.

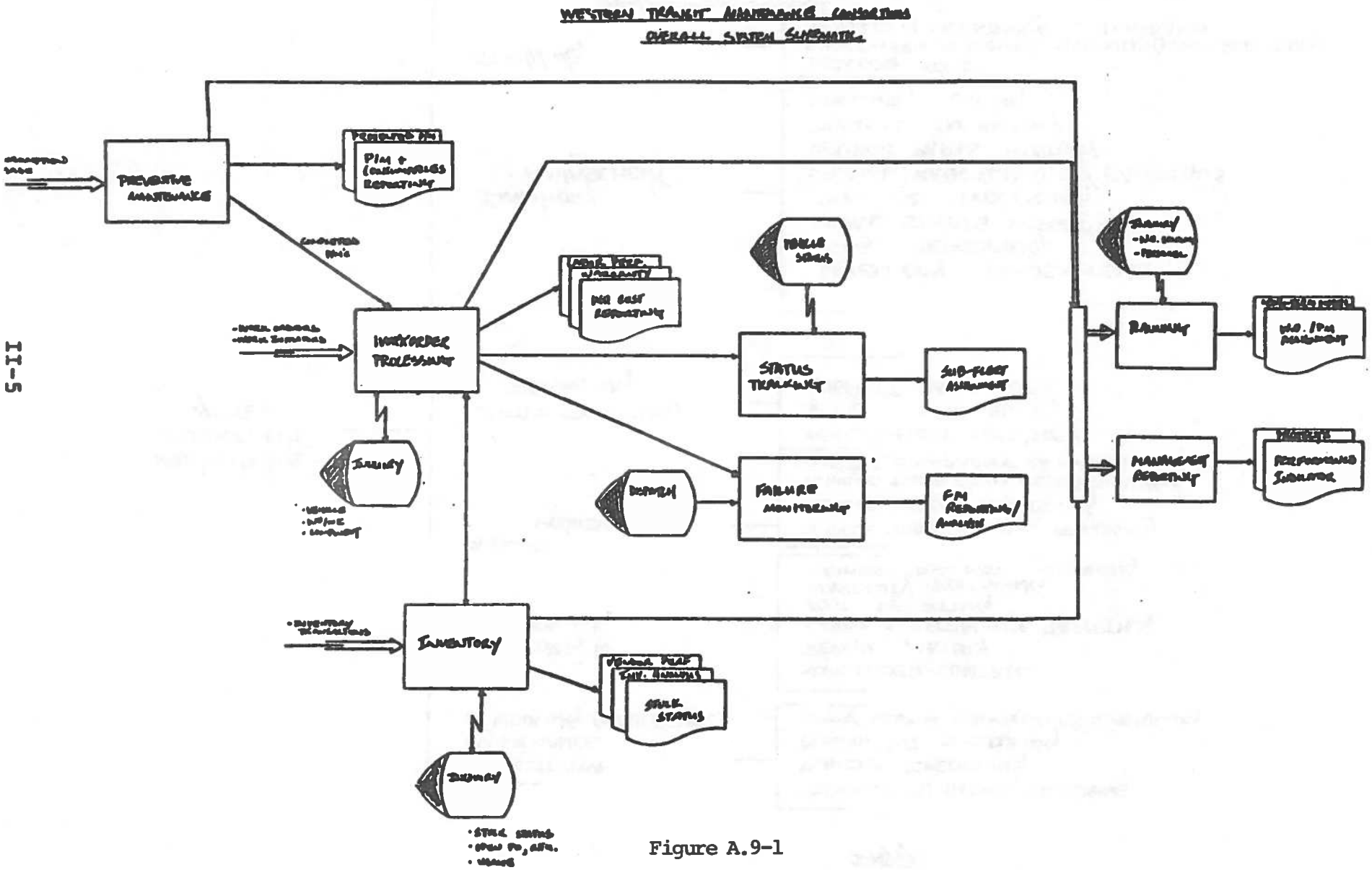

PREVENTIVE MAINTENANCE
PM & CONSUMABLES REPORTING
WORKORDER PROCESSING
PM COST REPORTING
STATUS TRACKING
SUB-FLEET ASSIGNMENT
FAILURE MONITORING
PM REPORTING/ ANALYSIS
INVENTORY
STOCK STATUS
PERFORMANCE SIMULATOR

Figure A.9-1

WESTERN TRANSIT MAINTENANCE CONSORTIUM
TOP-LEVEL FUNCTION CHART
INDEX

Figure A.9-2

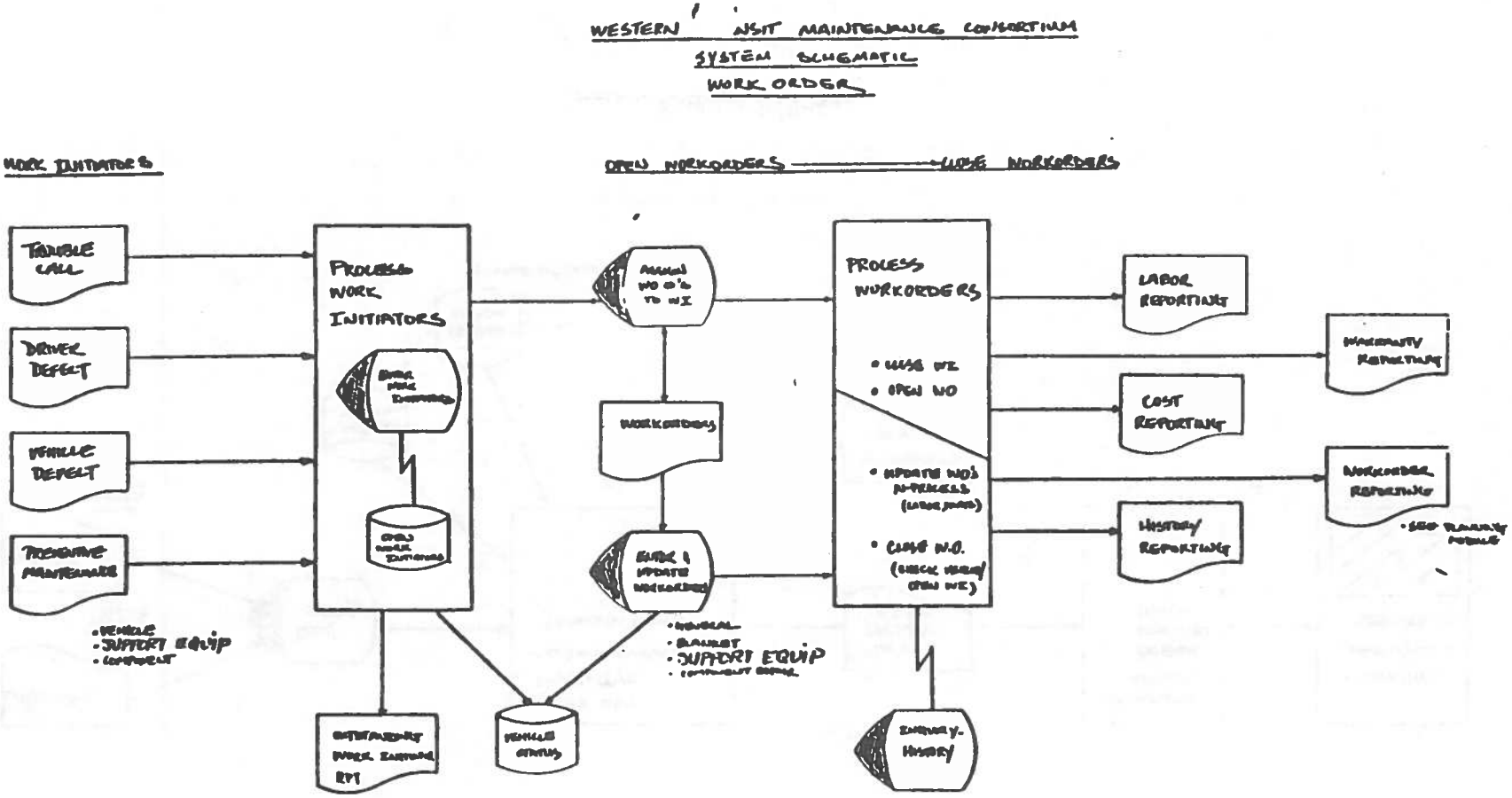

WESTERN ARSIT MAINTENANCE CONSORTIUM
SYSTEM SCHEMATIC
WORK ORDER
WORK INITIATORS
OPEN WORKORDERS
CLOSE WORKORDERS
TOWABLE CALL
DRIVER DEFECT
VEHICLE DEFECT
PREVENTIVE MAINTENANCE
PROCESS WORK INITIATORS
PROCESS WORKORDERS
LABOR REPORTING
COST REPORTING
HISTORY/ REPORTING
SUPPORT EQUIP

Figure A.9-3

WEST TRANSIT MAINTENANCE CONSORTIUM

SYSTEM SCHEMATIC

PREVENTIVE MAINTENANCE

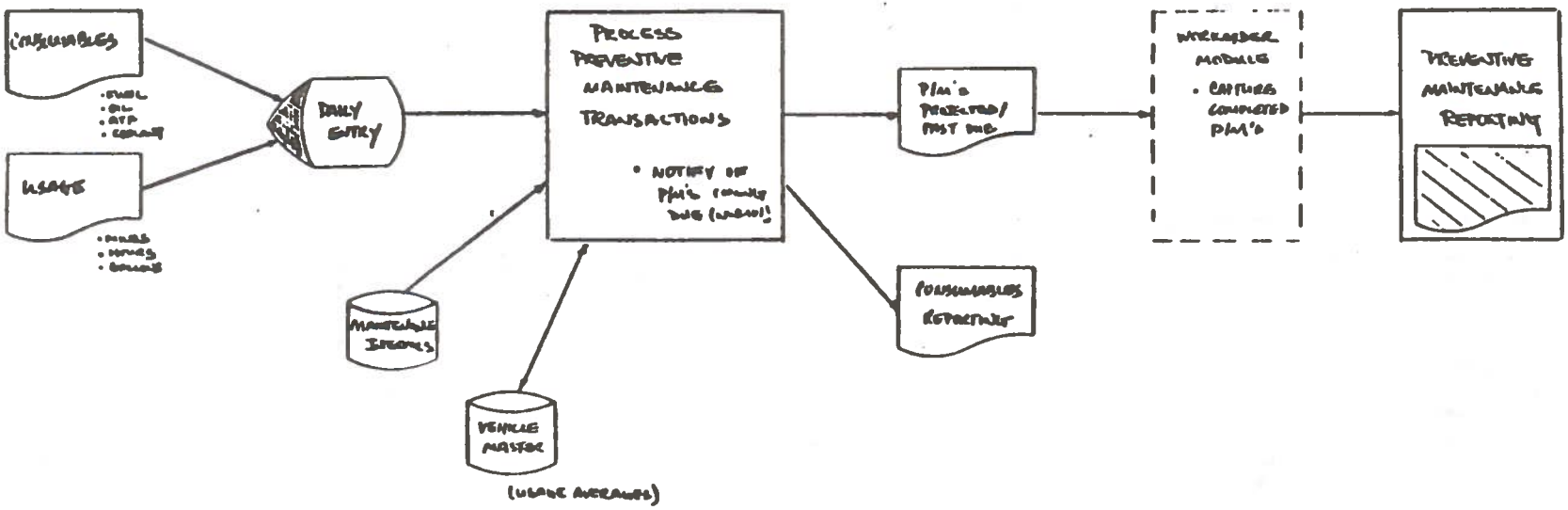


Figure A.9-4

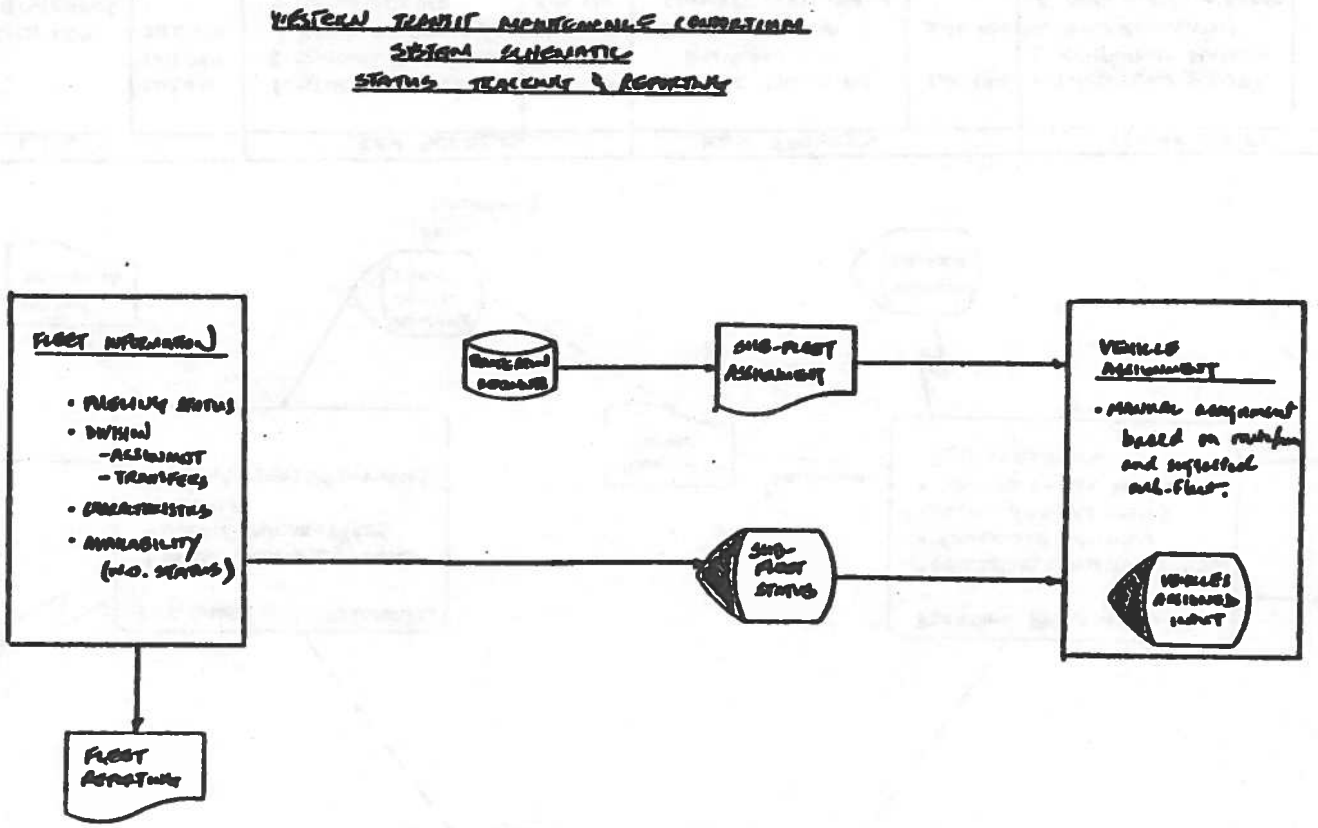
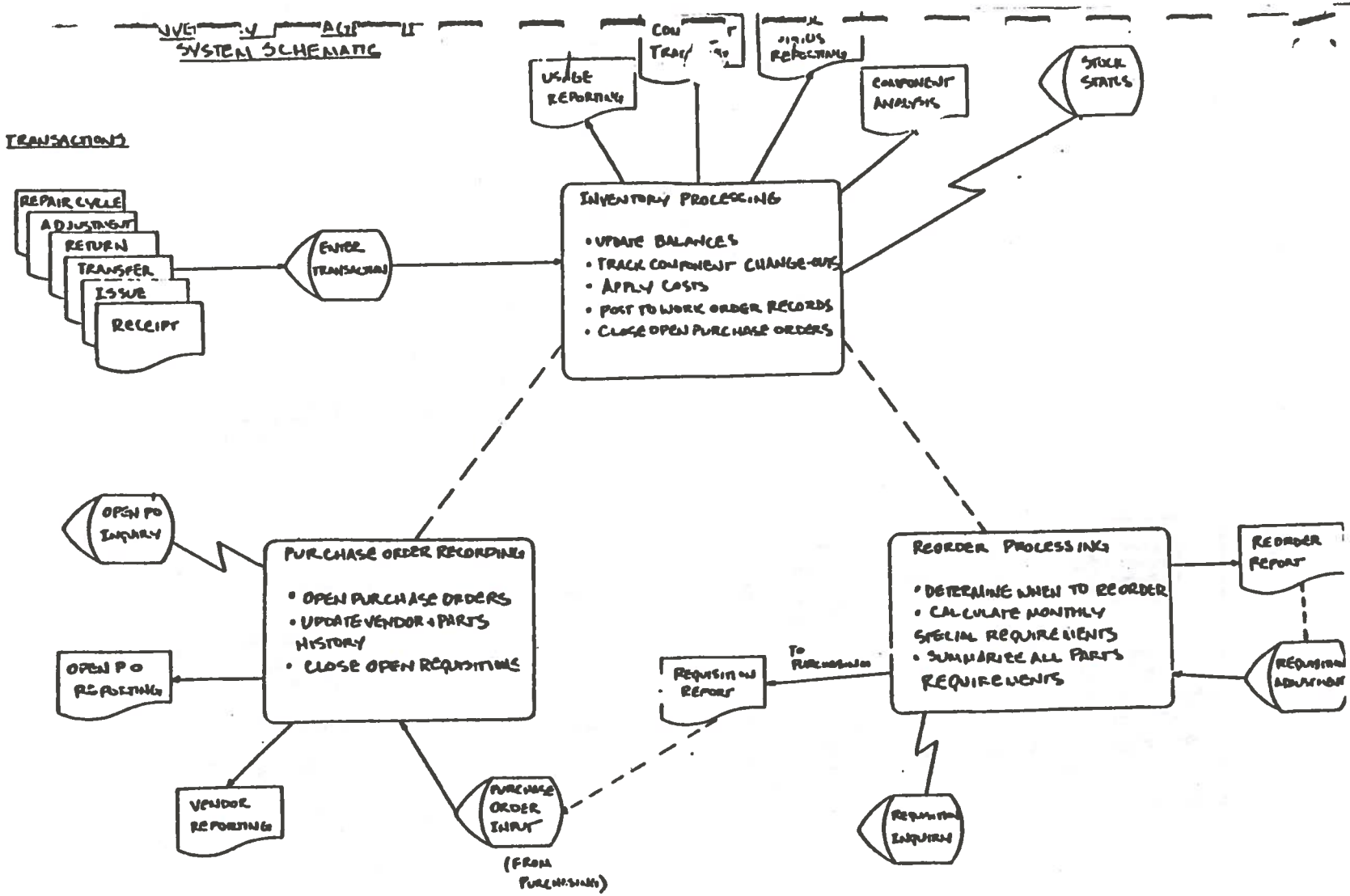

FLEET INFORMATION
• FLEETING STATUS
• DIVISION
-ASSIGNMENT
- TRANSFERS
• CHARACTERISTICS
• AVAILABILITY
(NO. STATUS)
SUB-FLEET ASSIGNMENT
SUB-FLEET STATUS
VEHICLE ASSIGNMENT
• MANUAL ASSIGNMENT
BASED ON
AND SUGGESTED
SUB-FLEET
FLEET ASSIGNMENT

Figure A.9-5

INVENTORY ACCOUNTING SYSTEM SCHEMATIC



KEY INPUTS		KEY SCREENS		KEY REPORTS		MAJOR FILES
1. RECEIPT	IN0010	1. STOCK STATUS INQUIRY	INS090	1. STOCK STATUS BY DIVISION	INR100	1. INVENTORY MASTER
2. ISSUE	IN0020	2. SEASONAL PART USAGE	INS115	2. SYSTEM GROUP SUMMARY PARTS USAGE	INR025	2. COMPONENT MASTER
3. REPAIR CYCLE PARTS TRANSACTIONS	IN0030	3. REQUISITION INQUIRY	INS130	3. COMPONENT ANALYSIS	INR090	3. OPEN REQUISITION
	:	4. PURCHASE ORDER INQUIRY	INS135	4. REORDER ACTION	INR160	4. OPEN PURCHASE ORDER
				5. REQUISITION	INR170	5. VENDOR MASTER
				6. RCP EXCEPTIONS	INR115	
				7. OVERDUE PURCHASE ORDERS	INR195	
				8 VENDOR PERFORMANCE	INR130	

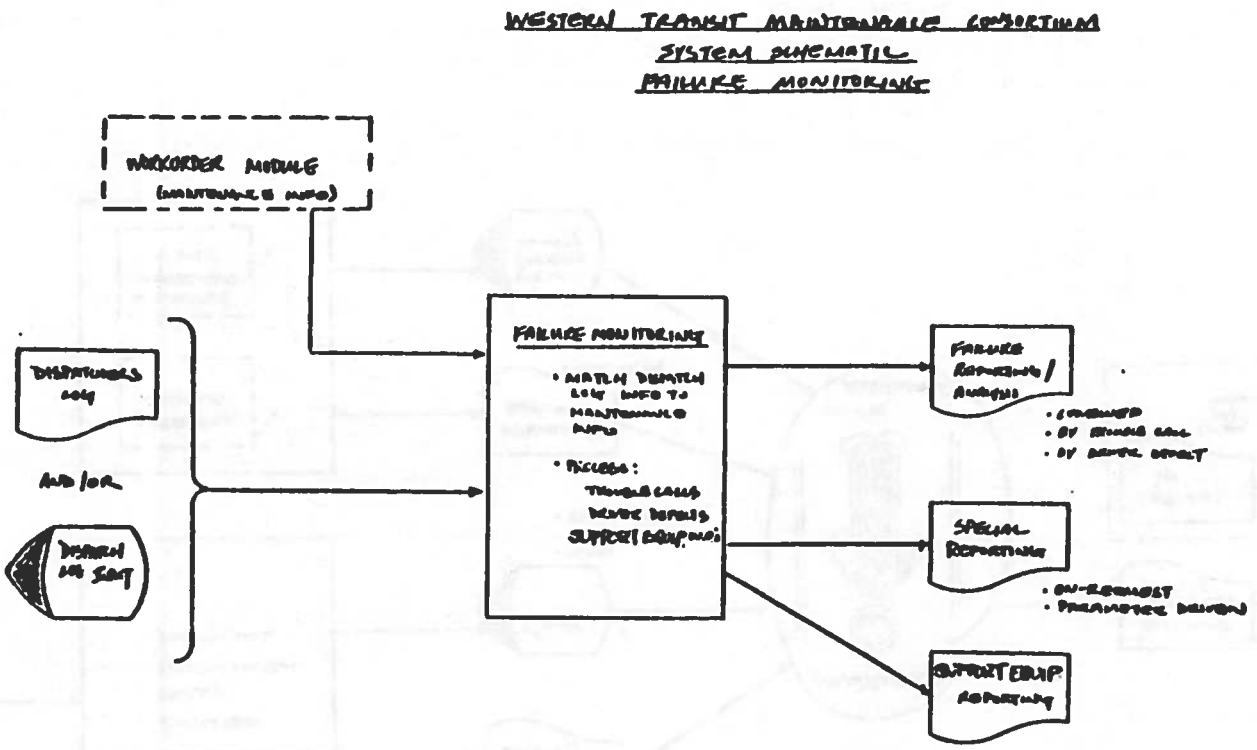

WESTERN TRANSIT MAINTENANCE CONSORTIUM
SYSTEM SCHEMATIC
FAILURE MONITORING
WORKORDER MODULE
AND/OR
FAILURE MONITORING
SPECIAL
SUPPORT EQUIP

Figure A.9-7

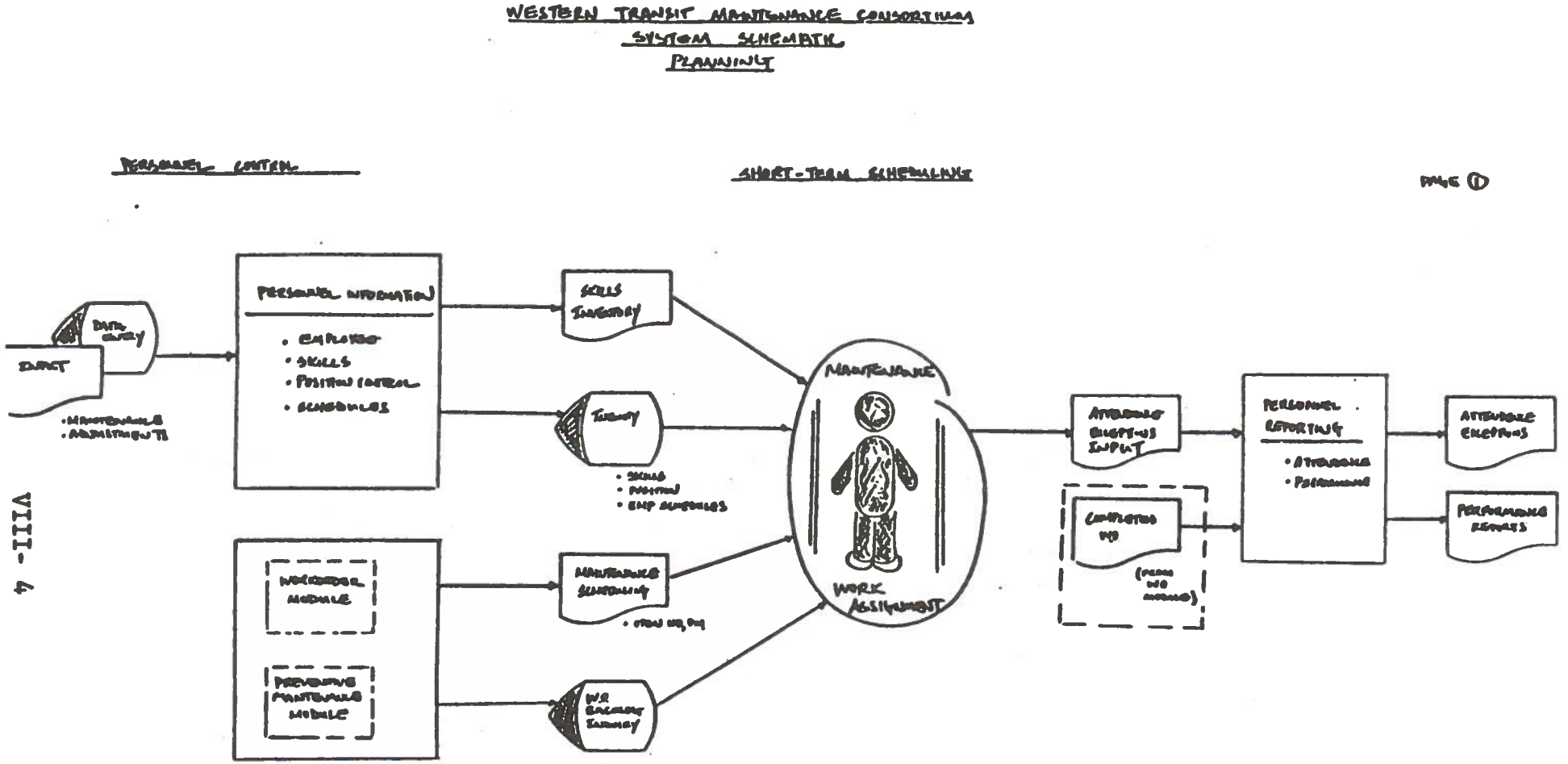

WESTERN TRANSIT MAINTENANCE CONSORTIUM
SYSTEM SCHEMATIC
PLANNING
SHORT-TERM SCHEDULING
PAGE 1
PERSONNEL INFORMATION
• EMPLOYEE
• SKILLS
• POSITION CONTROL
• SCHEDULES
SKILLS INVENTORY
TRAINING
MAINTENANCE
WORK ASSIGNMENT
PERSONNEL REPORTING
• ATTENDANCE
• PERFORMANCE
ATTENDANCE EXCEPTIONS
PERFORMANCE REPORTS
WORK ORDER MODULE
PREVENTIVE MAINTENANCE MODULE

Figure A.9-8

WESTERN TRANSIT MAINTENANCE CONSORTIUM
SYSTEM SCHEMATIC
PLANNING

LONG TERM PLANNING

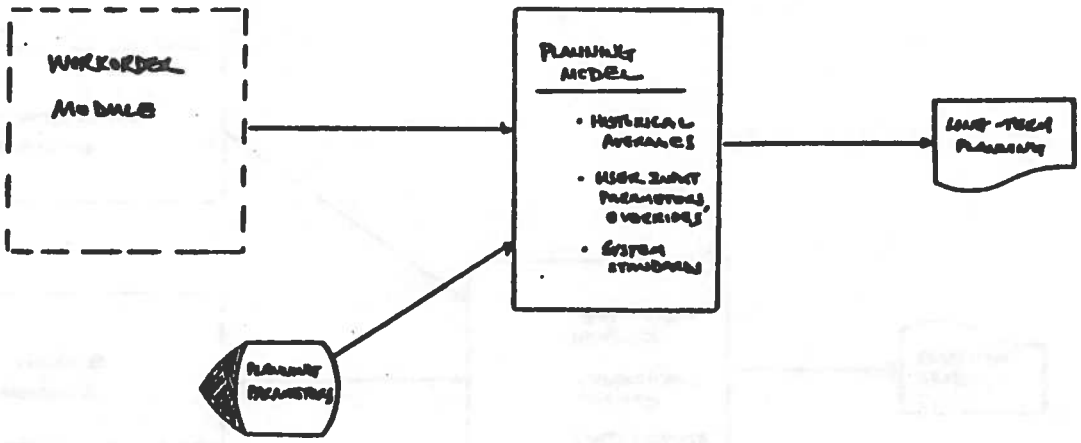


Figure A.9-9

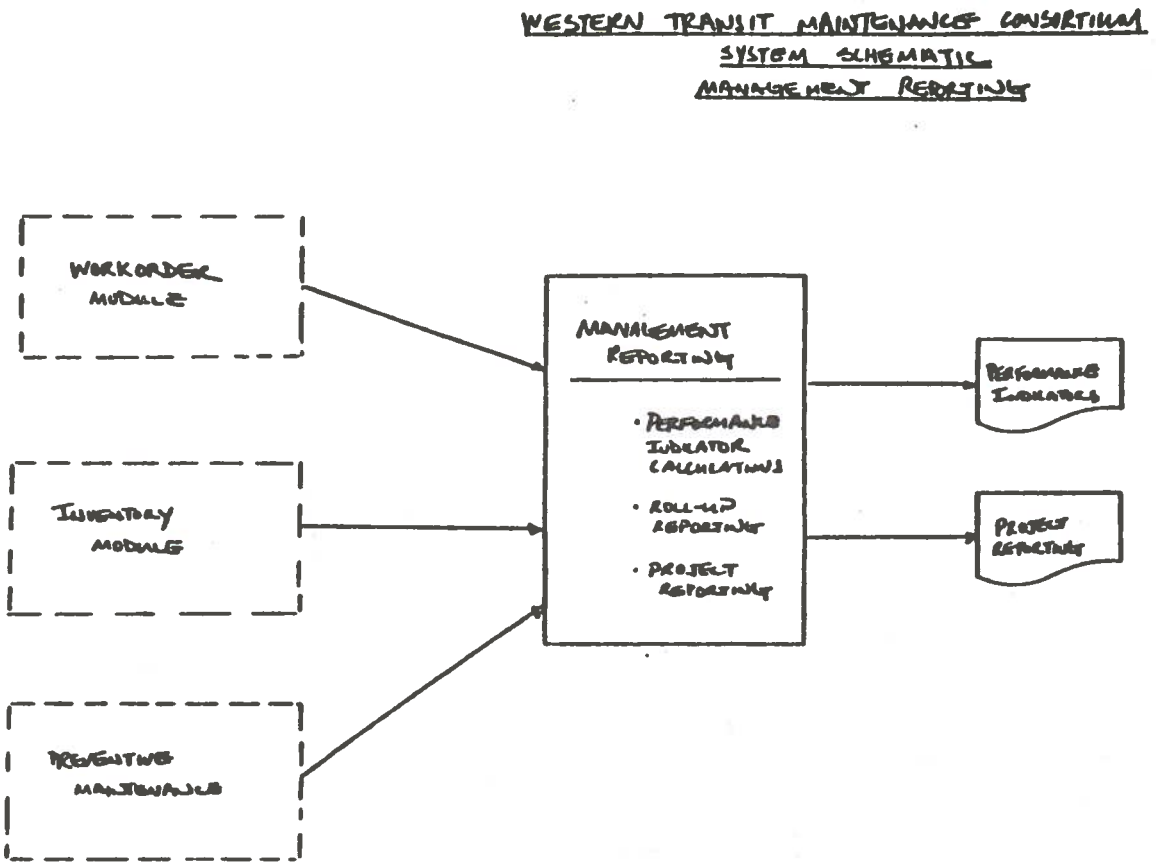

WESTERN TRANSIT MAINTENANCE CONSORTIUM
SYSTEM SCHEMATIC
MANAGEMENT REPORTING
WORK ORDER MODULE
INVENTORY MODULE
PREVENTIVE MAINTENANCE
MANAGEMENT REPORTING
• PERFORMANCE INDICATOR CALCULATIONS
• ROLL-UP REPORTING
• PROJECT REPORTING
PERFORMANCE INDICATORS
PROJECT REPORTING

Figure A.9-10

A.10 MAINTENANCE AND MATERIALS MANAGEMENT SYSTEM (MMM)

VISTA SYSTEMS, INC.

A.10 MMM

1. INTRODUCTION

VISTA's Maintenance and Materials Management (MMM) system automates information processing for equipment maintenance, parts inventory management and procurement. Although it is focussed on vehicle maintenance, it can also be used for any other type of equipment or facility.

MMM is fully interactive and uses simple commands and menus. Information is entered via interactive screens and can be retrieved in the form of on-line screen displays or or in the form of printed reports. MMM satisfies requirements for standard financial, historical, and trend reporting and provides information to assist the maintenance manager and the inventory clerk in their job functions. Many of the basic data can be defined by the user and modified as necessary. This is accomplished through user-defined files which specify stock items, equipment configurations, maintenance activity codes, and preventive maintenance programs. There are no limitations on the fleet sizes or number of stock items which can be handeld by the system.

MMM was developed by VISTA with the consultation of maintenance managers from a number of transit companies. It is currently being implemented at the Capital District Transit Authority of Albany, NY.

2. DESCRIPTION OF THE SYSTEM

MMM is divided into a Vehicle Maintenance Module and an Inventory Module. The maintenance module is designed to satisfy the information needs of the Maintenance shops and performs the following functions:

- Processing and tracking of work orders, road call records, and servicing records.
- Tracking of conditions and repair histories of vehicles and serialized components
- Projection of future maintenance events
- Accounting of maintenance labor and cost.

The Inventory Module is targeted at the inventory clerk, and the purchasing and finance departments. It performs the following functions:

- Manual purchasing of any item and automatic purchasing of inventoried items, including an optional reorder point calculation
- Procurement tracking
- Assistance in receiving, including price adjustments and returns to vendors
- Tracking of inventory movements (issues, inter-storeroom transfers and mechanic turn-ins)
- Assistance in taking of physical inventory count and reconciliation

2.1 The Vehicle Maintenance Module

The Vehicle Maintenance Module tracks and reports maintenance history; accumulates and reports labor and parts costs; analyzes and reports defects by component, vehicle and fleet; accumulates and reports consumables histories; and projects future maintenance events.

The user develops and maintains master files of equipment configurations and stock items as well as a code book for component, defect, problem, and repair action codes. All codes are defined by the user and may vary in length between one and thirteen characters. The user also specifies the preventive maintenance program. Inspection cycles may be entered in hours and/or miles.

The main menu of the Vehicle Maintenance Module is shown in Fig. A.10-1. All activities of the module are started from this menu. In the following these activities are described in groupings and in an order different from the main menu.

Work Order Processing

All maintenance actions are captured using a common work order entry screen shown in Fig. A.10-2. Work orders are opened by entering the date, vehicle number and problem. Defects, components, mechanic ID's and hours spent may be entered whenever this information becomes available, possibly at the time the work order is opened. The user can modify data after initial entry and add data to a work order (e.g. additional mechanics, problems or defects).

Tne user can call up screen displays which show the work orders that are open at some repair facility or on some vehicle. Another screen shows the work orders currently assigned to one mechanic. As an example for the format, Fig. A.10-3 shows the screen with the currently open work orders. A summary of each work order can also be printed. An example of this is shown in Fig. A.10-4.

The work order tracking function automatically accumulates all work performed on each vehicle and on up to ten user-specified sub-assemblies. The following information can be generated and displayed on on-line screens:

- The repair history of a vehicle
- A summary of components installed on a vehicle
- A listing of road calls
- A listing of inspections due

The following written reports can be generated from the work order information:

- A history of repairs on a vehicle or on a system
- A history of repairs by problem
- A fleet defects analysis (see Fig. A.10-5 for an example)
- A history of component changes for each vehicle
- A listing of repeat workorders on vehicles
- A listing of component replacements performed in one repair location in a specified interval of time

- A listing of all workorders one mechanic worked on during a specified interval of time
- A listing of workorders for one vehicle and one mechanic
- A listing of repair costs either by vehicle, by system or by problem (see Fig. A.10-6 for an example)
- A listing of system failures by vehicle or by date
- A listing of road calls by vehicle or by mechanic
- Listings of inspections performed and inspections due

Vehicle Status

The status of each vehicle may be updated via the screen shown in Fig A.10-7. Listings of vehicles available or disabled at any one given time may be displayed on the screen.

Venicle Servicing

Vehicle servicing activities are entered via the screen shown in Fig. A.10-8 or through hand-held data collectors. Daily fueling summaries per vehicle can be displayed on the screen, as can the rate of fuel consumption on a year-to-date and month-to-date basis. Annual summaries of fuel and oil consumption per month and for each vehicle may be printed or displayed on the screen. Only available in printed form is an exception report which shows all vehicles for which the consumption of fuel or oil was outside some specified range.

Warranty Claims

A facility is provided to track warranty claims for vehicles and components. The identification numbers of work orders associated with each claim are entered via the screen shown in Fig. A.10-9. Also entered in this screen are the amounts claimed and any compensation received. Summaries of open claims may be displayed on the screen. Also, a printed report for all claims within a specified interval of time may be produced.

Initialization of Data

The following data are required to initialize the maintenance module:

- The vehicle master file
- The file of repair codes
- The file of serialized components
- The specification of the maintenance program

These data are entered via the screens shown in Figures A.10-10 to 13. The data may be displayed on screens. Also, the vehicle master list and the file of repair codes can be printed. Examples of these are shown in Figures A.10-14 and 15.

2.2 The Inventory Control Module

The Inventory Control Module is a self-contained set of programs which monitor and report materials movements and assist in the purchasing function. It can be integrated with VISTA's Financial Management System for expense distribution on either a FIFO or an average pricing basis. It interfaces with the Vehicle Maintenance Module, receiving materials movements information and providing materals cost information.

The module supports the following four functions:

- Maintenance of an Inventory Master File. This file may contain an item description of up to 70 characters, bin locations, and information on up to ten vendors and their part numbers for each inventoried item. Manufacturers part number supercesssions are handled via look-up tables.
- Purchasing. A report is isssued when the stock level for an item falls below a user-specified threshold. Purchase orders are generated with operator interaction. For each item up to seven purchase orders may be tracked at any one time.
- Receiving. The stored purchase order data are retrieved on receipt of parts, minimizing the data entry required for recording the additions to inventory.
- Parts Issues. All issues of parts are tracked and the appropriate adjustments are made. All issues are recorded and may be costed using either the average or the FIFO method. Transfers between storeroom locations, turnins from mechanics, and return of parts to vendors can also be handled.

The various activities of the Inventory Control Module are started by means of commands listed in the Help Command Screen Display. This display is shown in Figure A.10-16.

Purchasing

A listing of stock items with stock levels below the specified minimum may be produced at any time at the request of the user. A sample copy of this listing ("Reorder Requirements Report") is shown in Figure A.10-17. For any of the items included in this listing an automatic purchase order may be generated on the screen. Alternatively, purchase orders may be created manually on the screen. After review and - if necessary - editing, the purchase order may be printed on stock forms.

At the time of printing, the system will initiate tracking of the purchase order. Issue of purchase orders, together with other inventory transactions, is recorded in the transaction log which may be called up on the screen at any time. Open purchase orders may be displayed on the screen on request. The status of all open purchase orders for each vendor may be printed on request.

The purchase history and alternative sources of supply may be displayed on the screen at any time. The information includes past lead times and prices as well as a calculation of an average price.

Receiving

When materials are received, the Receiving Clerk enters the purchase order number, the stock number, the quantity received, and the date. If the system has a record of a matching open order, it will display vendor information and price. If there is no record of a matching order in the system, the information has to be entered manually if the received materials are to be accepted. Recording receipt of materials causes the stock level and the average and last price to be updated. A special command ("ONHAND") allows receipt of materials without changing the average price. Through another command ("REHAB") rebuilt items may be added at a specified fraction of their new price.

Issues

All issues from stock are recorded via the Issue Command screen. The workorder number against which the material is charged is recorded on this screen, providing the bridge to the Vehicle Maintenance Module. Turnins and returns are handled in an analogous manner.

All movements of material between different locations are recorded on screen via the Transfer Command. Transfer packaging lists are produced and accompany the transfers.

The system permits for material to be set aside as reserve for future usage. The Reserve command is used to initiate this. All open reserve items may b displayed on the screen.

Physical Inventory Count

For the purpose of taking a physical inventory count, a list of all stock items by bin location may be produced. The physical count may be entered into blanks in this report. From there the information is transferred to the system. A hard-copy report of all count discrepancies is produced.

Inventory Status Displays and Reports

A number of reports on various aspects of the inventory situation may be produced at the request of the user.

- Inventory Status Report. This report provides detailed information for each stock item. It can be produced for specific stock items, for a specific storeroom, or for the entire system. An example of this report is shown in Figure A.10-18.
- Inventory Activity Report. This report summarizes orders, receipts, issues and transfer data for each storeroom for a specified period. An example of this report is shown in Figure A.10-19.
- The Inventory Transaction Report summarizes all inventory transactions for a stockroom.
- A display of inventory on hand per location for a specified item.
- A display of all stock numbers which correspond to the same item description.

3. Hardware

MMM is available for any of the families of PRIME and Digital Equipment Corporation VAX computers, including their low-end versions, and on any UNIX-based 16-bit microcomputer. For example, the smallest PRIME computer is a model 2250 with 1/2 Mb of main memory, a 58 Mb Winchester disk, and an integral cartridge tape drive. A typical microcomputer configuration includes 1/2 Mb RAM and a 20-40 Mb Winchester disk. Either one of these two systems would support two to three simultaneous users.

The microcomputer option could be upgraded to support a practical maximum of six to eight users, while the minicomputer option in the low-end range could handle up to 15 to 20 users. Other minicomputer configurations can handle 100 and more users.

The programs of MMM are written in ANSI standard FORTRAN 77. The data files are a mix of direct access and indexed sequential files, all of which are accessible from a variety of available report writer and query systems. The software system was designed to interface with INFO a relational data base management system that provides query capability.

4. References

A.10-1 VISTA - Pioneer Valley Transit Authority, Vehicle Maintenance Module, Reference Manual, 1983.

A.10-2 VISTA - Pioneer Valley Transit Authority, Inventory Module, Reference Manual, 1983.

```
7/25/83                                                    VMS 1.0

                          VISTA SYSTEMS

                VEHICLE MAINTENANCE MODULE

VALID COMMANDS ARE:

     WORK - TO DO WORK ORDER PROCESSING
     STAT - TO DO VEHICLE AVAILABILITY PROCESSING
     FUEL - TO DO VEHICLE SERVICE PROCESSING
     WARR - TO DO WARRANTY CLAIMS PROCESSING
     BOOK - TO UPDATE THE CODEBOOK
     UNIT - TO UPDATE THE VEHICLE MASTER FILE
     COMP - TO UPDATE THE SERIALIZED COMPONENTS FILE
     INSP - TO UPDATE THE INSPECTION FILE
     CLOS - TO PROCESS CLOSED WORK ORDERS
     ARCH - TO ARCHIVE WORK ORDER DATA

     HELP - TO DISPLAY HELP
     QUIT - TO END THIS SESSION



ENTER COMMAND >>
```

Fig. A.10-1

VISTA

VEHICLE MAINTENANCE MODULE

WORK ORDER ENTRY SCREEN

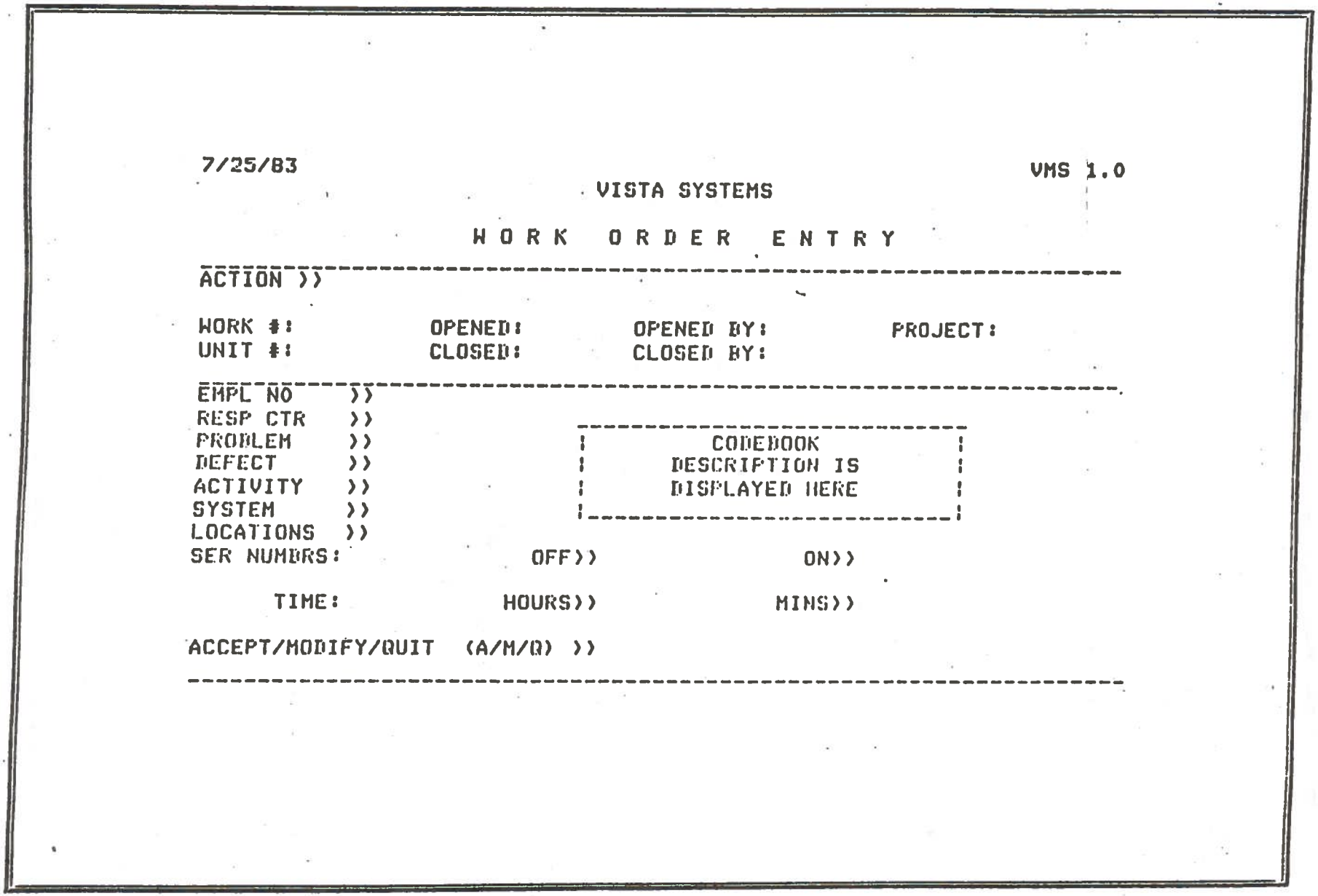


Fig. A.10-2

A.10 MMM

VEHICLE MAINTENANCE MODULE

CURRENT OPEN ORDERS SCREEN DISPLAY

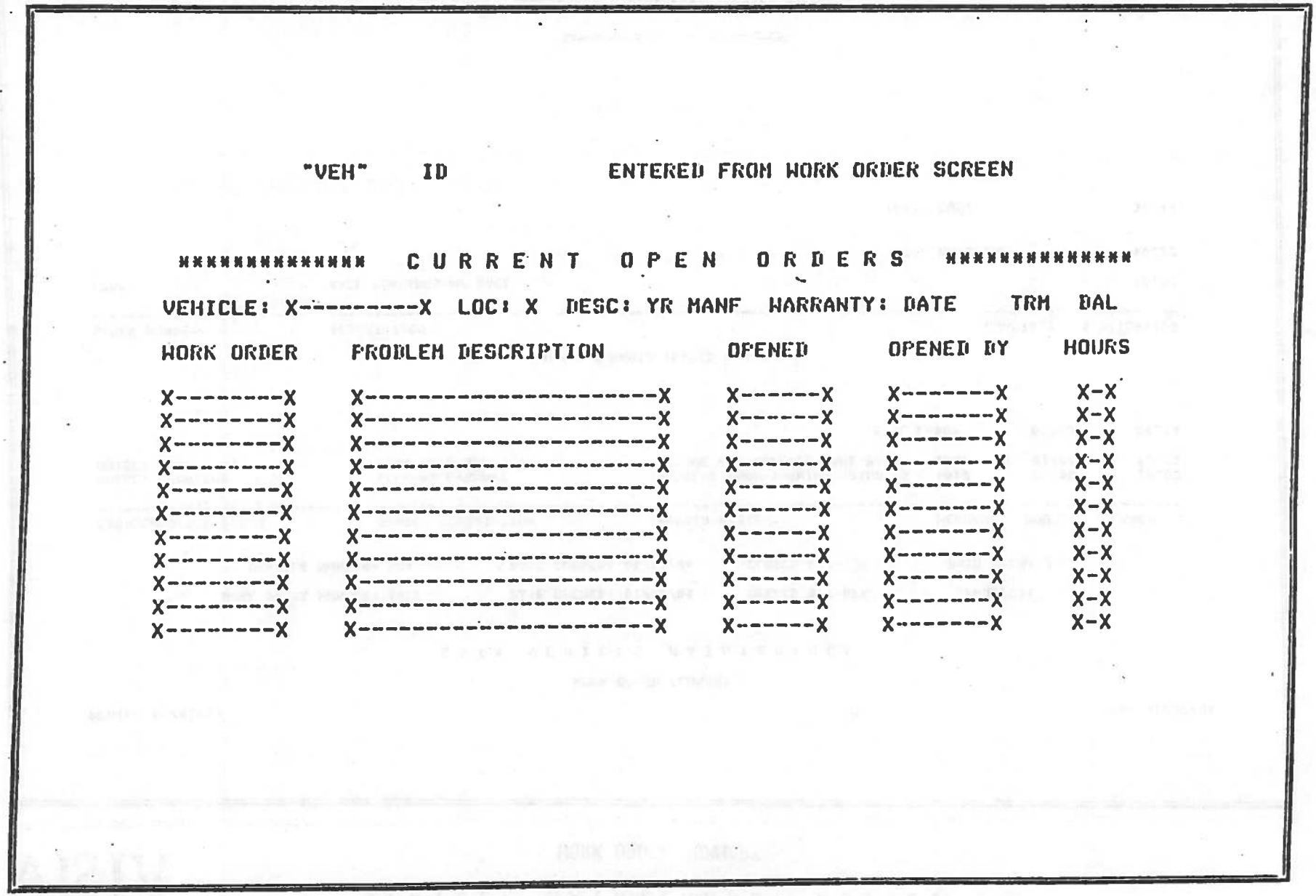


Fig. A.10-3

VISTA

VEHICLE MAINTENANCE MODULE

WORK ORDER SUMMARY

BEGIN: 01/01/83 END: 01/30/84

WORK ORDER SUMMARY

CDTA VEHICLE MAINTENANCE

WORK ORDER NUMBER: 1017 DATE OPENED: 01/12/84 OPENED BY: RFK PROJECT:

VEHICLE NUMBER: 504 DATE CLOSED: 01/13/84 CLOSED BY: TJS DAYS OPEN: 2

PROBLEM DESCRIPTION	SYSTEM DESCRIPTION	REPAIR ACTION	MECHANIC	HOURS	$ LABOR
NOISE, REAR END	REAR AXLE,SHAFT	MACHINE SHOP-TURNING GRINDING	1012	02:00	19.02
NOISE, REAR END	REAR AXLE,SHAFT	REMOVE AND REPLACE SAME PART	1037	01:00	10.12
		TOTAL LABOR		02:00	$ 29.14

* * * * * PARTS ISSUED * * * * *

STOCK NUMBER	DESCRIPTION	QUANTITY	$ MATERIALS
1200	AXEL BEARINGS W/ RACE	1	10.32
	TOTAL MATERIALS		$ 10.32
	TOTAL COST		$ 39.46

VISTA SYSTEMS INC. VEHICLE MAINTENANCE SYSTEM PRINCETON NJ

A.10 MMM

Fig. A.10-4

VISTA

VEHICLE MAINTENANCE MODULE

FLEET DEFECT ANALYSIS

BEGIN: 07/01/83 END: 12/31/83

FLEET DEFECT ANALYSIS

DATA VEHICLE MAINTENANCE

LOCATION: MAIN GARAGE FLEET: RV

SYSTEM DESCRIPTION	# OCCUR	% FLEET	# VEHICL	MDBF
FRONT AXLE,TIE RODS ENDS	87	70	77	7890
FRONT AXLE,KNUCKLE ASSY.	21	17	20	18073
FRONT AXLE,KING PIN	12	10	12	24076
FRONT AXLE,CONTROL ARM-LEVERS	2	2	2	31067
REAR AXLE,SHAFT	36	29	34	21043
REAR AXLE, HOUSING	3	2	3	28903
REAR AXLE, CARRIER	2	2	2	30941
REAR AXLE, BEARING	23	18	23	7905
REAR AXLE, GEARS	5	4	2	5670
REAR AXLE, PINION	13	10	11	6709
AIR SUPPLY SYSTEM-AIR COMPRESS	96	77	79	4567
AIR SUPPLY SYSTEM-GOVERNOR	18	14	18	13456
AIR SUPPLY SYSTEM-VALVES	56	45	53	4590
AIR SUPPLY SYSTEM-LINES-HOSES	61	49	59	3201
AIR SUPPLY SYSTEM-TANKS	2	2	2	35709
BRAKES,ADJUSTERS	70	54	60	3297
BRAKES, SHOES	897	90	123	1890
BRAKES, LINES-HOSES	131	78	97	2980
BRAKES, SPRINGS	41	32	40	8677
BRAKES, CAM SHAFTS	23	18	22	5790
BRAKES, CHAMBERS	13	10	13	12340
BRAKES, VALVES	67	54	45	5600
BRAKES, CONTROL RODS	5	4	5	18759
CLUTCH ASSY	46	37	45	15129
CLUTCH DISC.	46	37	45	15129
CLUTCH-PRESSURE PLATE	46	37	45	15129
CLUTCH-BEARING	46	37	45	15129
COOLING-RADIATOR	29	23	26	21303
COOLING-SURGE TANK	3	2	3	18981
COOLING-VALVES	3	2	3	18963
COOLING-WATER PUMP	3	2	3	26543
COOLING-FAN DRIVE	18	14	16	12391
COOLING-THERMOSTAT	16	11	14	12305
COOLING-TUBES-HOSES-LINES	41	31	39	7650
COOLING-GASKETS	107	79	99	3209
ELECTRICAL-STARTER	34	26	33	12506
ELECTRICAL-GENERATOR-ALTERNATO	64	46	58	4256
ELECTRICAL-HEATER BLOWER MOTOR	32	26	32	13123
ELECTRICAL-REGULATOR	50	38	47	5603
ELECTRICAL-LIGHTS	516	94	118	903
ELECTRICAL-INSTRUMENTS-GAUGES	107	73	91	1121
ELECTRICAL-VALVES	3	2	3	16780

VISTA SYSTEMS INC. VEHICLE MAINTENANCE SYSTEM PRINCETON NJ

Fig. A.10-5

VISTA

VEHICLE MAINTENANCE MODULE

REPAIR COST BY PROBLEM

BEGIN: 11/01/83 END: 11/30/83

REPAIR COST BY PROBLEM

CDTA VEHICLE MAINTENANCE

LOCATION: MAIN GARAGE

PROBLEM	VEHICLE ID	WORK ORDER	OPENED	SYSTEM	REP ACT	HOURS	$ LABOR	$ MATRL	TOTAL $
WON'T START - TURNS OVER	503	760	11/01/83	FUEL PMT	REM-REP	06:00	$ 52.16	$ 56.00	$ 108.16
WON'T START - TURNS OVER	679	802	11/06/83	VOLT REG	REM-REP	3:00	$ 30.02	$ 12.43	$ 43.45
WON'T START - TURNS OVER	212	809	11/06/83	ELECTRIC	NO DEFC	02:00	$ 19.21		$ 19.21
WON'T START - TURNS OVER	443	847	11/13/83	FUEL LINE	CLEAN	3:00	$ 29.63		$ 29.63
WON'T START - TURNS OVER	616	901	11/22/83	ELECTRIC	ADJ/ALN	3:30	$ 33.78	$ 9.20	$ 42.98
WON'T START - TURNS OVER	212	923	11/25/83	FUEL PMP	REM-REP	9:00	$ 93.16	$ 47.81	$ 140.97
WON'T START - TURNS OVER	456	967	11/29/83	STR MTR	REM-REP	6:00	$ 52.16	$ 67.89	$ 120.05
WON'T START - TURNS OVER	867	981	11/30/83	WIRING	SOLDER	4:00	$ 37.90	$ 6.21	$ 44.11

VISTA SYSTEMS INC. VEHICLE MAINTENANCE SYSTEM PRINCETON NJ

A.10 MMM

Fig. A.10-6

VEHICLE MAINTENANCE MODULE

VEHICLE STATUS INPUT SCREEN

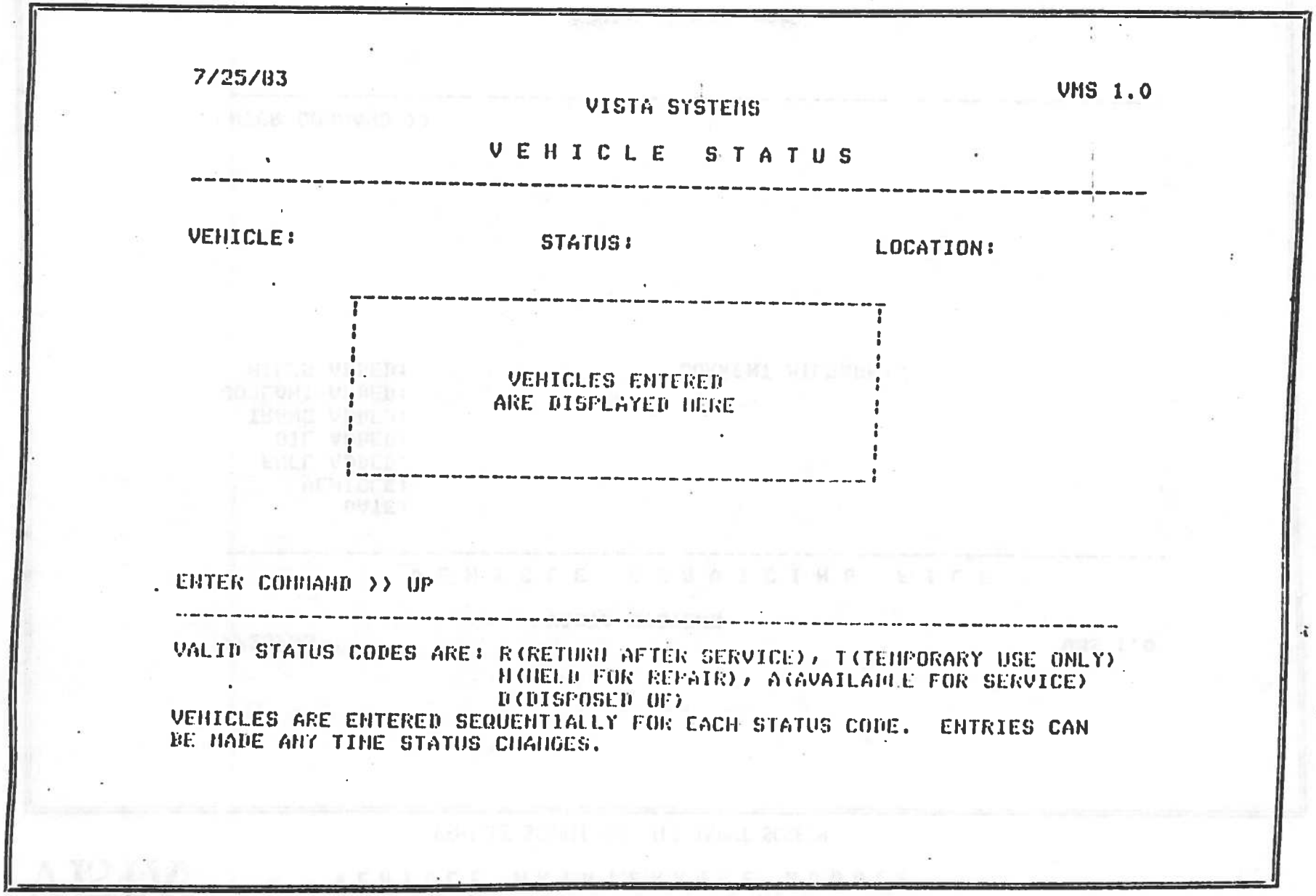


Fig. A.10-7

VISTA

VEHICLE MAINTENANCE MODULE

VEHICLE SERVICING FILE INPUT SCREEN

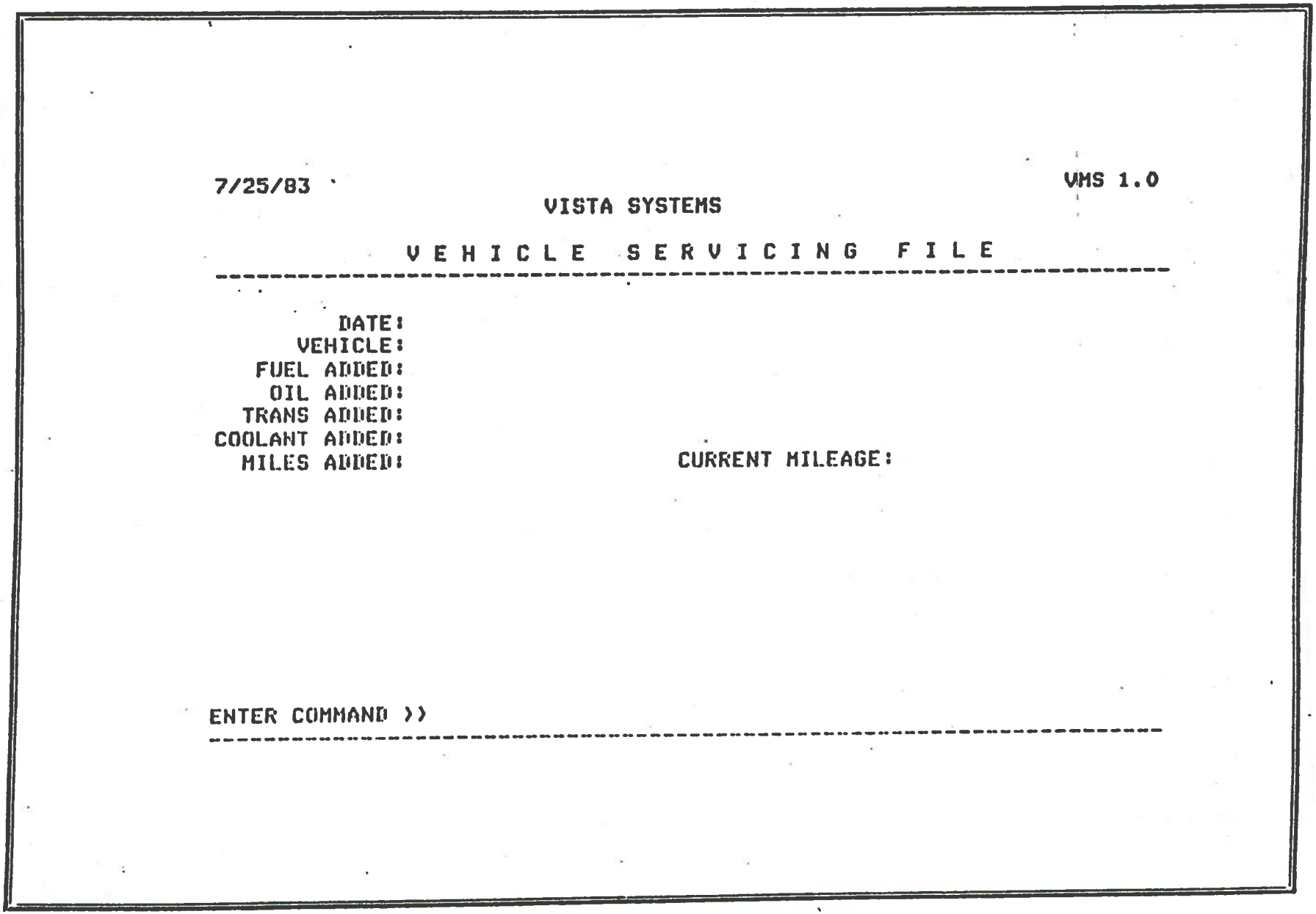


Fig. A.10-8

VISTA VEHICLE MAINTENANCE MODULE

WARRANTY CLAIMS INPUT SCREEN

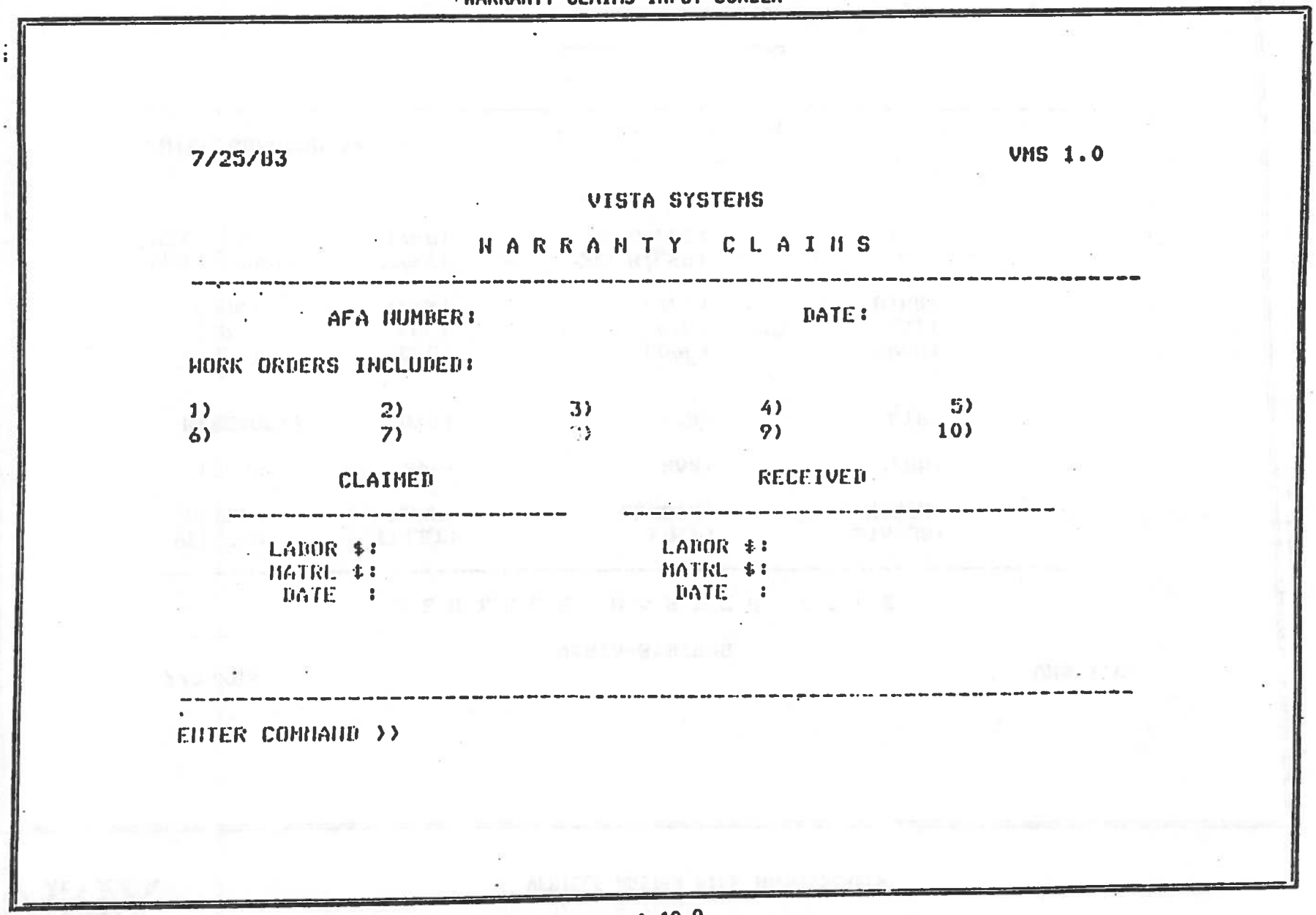


Fig. A.10-9

VISTA

VEHICLE MAINTENANCE MODULE

VEHICLE MASTER FILE INPUT SCREEN

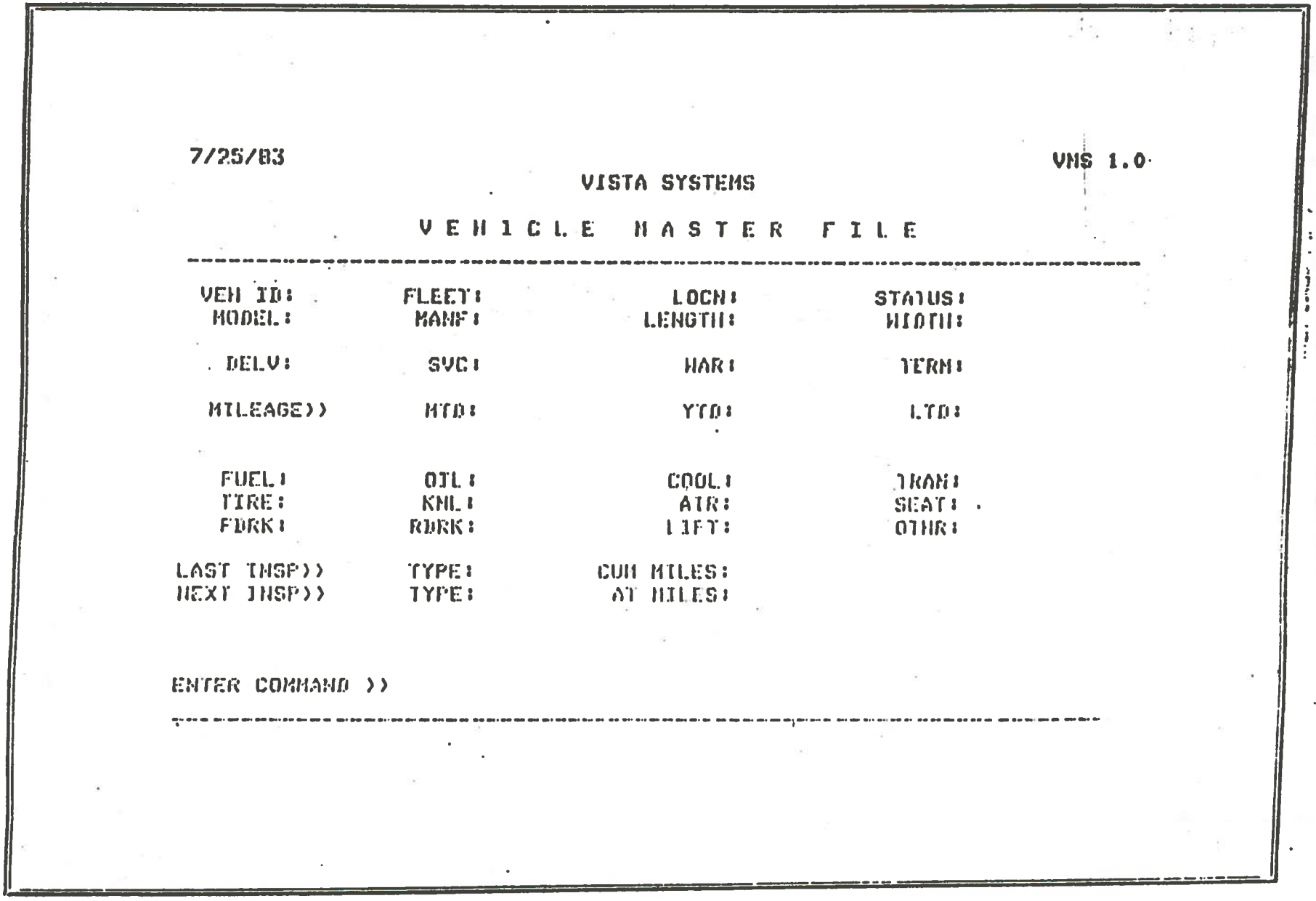


Fig. A.10-10

```
7/25/83                                                    VMS 1.0
                              VISTA SYSTEMS

                          C O D E B O O K   F I L E
-------------------------------------------------------------------------

 CODE TYPE:                    CODE TAG:

 LONG NAME:

SHORT NAME:




ENTER COMMAND>>
-------------------------------------------------------------------------

VALID TYPES: P(PROBLEM), G(GROUP), A(ACTIVITY), S(SYSTEM)
VALID TAGS: 1 TO 13, CHARACTERS, NONDUPLICATED, INCLUDES
            HIGHER LEVEL CODES
LONG NAME: 1 TO 32 CHARACTERS
SHORT NAME: 1 TO 8 CHARACTERS
```


Fig. A.10-11

7/25/83 VMS 1.0

VISTA SYSTEMS

S E R I A L I Z E D C O M P O N E N T S F I L E

COMPONENT)) COMP: SERIAL NO:
NHA)) COMP: SERIAL NO:

VEHICLE)) CURRENT: PRIOR: C/O'S:
ON VEH: (date) OFF VEH: (date)

MILEAGE)) CURRENT: PRIOR: LIFE:

SVC HRS)) CURRENT: PRIOR: LIFE:

DELIVERY: MANUF:
IN SERVC: MODEL:
WARRANTY: TERM:

ENTER COMMAND))

NHA = NEXT HIGHER ASSEMBLY (ON WHICH THIS COMPONENT IS MOUNTED)

Fig. A.10-12

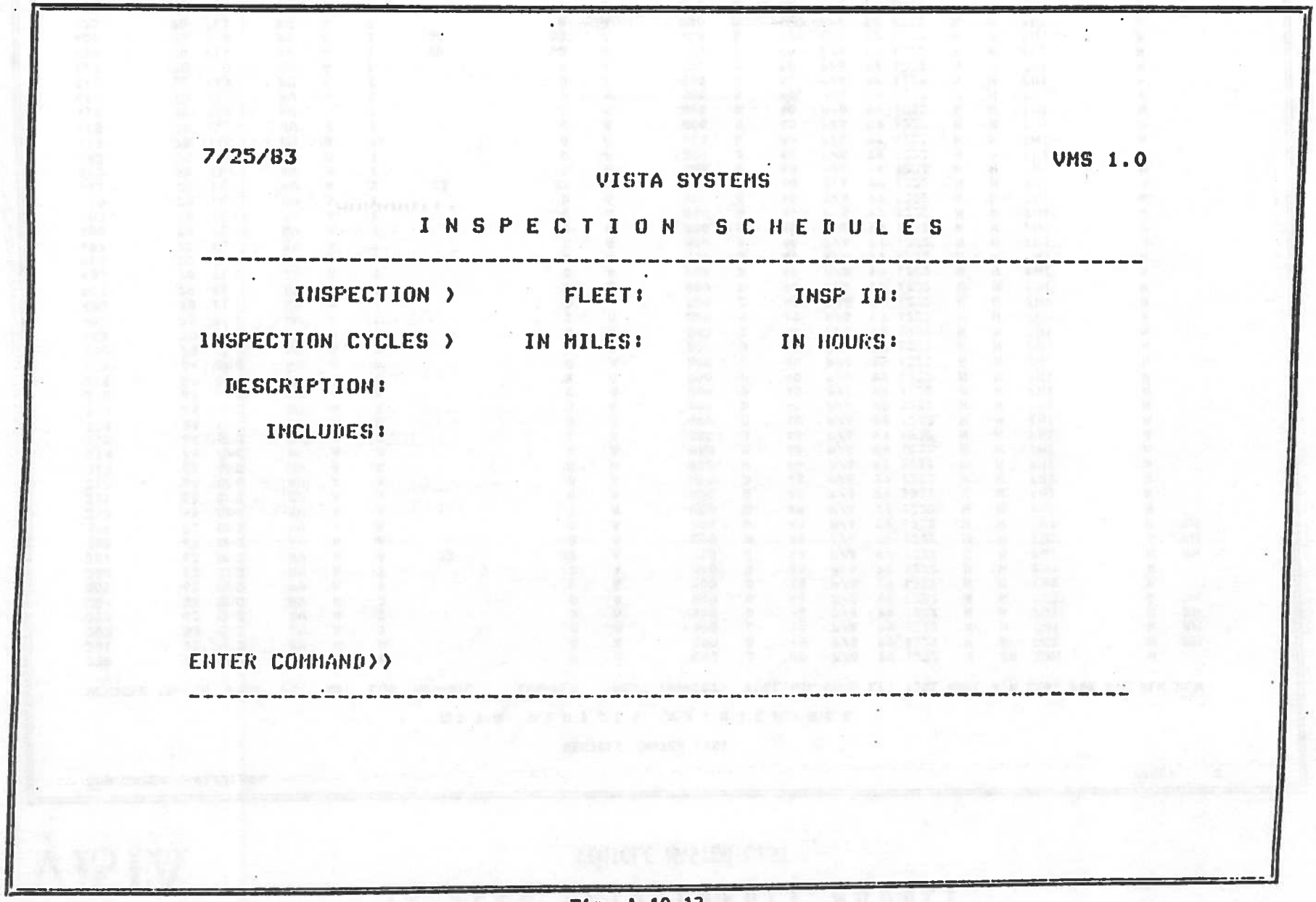

7/25/83
VMS 1.0
VISTA SYSTEMS
INSPECTION SCHEDULES
INSPECTION)
FLEET:
INSP ID:
INSPECTION CYCLES)
IN MILES:
IN HOURS:
DESCRIPTION:
INCLUDES:
ENTER COMMAND))

Fig. A.10-13

VISTA

VEHICLE MAINTENANCE MODULE

VEHICLE MASTER LIST

RUN DATE: 01/31/84 PAGE: 2

VEHICLE MASTER LIST

CDTA VEHICLE MAINTENANCE

VEHICLE ID	YR	MANF	FLT	RST	LOC	MTD-MIL	CUR-MLG	NEXT INSPECT	FUEL	OIL	COOL	LFT	TIRE	KNEL	AIR	SEAT	FBK	RAK	FLN	RLN
230	71	FLX	RV	A	S		0	A 800	D	40	P/S	99	1222	N		UPH			N	
301	83	GMC	RV	A	A		0	A 800	D	40	P/S	99	1222	N	N	FUI			N	RH
302	83	GMC	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FUI			N	RH
303	83	GMC	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FUI			N	RH
304	83	GMC	RV	A	S		0	A 800	D	40	P/S	99	1222	N	N	FUI			N	RH
305	83	GMC	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
306	83	GMC	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
307	83	GMC	RV	A	A	82	82	A 718	D	40	P/S	99	1222	N	N	FUI			N	RH
308	83	GMC	RV	A	A		0	A 800	D	40	P/S	99	1222	N	N	FUI			N	RH
309	83	GMC	RV	A	A		0	A 800	D	40	P/S	99	1222	N	N	FUI			N	RH
310	83	GMC	RV	A	A		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
311	84	GMC	RV	A	A		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
312	84	GMC	RV	A	A		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
313	84	GMC	RV	A	A		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
314	84	GMC	RV	A	A		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
315	84	GMC	RV	A	A		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
316	84	GMC	RV	A	A		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
317	84	GMC	RV	A	A		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
318	84	GMC	RV	A	A		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
319	84	GMC	RV	A	A		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
320	84	GMC	RV	A	A		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
400	70	FLX	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
401	70	FLX	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
402	70	FLX	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
403	70	FLX	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
404	70	FLX	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
405	70	FLX	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
406	70	FLX	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
407	70	FLX	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
408	70	FLX	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
409	70	FLX	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
410	70	FLX	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
411	70	FLX	RV	A	T	33	33	A 767	D	40	P/S	99	1222	N	N	FHI			N	
412	70	FLX	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
413	70	FLX	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
414	70	FLX	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
415	70	FLX	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
416	70	FLX	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
417	70	FLX	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
418	70	FLX	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
419	70	FLX	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
420	70	FLX	RV	A	T	80	80	A 720	D	40	P/S	99	1222	N	N	FHI			N	
421	70	FLX	RV	A	T	50	50	A 750	D	40	P/S	99	1222	N	N	FHI			N	
422	70	FLX	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
423	70	FLX	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	
424	70	FLX	RV	A	T		0	A 800	D	40	P/S	99	1222	N	N	FHI			N	

VISTA SYSTEMS INC VEHICLE MAINTENANCE SYSTEM PRINCETON NJ

Fig. A.10-14

VISTA

VEHICLE MAINTENANCE MODULE

CODEBOOK LIST

RUN DATE: 01/31/84

PAGE: 1

CODEBOOK LIST

CDTA VEHICLE MAINTENANCE

TYPE	CODE TAG	LONG NAME	SHORT NAME
S	01010	FRONT AXLE,TIE RODS ENDS	
S	01020	FRONT AXLE,KNUCKLE ASSY.	
S	01030	FRONT AXLE,KING PIN	
S	01040	FRONT AXLE,CONTROL ARM-LEVERS	
S	02010	REAR AXLE,SHAFT	
S	02020	REAR AXLE, HOUSING	
S	02030	REAR AXLE, CARRIER	
S	02040	REAR AXLE, BEARING	
S	02050	REAR AXLE, GEARS	
S	02060	REAR AXLE, SPIDER	
S	02070	REAR AXLE, PINION	
S	03010	AIR SUPPLY SYSTEM-AIR COMPRESS	
S	03020	AIR SUPPLY SYSTEM-GOVERNOR	
S	03030	AIR SUPPLY SYSTEM-VALVES	
S	03040	AIR SUPPLY SYSTEM-LINES-HOSES	
S	03050	AIR SUPPLY SYSTEM-TANKS	
S	04010	BRAKES,ADJUSTERS	
S	04020	BRAKES, SHOES	
S	04030	BRAKES, LINES-HOSES	
S	04040	BRAKES, SPIDERS	
S	04050	BRAKES, CAM SHAFTS	
S	04060	BRAKES, CHAMBERS	
S	04070	BRAKES, VALVES	
S	04080	BRAKES, CONTROL RODS	
S	05010	CLUTCH ASSY	
S	05020	CLUTCH DISC.	
S	05030	CLUTCH-PRESSURE PLATE	
S	05040	CLUTCH-BEARING	
S	06010	COOLING-RADIATOR	
S	06020	COOLING-SURGE TANK	
S	06030	COOLING-VALVES	
S	06040	COOLING-WATER PUMP	
S	06050	COOLING-FAN DRIVE	
S	06060	COOLING-THERMOSTAT	
S	06070	COOLING-TUBES-HOSES-LINES	
S	06080	COOLING-GASKETS	
S	07010	ELECTRICAL-STARTER	
S	07020	ELECTRICAL-GENERATOR-ALTERNATO	
S	07030	ELECTRICAL-HEATER BLOWER MOTOR	
S	07040	ELECTRICAL-REGULATOR	
S	07050	ELECTRICAL-LIGHTS	
S	07060	ELECTRICAL-INSTRUMENTS-GAUGES	
S	07070	ELECTRICAL-VALVES	

VISIA SYSTEMS INC VEHICLE MAINTENANCE SYSTEM PRINCETON NJ

Fig. A.10-15

INVENTORY MODULE

HELP COMMAND-SCREEN DISPLAY

```
                LIST OF AVAILABLE COMMANDS FOR INVENTORY SYSTEM EDITOR

HELP C          - DISPLAYS HELP INFO FOR COMMAND 'C'. 'C' IS OPTIONAL.

AFC             - USED TO GENERATE PURCHASE ORDER DATA FROM REQUISITIONS REPORT.
ASN             - PERMITS ADDITION OF NEW STOCK ITEMS TO THE INVENTORY.
BRZ PWD    F    - DISPLAYS RECORDS SEQUENTIALLY USING FORMAT 'F'.
DSN             - PERMITS DELETION OF INVENTORY STOCK RECORDS.
EPO             - PERMITS CHANGES TO BE MADE TO PURCHASE ORDER INPUT DATA.
ESN             - USED TO CHANGE BOOK PRICE AND/OR VENDOR INFORMATION.
ISS             - USED TO RECORD AN ISSUE FROM INVENTORY.
LOG PWD   <D>   - DETAILED TRANSACTION LOG. PWD IS REQUIRED. D(ATE) IS OPTIONAL.
LPR             - DISPLAYS RECENT PURCHASE ORDER PRICE INFORMATION.
LSN             - DISPLAYS DATA ABOUT A SPECIFIC STOCK NUMBER.
LUP             - DISPLAYS PRIMARY RECORD FOR A SPECIFIED ALTERNATE PART NUMBER.
MPO             - USED TO FORCE ENTER PURCHASE ORDER DATA.
ONH             - DISPLAYS ONHAND STATUS DATA FOR SPECIFIED ITEM.
POS PWD   <N>   - DISPLAYS OPEN PURCHASE ORDER STATUS. PWD IS REQUIRED.
Q               - EXITS INVENTORY SYSTEM.
RCV             - USED TO RECORD RECEIPTS INTO INVENTORY.
REF PWD    N    - PRODUCES REPORT 'N'. PWD IS REQUIRED.
RES             - DISPLAYS CURRENT RESERVATIONS BY REQUESTING STOREROOM.
RSV             - USED TO RESERVE ITEMS FOR TRANSFER.
RTN             - USED TO RECORD THE RETURN OF AN ITEM TO THE VENDOR.
SEL FOR    D    - DISPLAYS NUMBER AND DESCRIPTION FOR ITEMS WITH DESCRIPTION 'D'.
TRF             - RECORDS TRANSFER OF ITEMS FROM STOREROOM TO STOREROOM.
TRN             - TO RECORD THE TURNIN OF AN ITEM AFTER AN 'ISSUE'.
UON             - USED TO CHANGE BIN LOCATIONS AND ORDERING PARAMETERS.
UPR             - USED TO UPDATE PURCHASE PRICE INFORMATION AFTER RECEIPT.
USE             - DISPLAYS SUMMARY USAGE DATA FOR SPECIFIED ITEM.
VPO             - VOIDS SPECIFIC STOCK ORDERS BEFORE RECEIPT.
```

Fig. A.10-16

VISTA

REORDER REQUIREMENTS REPORT

RUN DATE: 01/06/84 PAGE: 2

REORDER REQUIREMENTS REPORT

PIONEER VALLEY TRANSIT AUTHORITY

STOCK NUMBER	....MOST RECENT SUPPLIER.... VENDOR	DATE	PRICE	AVAIL	ORDRD	BKORD	MINIM	REORD	Y-T-D ISSUE	DESCRIPTION
1110437	** NONE ON FILE **			0	0	0	1**	1	0	REGULATOR-VOLTAGE RTS
1119848	** NONE ON FILE **			0	0	0	1**	1	0	SOLENOID-STARTER RTS SS 11
1200	** NONE ON FILE **			0	0	0	5**	15	0	BATTERY-DELCO RTS
12006377	** NONE ON FILE **			0	0	0	1	4	0	RECTIFIER RTS
12026408	** NONE ON FILE **			0	0	0	1	2	0	HARNESS. WIRING RTS
127687	** NONE ON FILE **			0	0	0	4**	20	0	WASHER- FAN & DRIVE RTS
127710	** NONE ON FILE **			0	0	0	2**	10	0	NUT-SAME AS 691865 RTS S.S.
128-M	** NONE ON FILE **			0	0	0	6**	18	0	CARTRIDGE-TRANSMISSION FLUID F
153702	** NONE ON FILE **			0	0	0	1	1	0	BOLT, GOV. COVER 1/4" X 3/4"
1543053	** NONE ON FILE **			0	0	0	1**	1	0	CAP ASSY. OIL FILTER 4519-21
1543095	** NONE ON FILE **			0	0	0	1**	1	0	CATCH ASSY.
15503905	** NONE ON FILE **			0	0	0	16	32	0	BUSHING-FRONT END SUSPENSION K
15504096	** NONE ON FILE **			0	0	0	5	25	0	NUT RTS
1560220	** NONE ON FILE **			0	0	0	1**	1	0	GASKET - TACK CAP 4519
1580702	** NONE ON FILE **			0	0	0	1**	1	0	BRUSH - SPEED DRIVE UNIT 451
1580705	** NONE ON FILE **			0	0	0	1**	1	0	BRUSH - SPEED DRIVE UNIT 45
16-120	** NONE ON FILE **			0	0	0	1**	1	0	SWITCH-12 V SIGNAL (SIGNAL STA
1857268	** NONE ON FILE **			0	0	0	1**	1	0	WASHER-INSUL. SS 1950029
1858749	** NONE ON FILE **			0	0	0	1**	1	0	STUD-HEATER MOTOR 4519
1861589	** NONE ON FILE **			0	0	0	1**	1	0	SPACER-WASHER 4519
1861785	** NONE ON FILE **			0	0	0	1**	1	0	SPRING-STARTER BRUSH 4519-45
1861791	** NONE ON FILE **			0	0	0	1**	1	0	WASHER-GEN. & STARTER TERM. ST
1864279	** NONE ON FILE **			0	0	0	1**	1	0	BUSHING-VOLTAGE REGULATOR

VISTA SYSTEMS INC INVENTORY CONTROL SYSTEM PRINCETON NJ

Fig. A.10-17

VISTA

INVENTORY MODULE

INVENTORY STATUS REPORT

RUN DATE: 01/06/84 — INVENTORY STATUS REPORT — PAGE: 3

PIONEER VALLEY TRANSIT AUTHORITY

STOCK NUMBER & DESCRIPTION / STORE	BIN LOC	LAST ISSUED	LAST ORDERED	LAST PRICE	AVG PRICE	MINIM	ON ORDER	ON HAND	VALUE
0474-0004-001 -----> WINDSHIELD-ROADSIDE (LEFT HAND) GRUMMAN									
SPRNGFLD	B-GLASS					1			0.00
< TOTALS >						1	0	0	0.00
0474-0005-002 -----> WINDSHIELD-CURBSIDE (RIGHT HAND) GRUMMAN									
SPRNGFLD	B-GLASS								0.00
< TOTALS >						0	0	0	0.00
0482-1528-001 -----> COMPRESSOR ASSY. GRUMMAN									
SPRNGFLD	CAB. 2-H					1			0.00
< TOTALS >						1	0	0	0.00
0490-257-001 -----> VALVE-HEIGHT CONTROL GRUMMAN									
SPRNGFLD	CAB2/TOP								0.00
< TOTALS >						0	0	0	0.00
055390 -----> CLIP, PEDAL PAD TDH 4519									
SPRNGFLD	C-2-D								0.00
< TOTALS >						0	0	0	0.00
060886 -----> STUD, CLUTCH HOUSING TDH-GEN. APPL.									
SPRNGFLD	F-2-D								0.00
< TOTALS >						0	0	0	0.00
064079 -----> BUSHING, CONTROL LEVER TDH 4519									
SPRNGFLD	C-1-C								0.00
< TOTALS >						0	0	0	0.00
075911 -----> YOKE, ACC. CONTROL SLIDE END-TDH 4519									
SPRNGFLD	C-2-D								0.00
< TOTALS >						0	0	0	0.00
077640 -----> PIN, YOKE-LEVER IDLER-TDH 4519									
SPRNGFLD	C-3-C								0.00
< TOTALS >						0	0	0	0.00
082917 -----> NUT, LOCKING FRONT WHEEL 4519-21-RTS									
SPRNGFLD	F-1-G								0.00
< TOTALS >						0	0	0	0.00
082918 -----> NUT, TDH 4519-21-RTS & FLX									
SPRNGFLD	NONE								0.00
< TOTALS >						0	0	0	0.00

VISTA SYSTEMS INC. — INVENTORY CONTROL SYSTEM — PRINCETON NJ

Fig. A.10-18

RUN DATE: 01/09/84
BEGIN DATE: 12/01/83

INVENTORY ACTIVITY REPORT

PAGE: 1
END DATE: 12/01/83

CAPITAL DISTRICT TRANSPORTATION AUTHORITY

STOCK NUMBER & DESCRIPTION / STORE	(-----ORDERS-----) QNTY	TOT VALUE	(----RECEIPTS----) QNTY	TOT VALUE	(-----ISSUES-----) QNTY	TOT VALUE	(--TRANSFERS IN--) QNTY	TOT VALUE	(--TRANSFERS OUT--) QNTY	TOT VALUE
1118437 -----) REGULATOR-VOLTAGE RTS										
ALBANY	0	0.00	100	500.00	0	0.00	100	500.00	100	500.00
TROY	0	0.00	-100	-500.00	0	0.00	100	500.00	100	500.00
SCHEN	0	0.00	0	0.00	0	0.00	100	500.00	100	500.00
(TOTALS)	0	0.00	0	0.00	0	0.00	300	1500.00	300	1500.00
1119840 -----) SOLENOID-STARTER RTS										
ALBANY	100	500.00	0	0.00	0	0.00	100	500.00	100	500.00
TROY	100	500.00	0	0.00	0	0.00	100	500.00	100	500.00
SCHEN	100	500.00	0	0.00	0	0.00	100	500.00	100	500.00
(TOTALS)	300	1500.00	0	0.00	0	0.00	300	1500.00	300	1500.00
1200 -----) BATTERY-DELCO* RTS										
ALBANY	100	500.00	0	0.00	0	0.00	100	500.00	100	500.00
TROY	100	500.00	0	0.00	0	0.00	100	500.00	100	500.00
SCHEN	100	500.00	0	0.00	0	0.00	100	500.00	100	500.00
(TOTALS)	300	1500.00	0	0.00	0	0.00	300	1500.00	300	1500.00
12006377 -----) RECTIFIER RTS										
ALBANY	100	500.00	0	0.00	0	0.00	100	500.00	100	500.00
TROY	100	500.00	0	0.00	0	0.00	100	500.00	100	500.00
SCHEN	100	500.00	0	0.00	0	0.00	100	500.00	100	500.00
(TOTALS)	300	1500.00	0	0.00	0	0.00	300	1500.00	300	1500.00
16-120 -----) SWITCH 12V SIGNAL										
ALBANY	100	500.00	0	0.00	0	0.00	100	500.00	100	500.00
TROY	100	500.00	0	0.00	0	0.00	100	500.00	100	500.00
SCHEN	100	500.00	0	0.00	0	0.00	100	500.00	100	500.00
(TOTALS)	300	1500.00	0	0.00	0	0.00	300	1500.00	300	1500.00

SUMMARY OF VALUES

STORE	(-----ORDERS-----) TOT VALUE	(----RECEIPTS----) TOT VALUE	(-----ISSUES-----) TOT VALUE	(--TRANSFERS IN--) TOT VALUE	(--TRANSFERS OUT--) TOT VALUE
ALBANY	4000.00	500.00	0.00	4500.00	4500.00
TROY	4000.00	-500.00	0.00	4500.00	4500.00
SCHEN	3500.00	0.00	0.00	4000.00	4000.00
(TOTALS)	11500.00	0.00	0.00	13000.00	13000.00

Fig. A.10-19

APPENDIX B

NAMES AND ADDRESSES OF

SYSTEM DEVELOPERS

B.1 Vehicle Maintenance Reporting Standards (VMRS)
American Trucking Association, Inc.
1616 P Street, N.W.
Washington, D.C. 20036
(202)797-5371

B.2 Hercules Vehicle Maintenance Reporting System
Computer Task Group, Inc.
800 Delaware Ave.
Buffalo, NY 14209
(716)882-8000

B.3 Fleet Maintenance System (FMS)
DDS, Incorporated
5155 Mercury Point
San Diego, CA 92111
(619)565-9166

B.4 CPMU/V
The Facts Corp.
275 Fresh Pond Parkway
Cambridge, MA 02140
(617)864-5900

B.5 Fleet Controller
Fleet Technologies International
P.O. Box 1070
Minnetonka, MN 55343
(612)938-8861

B.6 TRANS-PAC
MTD Project Services, Inc.
8050 Seminole Office Center, Suite 302
Seminole, FL 33542
(813)398-4436

B.7 Vehicle Maintenance and Monitoring System (VEMM)
Modeling Systems, Inc.
Ten Emerson Place, Suite 3-E
Boston, MA 02114
(617)227-6778

B.8 MICRO (EMIS) Equipment Management Information System
Public Technology, Inc.
1301 Pennsylvania Ave., N.W.
Washington, DC 20004
(202)626-2400

B.9 Transit Maintenance Management System
Western Transit Maintenance Consortium
METRO
Municipality of Metropolitan Seattle
Exchange Bldg.
821 Second Ave.
Seattle, WA 98104
(206)447-6829

B.10 Maintenance and Materials Management (MMM)
VISTA Systems, Inc.
900 State Road
Princeton, NJ 08540
(609)921-0065

☆U.S. GOVERNMENT PRINTING OFFICE: 1985 461 816 20213