PN-AAM-423
ISN=27620

/68

FINAL REPORT

TECHNICAL AND FEASIBILITY STUDIES

of

PUBLIC SECTOR VEHICLE MAINTENANCE

IN EGYPT

November 29, 1979

PRC-HARRIS, INC.
6 Ibrahim Naguib Street
Garden City, Cairo
Egypt

TABLE OF CONTENTS

LIST OF TABLES

LIST OF APPENDIXES

FINAL REPORT
TECHNICAL AND FEASIBILITY STUDIES
of
PUBLIC SECTOR VEHICLE MAINTENANCE
IN EGYPT

TABLE OF CONTENTS

1.0 SUMMARY S1

2.0 INTRODUCTION 1
2.1 Purpose of the Project 1
2.2 Project Participants 2
2.3 Methodology 2
2.4 Report Outline 3

3.0 OVERVIEW 4
3.1 Recent History of Development 4
3.2 Areas of Responsibility 8
3.3 Location of Facilities 9

4.0 RESULTS OF THE GENERAL SURVEY 10
4.1 Maintenance Systems and Vehicle Systems 10
4.1.1 Cairo Transport Authority 18
Expansion or Improvement 20
4.1.2 Greater Cairo Bus Company 20
4.1.3 Alexandria Transport Authority 21
4.1.4 West Delta Company 22
Expansion or Improvement 22
4.1.5 East Delta Company 23
Expansion or Improvement 25
4.1.6 Upper Egypt Company 27
Expansion or Improvement 29
4.1.7 Public Sector Truck Companies 29
Expansion or Improvement 30
4.2 Financial and Economic Information 31
4.2.1 Accounting Systems 31
4.2.2 The Maintenance Budget 32
4.2.3 General Financial Situation 33
4.2.4 Costs 34
4.2.5 Vehicle Acquisition 36
4.2.6 Spare Parts 40
4.2.7 Budgetary Projections 42
4.3 Organization and Management 47

5.0 THE DETAILED SURVEY AND COMPANY SUMMARIES 60
5.1 Implications derived from the Detailed Survey 60
5.1.1 Analysis of CTA Facility Operations 61
5.1.2 Implications derived from GNC Detailed Survey 64
5.2 Company Oriented Summaries 66
5.2.1 The General Nile Company for East Delta 66
5.2.2 The General Nile Bus Company for Upper Egypt 74
5.2.3 General Nile Company, Middle Delta 76
5.3 Recommendations for Specific Companies 77

3

6.0 GENERAL CONCLUSIONS AND RECOMMENDATIONS 80
6.1 A Punch List of Problems 80
6.1.1 General Management Problems 80
6.1.2 Physical Facilities 81
6.1.3 Equipment 81
6.1.4 Maintenance System Concept 82
6.1.5 Logistic Support System 82
6.1.6 Financial and Economic 82
6.1.7 Training 83
6.2 Basic Transport Policy 83
6.2.1 Urban Passenger Service 83
6.2.2 Intercity Passenger Service 84
6.2.3 Truck Companies 85
6.3 Management Policy, Procedures and Organization 86
6.3.1 Development of an Organization Plan 86
6.3.2 Training of Company Management in Basic Managerial Techniques 87
6.3.3 Management Science 90
6.4 Financial and Economic Policy and Procedures 91
6.4.1 Cost System 92
6.4.2 Diversity of Vehicle Type 94
6.4.3 The Flow of Spare Parts 94
6.4.4 Coordination within the Transport Sector 95
6.4.5 The Character of Transportation Organizations 96
6.5 Physical Facilities 99
6.5.1 Clean-up of Garages and Workshops 99
6.5.2 Improve Lighting and Ventilation 101
6.5.3 Pave Yard Areas and Improve Access Roads 102
6.5.4 Correct Drainage Problems 102
6.5.5 Build New Facilities in a More Compact and Efficient Design 103
6.6 Maintenance Systems Concepts and Logistic Support 109
6.6.1 Centralization of Functions and Unit Replacement 109
6.6.2 Maintenance Teams 110
6.6.3 Vehicle Standardization and Design Specifications 110
6.6.4 Management and Operating Efficiency and Audit Teams 111
6.6.5 Training 112

7.0 SOME SUGGESTED ACTION PROGRAMS FOR A.I.D. 113

4

LIST OF TABLES

Table 4-1	LIST OF VEHICLE MAINTENANCE FACILITIES VISITED BY TECHNICAL TEAM MEMBERS	11-12
Table 4-2		13a-13j
Table 4-3	VEHICLE ACQUISITION, SPARES AND OPERATIONS Buses	16-17

LIST OF FIGURES

Figure 4.1	TYPICAL ENGINEERING SECTOR ORGANIZATION	48
Figure 4.2	CENTRAL WORKSHOP ORGANIZATION	50
Figure 4.3	BRANCH ORGANIZATION	51
Figure 4.4	LEVELS OF MANAGEMENT	53
Figure 6.1	GREATER CAIRO BUS COMPANY TYPICAL COMPANY ORGANIZATION	89
Figure 6.2	GARAGE AND WORKSHOP WITHOUT ENGINE REBUILD	104
Figure 6.3	GARAGE SITE PLAN	106
Figure 6.4	CENTRAL WORKSHOP includes engine rebuild + body shop	107

LIST OF APPENDIXES

APPENDIX I	GENERAL SURVEY QUESTIONAIRE
APPENDIX II	SAMPLE DETAILED QUESTIONAIRES
APPENDIX III	SUMMARY RESULTS OF QUESTIONAIRE SURVEYS
APPENDIX IV	BUS MAINTENANCE AND LOGIST SUPPORT PRACTICES
APPENDIX V	FINANCIAL AND ECONOMIC INFORMATION
APPENDIX VI	JOB DESCRIPTIONS IN THE ENGINEERING SECTOR
APPENDIX VII	MANAGEMENT INFORMATION ANALYSIS
APPENDIX VIII	A BUS DESIGNED WITH EGYPT IN MIND

SUMMARY

1.0 SUMMARY

The purpose of this report is to summarize the results of an extensive study of the vehicle maintenance programing of Egyptian public sector bus and truck companies.

The organizations surveyed were:

(1) The four (4) General Nile Bus Companies

- Upper Egypt
- West Delta
- Middle Delta
- East Delta

(2) The two (2) Urban Transport Organizations

- The Cairo Transport Authority
- The Alexandria Transport Authority

(3) The five (5) General Nile Truck Companies

- Goods Transport
- Transport Works
- Heavy Transport
- Direct Transport
- Rural Transport

(4) The General Nile Company for Automotive Works.

The survey was conducted by site and office visits and was supplemented by extensive questionairies.

The survey examined several functional aspects of the vehicle maintenance programs including:

- o Maintenance and logistic support systems
- o Physical facilities and equipment
- o Management and organization
- o Finance and economics
- o Training

More than 50 garages, workshops and administrative offices were visited during the survey. These were followed up by visits to 9 facilities selected on the basis of their relative performance and the degree to which they represented typical operations of the sector.

The survey revealed a large number of fundamental problems with the maintenance programs of the public sector. Although most of these are described in great detail in the body of this report, a few of the most important ones are highlighted in this summary.

4

With respect to Maintenance Systems and associated logistics, the most pressing problems are:

- Excessive duplication of the rebuild and overhaul function in the garages and regional workshops. This results in excessive dilution of
  - the trained labor force
  - the inventory of critical spare parts
  - the inventory of specialized test equipment
- Extraordinarily complex procurement procedures resulting in a 9-12 month procurement cycle
- Irrational criteria for determining spares quantities e.g., decreasing spares ordered as a function of vehicle age; lack of statistical basis for selecting reorder points and for determining reorder quantity
- A total lack of quality control of the maintenance function
- The concept of preventive maintenance does not appear to be properly understood as demonstrated by the fact, for example, that the team was unable to find any example of unit replacement in anticipation of failure.

With respect to physical facilities and equipment it was found that:

- The general lack of cleanliness, state of disrepair and disorganization contribute significantly to high failure rates and poor maintenance.
- The basic facility design is grossly over-designed from a structural viewpoint and poorly laid out from an operations and management viewpoint.
- The facilities are very poorly equipped from the viewpoint of diagnostic equipment, test equipment, and mechanical aids (lifts, compressed air torque wrenches, etc.)

With respect to Management and Organization it appears that:

- Most of the maintenance facilities are inadequately staffed with trained middle management personnel.

- Upper echelon managers lack the ability to delegate or plan and demonstrate little training in management techniques.

- Very little use is made of management information even though reams of data are collected daily.

- There is no evidence of performance standards with which to measure unit performance--only a very gross measure is used which does not differentiate between operating centers.

In the area of Financial and Economic Information it was observed that:

- There is no cost control system because there are very few cost centers and little or not cost accounting.

- Budgeting and budget planning are primitive because planning factors if used at all, are inaccurate and operating objectives are unspecified or unclear.

- Vehicle procurement practices aggravate the maintenance problem by considering first cost instead of life-cycle cost in making procurement decisions. The resulting diversity of vehicle makes and models greatly complicates the maintenance and parts supply problem.

Finally, in the area of training, there appears to be a lack of interest in providing adequate management on-the-job training. There is also an uncoordinated approach to vocational training that results in disproportionately large capital investments for the results attained. A contributing factor to the poor results is the lack of managers who are trained to properly motivate or employ these human assets.

In order to improve the quality and quantity of maintenance activity devoted to the public sector bus and truck companies, there are a number of actions that should be taken. Some should be of a general nature; many others can be specific to a particular facility, activity or company.

A reasonable approach to remedying some of the most pressing problems can be achieved through a three step program.

First, a concerted effort should be made to define as an attainable goal for all facilities, the standards of performance for the best existing public sector facilities.

Second, programs should be defined for attaining these goals in three time frames.

- Programs that achieve desired results in the short term (up to 6 months)
- Mid-term programs; i.e., those that should yield results within 2 years.
- Long-term programs that might take as long as 5 years to show results.

Third, as a continuing effort with long-term programs, raise the standard of performance for the entire sector.

The survey identified a number of exemplary facilities that could serve as prototypes from the viewpoint of relative performance confirming that excellence can exist in the midst of an otherwise mediocre or poor situation.

Foremost among the more generally applicable remedies suggested, is On-the-Job Management Training - primarily for middle and lower echelon managers. But for such a program to be totally effective, top managers must also participate. Key elements of such a program would include:

- Management principles and techniques for top managers.
- Organization planning for top managers.
- Development of performance standards and use of management information.
- Applications of basic management methods for
  - shop scheduling
  - quality control
  - inventory control
  - manpower planning
  - operations analysis
  - cost control

The program should be implemented using the Greater Cairo Bus Company as a testing ground because it is small, a new company, and has a relatively uncomplicated organization structure.

Next, most important as a general remedy, is the need for a more sophisticated cost accounting and control system. This combined with performance audit and quality audit would permit more accurate decisions regarding vehicle and spares procurement on the basis of life cycle costs rather than only initial procurement costs. Bits and pieces of the data necessary to implement such a system already is collected, but it is not properly processed. Some data requirements will be reduced and others required, in order to properly establish such a system.

Another of the more general remedies is the need to alter procurement policies so that, at most, two vehicle makes are purchased, one of which should be produced by the Nasr Automotive Works. But Nasr should also be required to first serve the needs of the public sector bus companies and authorities, and to quickly remedy technical defects that become evident through operating experience.

Procurement of the Nasr vehicle can also greatly reduce the parts supply problem.

A second make of vehicle comparable to the Mercedes should make up the remainder of the fleet.

More specifically, there are a number of recommendations that can be made with respect to maintenance operations and facilities.

First, all overhaul and rework should be centralized, at least at the company level. All overhaul and rework activity should be removed from garages so that garages can operate on a unit replacment basis. There are a number of facilities under construction and already in existance that can be modified to accept this activity. Centralization would eliminate many problems in the existing system by:

- Consolidating expensive and scarce rework, test and calibration equipment.
- Consolidate skilled managers and craftsmen.
- Consolidate parts supplies.

Second, garages should be designed differently in order to facilitate material flow, improve management supervision, and reduce construction time and cost. The discussion of a suggested design is contained in the body of this report.

12

Third, a concerted effort should be made to improve working conditions by:

- Cleaning work areas including removal of scrap and other debris.
- Removal of oil from work surfaces and proper disposal of future drainings.
- Improving lighting and ventilation.
- Paving yard areas and improving access roads wherever needed.
- Correcting drainage problems wherever needed.

Finally, the task force concept of problem solving should be employed in a number of areas including:

- Vehicle on-the-road maintenance; there is no evidence of an organized approach to on-the-road maintenance. Vehicles are out of service a disproportionately long time for problems such as tire failure, fan belt failure, and other defects that could be handled by properly equipped road maintenance crews. Light weight emergency vehicles at each garage and heavy duty tow trucks at suitable locations within a system are a recommended solution.
- Operational efficency evaluation; quality audit teams should be organized and assigned at the level of company and regional managment for the purpose of trouble shooting the causes of substandard or erratic performance.

The time frame for implementation of most of these measures would extend over a period of at least five years, with improvement in the maintenance system being a progressive thing.

The numerous appendixes attached to the report contain papers and data which substantiate the conclusions of the analysis and recommendations for improvement.

13

2.0 INTRODUCTION

2.1 Purpose of the Project

The purpose of the Technical and Feasibility Studies of Vehicle Maintenance in Egypt is to analyze and evaluate the maintenance capability of the Public Sector bus and truck companies and to recommend short, intermediate and long-term solutions to problems identified in the course of performing the Study.

The Study was concerned with six major functional aspects of vehicle maintenance. These were:

(a) Management: An assessment of Management as related to organization, policy and practices.

(b) Financial Operations: An assessment from the viewpoint of funding process, budgeting process, level of funding, allocation of funds and distribution of funds.

(c) Equipment and Facilities: Assessing the adequacy of equipment and facilities for conducting maintenance operations. This included information concerning process flow and, where available, layouts, plans and other descriptive data.

(d) Maintenance System Procedures and Operations: Assessing the present status of the maintenance programs from the viewpoints of operational effectiveness, quality of work, productivity and capability.

(e) Logistic Support Systems Procedures and Operations: Assessing all aspects of inventory management, procurement operations, and warehouse operations.

(f) Training: An assessment of training programs within the sectors and how they influence maintenance operations.

In the context of the Study, short-term improvements are those which can be implemented within six (6) months of a decision to proceed; mid-term would require up to two (2) years for implementation and long-term from two (2) to five (5) years.

Such recommendations will also serve the purpose of providing guide lines for commitment by the Public Sector Transportation Systems.

2.2 Project Participants

The project team was comprised of a group of technical specialists from the United States in the areas of finance, management, operations analysis, equipment, facilities, and logistics. The specialists were supported by a team of Egyptian engineers and technicians who provided interpreting and translation services in addition to performing technical duties.

Help in coordinating information requests, scheduling the receipt of information, opening doors and handling problems of protocol was provided by the Ministry of Transportation. Assistance of particular note was provided by personnel of the Cairo Transit Authority, The East Delta Company, The Middle Delta Company, and The Upper Egypt Company, all of whom took great pains to provide the detailed information necessary to synthesize performance standards.

2.3 Methodology

The Study was performed in two phases. The first, a survey of the maintenance system, included visits to more than 50 sites of the Public Sector companies and authorities including garage, major repair and overhaul facilities. The headquarters of all of the companies were visited and a general questionaire prepared to determine the tenor of their approach to and understanding of maintenance operations. Coordination with all companies was provided through the offices of Undersecretary Zyat of the Ministry of Transporation. A copy of the general questionaire is provided in Appendix I.

The second phase was a detailed study of nine (9) facilities. Eight (8) were selected on the basis of comparative efficiency in order to establish standards which might be used for the purpose of management control. Four facilities of the CTA were selected for study representing the best and the worst of a system employing a single vehicle type (El Muneeb and Ather El Nabi), the worst of a multiple vehicle system (Nasr) and a "Ward" bus facility (Port Said). A fifth facility (Imbaba) was added at the request of the CTA Chairman which he felt exemplified the best facility in CTA.

The remaining four (4) facilities included one example from Upper Egypt (El Giza), considered to exemplify many of the problems with average, poorly equipped, and badly located rural facilities, one from East Delta Company (Mansura) was selected which exemplified a superior rural facility from the viewpoint of cleanliness, productivity, and overall efficiency of operations.

15

One garage from the truck sector (Goods Transport-Ameriya)was selected for examination as a typical facility for that type of service. And, finally one garage from the Middle Delta Company (Shubra) was also selected as one that exemplified a rural unit.

Detailed questionaires were designed in order to develop operating information for each of the facilities visited during the second phase of study. The questionaires dealt with financial, management facility, and operational information and provided the statistical basis for the development of operational standards. Copies of the Questionaires are provided in Appendix II.

2.4 Report Outline

The remainder of this report will be organized in the following manner.

In Section 3, an overview of the public sector bus and truck companies is presented including the recent history of development and organization, areas of service responsibility and the characteristics of the distribution of facilities by type. The section includes maps which locate the facilities of the sector including those visited by the survey team.

Section 4 describes the results of the Phase I survey including a trip log. This Section also provides summaries of the results of the survey by function and by company.

Section 5 provides the results of the detailed studies of the 9 facilities selected. The results are presented in narrative tabular and graphical format. The section also synthesizes specific recommendations for some companies based on the detailed survey and the results of the general survey of Phase I.

Short-term, mid-term and long-term recommendations for improving the Public Sector Vehicle Maintenance function are offered in Section 6. Particular emphasis is placed on viable solutions given the cultural and social constraints within which the system operates.

The final section of the report contains appendices referred to in the text.

3.0 OVERVIEW

3.1 Recent History of Development

The Vehicle Maintenance Study is limited to the public sector bus and truck companies. These organizations, while all involving transportation, can be divided into three classifications along organizational and operational lines:

(1) Public sector truck companies
(2) Public sector bus companies
(3) Transportation authorities

Each truck company is authorized to have a certain capacity and receives government support to maintain this capacity. Should demand for trucking service significantly exceed the total capacity, the Egyptian Government creates a new firm. This last occurred in 1971.

The public sector bus companies were produced by the nationalization of transport companies in 1961. In 1964, the organizational structure was altered to form four separate companies in the configuration that continues up to the present. The companies serve specific geographical areas - East Delta, Middle Delta, West Delta and Upper Egypt. Each bus company provides both intercity and intracity service with a zone of operations. The companies are autonomous, run by a Board of Directors appointed by the Government, (four directors) and the employees, (four directors). Each firm is expected to earn a profit on its' operations.

The transportation authorities provide public transport for the two major metropolitan areas, Cairo and Alexandria. These authorities serve the public in the urban areas and are regarded as service organizations in contrast to commercial organizations. They operate buses, trains, trolleys and, in Cairo, river transport for passengers. Both systems produce large operating losses which are made up by subsidies from the Egyptian Government.

The Cairo Transport Authority was established according to the Presidential Decree No. 1360/1959 issued on August 4, 1959. It then came under the jurisdiction of the Armed Forces in 1964. In 1965, it was associated to the Ministry of Transport according to the Presidential Decree No. 3576/1965.

In 1971, it came under the jurisdiction of the Governor of Cairo following Presidential Decree No. 141/1971. But it was re-associated with the Ministry of Transport in compliance with Presidential Decree No. 1097/1974.

17

In 1975, the Presidential Decree No. 1167/1975 was issued according to which the "Higher Councils for Sectors" were established. Since then Cairo Transport Authority came under the jurisdiction of the Local Government (administratively), and according to the decree issued by the Minister of Local Government, No. 36/1976, in application of the second article of Law No. 52/1975, the Governor became responsible for approving the decisions of the Authority's Board of Directors.

In 1966, the Ministerial Decree No. 549/1966, issued on 12/7/1966, laid the foundation for the organization structure of the Cairo Transport Authority, based on centralization of planning and control and decentralization of implementation. The Ministerial Act No. 214/1974 was issued to charge the operating units with more responsibilities and freedom of action. According to this Ministerial Act, 6 operating units were established, 4 for buses and 1 for the tramway and another 1 for the main workshops.

The idea was to divide Cairo into several service regions, each of which was responsible for operating the region through different branches.

The 4 bus units were:

(a) North Cairo Bus General Transport Unit with branches in:

- Port Said
- Al Tiraa Al Boulakiya
- Al Mazalat
- River Bus Unit
- A Maintenance Workshop in Al Mazalat Garage

This unit operates the local lines in the region from Shubra Al Khema (North) to Boulac (South) and from Port Said Street (East) to the River Nile (West).

The lines of this unit serves the region of Musturud, Shubra Al Khema, Al Mazalat, Al Zawia Al Hamraa, Al Ameriya, Mahmasha, Road Al Farag, Al Tiraa Al Boulakia, Al Sharabia, and Boulac.

(b) East Cairo Bus General Transport Unit with branches in:

- Al Ameriya
- Gisr Al Suez
- Fatth
- Nasr
- A Maintenance Workshop in Nasr Garage

This unit operates the local lines in the region from Al Kalubia Governorate (North) to Al Azhar Street (South) and from Almaza Desert (East) to Port Said (West).

The lines of this unit serves the regions of Al Hakesteb, Cairo International Airport, Al Zaytoon, Roxy, Sarray Al Kouba, Al Abassia, Madinet Al Bou-ooth Al Islamiya.

(c) South Cairo Bus General Transport Unit with branches in:

- Athar Al Nabi
- Al Basateen
- Helwan (under establishment)
- Maintenance Workshop near Al Basateen Garage

This unit operates the local lines in the region at the remote south of Al Tibeen up to Alazhar Street.

The lines of this unit serves the regions of Helwan, Al Maadi, Al Basateen, Al Kalaa, Al Sayeda Zeinab, Al Darb Al-Ahmar, Al Imam Al Shafii, Athar Al Nabi, Masr Al Kadima, Ein Alsira, Zeanhom, Fom Al Khaleeg, Al Moukatam, Al Darasaa and Al Roda.

(d) West Cairo Bus General Transport Unit with branches in:

- Al Muneeb
- Al Giza
- Imbaba
- Imbaba Maintenance Workshop

This unit operates the local lines in West Cairo Region.

The lines of this unit serves the regions of Al Warak, Imbaba, Al Kitkat, Meet-Ukba, Madinet Al Awkaf, Al Zamalek, Al Giza, Al Duki, Boulac Al Dakrour, Cairo University, Al Munib, Al Umraniya, and Al Ahram.

19

In July 1978, a new transporation company was created from the assets of the Cairo Transport Authority. The 400 new Ward buses were transferred to the Greater Cairo Bus Company. The organization is still in its initial phase of operations, but the intention is to make the company a commerical organization. The CTA assigns routes to the company, and maintains the assets used in the formation of the company as investment.

The public transportation companies are placed within the realm of responsibility of the Ministry of Transport.

Upon nationalization, the bus and truck companies were placed under the general control of the General Organization for Intercity Passenger Transport and the General Authority for Rural Goods Transport. The organizations regulated the operations of the companies and handled coordination between the firms and other entities. Centralization of certain major repairs as well as vehicle acquisition and spare parts purchase was assigned to the General Nile Company for Automotive Repair.

Since 1975, the Egyptian Government has taken steps designed to heighten accountability for public sector companies through increasing the responsibility of operational authorities. The General Organizations for both the bus and truck companies were abolished. The Technical Secretariat of the Undersecretary of Transport has maintained an overall supervisory authority over the companies, but this is exercised through approval of the budget and other formal procedures, not in operations. This increased freedom to maneuver was utilized to chip away at the position of the General Nile Company for Automotive Repair. The companies are currently free to make basic decisions as to expansion of facilities, the purchase of spare parts, new vehicles and equipment. Common interest dictates a handling together for parts or vehicle purchases when the needs are generalized. Some purchases and an occasional spare parts order are channeled through the Automotive Repair Company. The Chairman of that organization has indicated that his company is somewhat at a loss as to how to adjust to the new situation. He is attempting to attract a considerable portion of the private automobile overhaul trade in the Cairo area to his shops.

In discussing the present regime the bus and truck company officials feel the change has been beneficial in giving operational authorities more control over the filling of their requests for equipment and parts, and that one layer of "red tape" has been removed by the reform. These positive consequences, however, are counterbalanced by the desire of each organization to maximize its independence; to build its own "empire". This results in the unnecessary duplication of facilities, and the purchase of expensive equipment that will be under-utilized and simply wasted.

At this moment, the picture is somewhat unsettled. The bus and the truck companies appear to recognize that their problems and needs are similar, producing an amount of voluntary cooperation. Personal relationships within the upper echelons of the management seem to be helpful in this regard. Through various discussions it has become clear that there is a recognition that more coordination and rationalization of the structure of the public bus and truck companies is required. The exact nature of this need is still an area of great debate, with each separate entity being hesitant to compromise its independence of action.

The urban transport organization, the Cairo Transport Authority and the Alexandria Transport Authority, appear to operate with a great deal of autonomy. They are dependencies of their respective governorates, and do not report to the Ministry of Transport. Operational losses are made up by the Ministry of Finance. The Greater Cairo Bus Company was created from the assets of the CTA, and the CTA retains a large share of the net worth of the company, as well as assigning the routes to the Greater Cairo Bus Company. Conversations with company officials indicate that the new organization reports to the Ministry of Transport and to the Cairo Governorate.

3.2 Areas of Responsibility

The responsibilities of the various elements of public sector transportation appear to be reasonably well-defined.

The public sector bus companies and transportation authorities are clearly responsible for the general intercity and intracity transportation of the general public. Their routes are non-competitive in that each has a unique service area, and there are no private sector bus companies to provide an alternative.

21

The trucking fleet operated by the Government is a small portion of this sector in Egypt. Their mission is to haul public cargo, principally to and from the ports and interior.

A very small percentage of the total load is made up of private sector goods, sought only to avoid unloaded returns from delivery of public sector cargo. There are currently five public truck companies - Goods Transport, Rural Transport, Direct Transport, Transportation Works and Heavy Transport. All companies serve Cairo and Alexandria, and have a specific geographic zone to cover. These operational zones are exclusive.

Each company is autonomous in its operations and is expected to remain profitable. Each firm has a service area, although there is considerable overlap in these areas from company to company. The companies utilize private trucking cooperatives on a regular basis to carry some of their freight.

3.3 Location of Facilities

Maintenance facilities of the public sector companies and authorities are numerous and dispersed to some extent in accordance with the area covered. The area of each of the three Delta bus companies includes most of the population of the country, most of the land area and most of the major cities. The systems are amenable to service by facilities located with respect to a center of gravity concept (hub and spokes). In contrast, the Upper Egypt system is a "linear" system of great length suggesting a line of maintenance nodes intermixed with passenger service nodes.

The truck companies with a much less structured route system have facilities located at major terminus points.

The Cairo area abounds with facilities of every public sector company in addition to the numerous facilities of the CTA. It clearly raises the issue as to the desirability for coordination and consolidation of overhaul and repair activities in the Cairo Area.

Three maps showing the locations of all of the facilities are contained in the rear pocket of the report cover.

,0 RESULTS OF THE GENERAL SURVEY

During the first phase of study a general survey was ›nducted of vehicle maintenance operations in the public ›ctor bus and truck companies. The general survey was ›nducted by facility visits supplemented with information ac- ›ired through questionaires and by visits to administrative ffices. More than 50 facilities and offices were visited - ›ese are listed in Tables 4-1 and 4.2. Table 4-1 also shows ›e year in which the facility was built and, where available, ›e site area including buildings and grounds. Table 4-2 is trip log which provides a brief qualitative assessment of ›ch facility. Most are classified as poor in physical ›ndition, layout, compliment of equipment, cleanliness and ›rtually any other criterion one can conceive to measure ›intenance system quality. But every now and then there is › exception which demonstrates that something better is ›tainable. Further efforts were expended in a more detailed ›rvey to try to find the key to these exceptions which to- ›ther with some basic improvements might yield substantial ›provements to the overall systems.

The company-wide questionaires were designed to ›ovide each Company's (or Authority's) overall perspective of ›eir maintenance program by covering four groups of activities:

(1) Maintenance Systems - definitions, procedures, equipment, physical facilities, logistics, etc.

(2) Vehicle Systems - fleet composition, spare parts sources of supply, operating requirements, etc.

(3) Financial and Economic Information - budgeting process, acquisition policy, cost accounting and control, revenues, financial planning,etc.

(4) Organization Policy and Practices - structure, span-of-control, incentives, disincentives, goals, objectives, etc.

As noted in Section 2.3, copies of the four question- res are provided in Appendix I.

The results of the questionaires and site surveys e provided in the following pages and appended detail reports ppendixes IV, V and VI).

4.1 Maintenance Systems and Vehicle Systems (Appendix IV)

For the purpose of this analysis Maintenance Systems and Vehicle Systems will be considered jointly, because of their dual impact on logistic support.

There are certain basic principals and practices of good maintenance and logistic support that have evolved from world-wide operations of buses and trucks,

TABLE 4-1

LIST OF VEHICLE MAINTENANCE FACILITIES VISITED BY TECHNICAL TEAM MEMBERS

COMPANY AND FACILITY	No. Buses Handled	Year Built	Site Area (Sq.Meters)
Cairo Transport Authority			
(1) Nasr Central Workshop	NA	1965	25,032
(2) El Ameriya Main Workshop	NA	1958	6,623
(3) El Ameriya Garage	163	1958	26,894
(4) Imbaba Maintenance Workshop)	171	1970	60,678
(5) Imbaba Garage)			
(6) El Basateen Maintenance Workshop)	200	1972	51,789
(7) El Basateen Garage)			
(8) Athar el Nabi Garage	135	1970	34,153
(9) Nasr Maintenance Workshop)	198	1968	44,430
(10) Nasr Garage)		1965	
(11) Port Said Street Garage (Ward Buses)		1972	
(12) El Mazalat Maintenance Workshop)	197	1966	30,710
(13) El Mazalat Garage)			
(14) El Monib Garage	193	1970	40,744
(15) El Giza Garage	75	1956	9,794
(16) Helwan Garage (Ward Buses)		1979	
West Delta Bus Company			
(17) Alexandria Garage and Workshop	139	After 1964	21,900
East Delta Bus Company			
(18) Central Workshop - Amiriya, Cairo		Before 1949)	18,285
(19) El Kanal Garage	77	Before 1949)	
(20) Benha Garage	85	1972	6,000
(21) Mansura Garage and Workshop	144	1976	14,064
(22) Zagazig Garage	178	1942	7.350
(23) Ismailia Garage	70	1961	2,660
(24) Port Said Garage	58	1966	9,370
(25) Nasr City Central Workshop		Under Construction	
Middle Delta Bus Company			
(26) Shubra Garage and Workshop, Cairo		Very old	
(27) Mahalla Garage and Workshop			
(28) Tanta Training Center/Rebuild Shop		Under Construction	
Alexandria Transport Authority			
(29) Sidi Bishr Garage		1962	30,800
(30) Smouha Garage (Ward Buses)			26,200
(31) Main Workshop Sidi Gabr		Very old	?
Upper Egypt Bus Company			
(32) Giza Garage and Central Workshop, Cairo	82	Before 1956	9,233
(33) Al Fayum Garage and Bus Station	98	1960	12,600
(34) Al Fayum Body Shop/Main Parts Store	NA		
(35) Aswan Garage	59	1969	?
(36) Qena Garage and Central Workshop	52	1975	15,000
(37) El Minya Garage	90	1977	17,000
(38) Assiut Garage	97	Very old	4,854

24

TABLE 4-1
(Continued)

K COMPANIES	Year Built
ɔt Transport Company	
Nasr City Garage and Workshop	
s Transport Company	
El Minya Garage	1974
Ameriya Garage (Cairo)	1966
Der El Malak Main Workshop (Cairo)	Before 1964
Alexandria Garage	
y Transport Company	
Mataria Garage and Workshop (Cairo)	1971
Alexandria Garage and Workshop	
l Transport Company	
Alexandria Garage and Workshop	
Mahalla Garage and Workshop	1970
notive Repair Company	
Abassia Body Workshop	Very old - Addition 1974
Abassia Engine Rebuild	1945
Ministry of Transport Training Center	1967

TABLE 4-2

FACILITY NAME	DATE	OPERATOR	LOCATION	VEHICLE TYPE	THRUPUT	MAKE OF VEHICLES HANDLED	SCOPE OF SERVICES	COMPONENT SPECIALIZATION	ACTIVITY RATING GOOD	FAIR	POOR	COMMENTS	PERSONNEL
[illegible] Garage	6-24-79	CTA	Cairo	B	9.5/day	Irannat'l total 171 avail 137 Mercedes engine	Insp;PPM Serv;repair rebuild	Total Vehicle			x	Capacity far in excess of need if properly utilized; poor lighting with work days at night. Dirty	Engr.Mohamed Magad; Engr. Rashed Riad Gurgus; Engr. Moawad Shafik
Maint.Shop	6-24-79	CTA	Cairo	B	?						x		
Gisr El Suez Major Overhaul & Rebuild	6-27-79	CTA	Cairo	B	150/M	All buses	Major ovhl & rebuild	Total Vehicle	NA	NA	NA	Under constr. capacity to rebuild and build new; 1500 buses/yr.	Engr. Hamed A Ramadan; Engr Moawad Shafik
Al Bastoen Garage	6-21-79	CTA	Cairo	B	14/day	Irannat'l Total 200 Avail 160 Mercedes engine	Insp;PPM Serv; repair	Total Vehicle	x			Clean, well-managed facility	Engr.Hassan Ahmed; Abdal Messih Aziz; Engr.Moawad Shafik Engr. Naci Louis Boctor (Maint.Shop)
Maint.Shop	6-21-79	CTA	Cairo	B	?					x			
Pl [illegible] Garage	6-20-79	CTA	Cairo	B	?	Nasr Total 134 Avail 95 Pegasco Total 113 Avail 51 Sava Total 50 Avail 14	Insp;PPM Serv; repair	Total Vehicle			x	Understaffed, Underequipped, lack spare parts	Engr. Fawzi Farid; Engr. Moawad Shafik
Maint.Shop	6-20-79	CTA	Cairo	B	?	Deutz engine	Rebuild	engine			x	Dirty,facility services 2 garages	Engr. Fawzi Farid; Engr. Moawad Shafik
Al [illegible] Garage	6-25-79	CTA	Cairo	B	?	Pegasso Total 126 Nasr Total 40 Avail 108	Insp;PPM Serv; repair	Total Vehicle			x	Dirty,oil covered floors and tarmac lacks equipment	Engr. Moawad Shafik

(13a)

96

SHOP NAME	DATE	OPERATOR	LOCATION	VEHICLE TYPE	THRUPUT	MAKE OF VEHICLES HANDLED	SCOPE OF SERVICES	COMPONENT SPECIALIZATION	ACTIVITY RATINGS GOOD	FAIR	POOR	COMMENTS	PERSONNEL
Smouha Garage	6-16-79	APTA	Alex	B	?	Ward Total 200 Avail 170	Insp;PPM Serv; Repair	Total Vehicle		x		Oil covered tarmac; spare parts a problem	Engr. Abdalla El Karmaty
Sidi Gaber Main Workshop	6-16-79	APTA	Alex	B	8 lg/mo. 12 sm/mo	all buses	overhaul	All major components			x	Facility old; piled high with un-servicable components; no lifting devices	
Sidi Beihr Garage	6-16-79	APTA	East Alex	B	?	Saviem Total 100 Nasr Hvy Total 50 Nasr Lt Total 119 Avail 150	Insp;PPM serv; repair	Total Vehicle			x	Tools and equipment inadequate	
Shubra Garage	7-3-79	Middle Delta Bus Co.	Cairo	B	?	Ward Total 30 Mercedes Total 25 Nasr Total 15 Barrieroe Total 20	Insp;PPM serv; repair	Total Vehicle			x	Facility in total dis-repair; dirty, flooded, sewerage backed up into facility	Engr. Mohamed El Madawy
Shubra Workshop	7-3-79	Middle Delta Bus Co.	Cairo	B	40 eng/ yr.	All buses	overhaul	All major components			x	poorly lighted very small shops, very dirty, poorly equipped battery rebuild facility	Engr. Mohamed El Madawy

(13)

27

SHOP NAME	DATE	OPERATOR	LOCATION	VEHICLE TYPE	THRUPUT	MAKE OF VEHICLES HANDLED	SCOPE OF SERVICES	COMPONENT SPECIALIZATION	ACTIVITY RATING GOOD	FAIR	POOR	COMMENTS	PERSONNEL
Al Amaria Main Workshop	6-25-79	CTA	Cairo	B	?	All buses	Major component overhaul & rebuild	Engine Transmission Gear Box&Axle Electrical plus support shops	x		x phys. fac.	Buildings very poor, congested inadequate lighting	Engr. Mosaad Shafik
Athar Al Nabi Garage	6-21-79	CTA	Cairo	B	?	Mercedes Total 135 Avail 108	Insp;PPM Serv. Repair	Total vehicle			x	Dirty, slippery floors; trades shops; ill-equipped	Engr. Mosaad Shafik
Nasr Engine Rebuild Shop	6-20-79	CTA	Cairo	B	50 eng/ mo.	Deutz Pegasso	Eng. Overhaul & rebuild	Engine			x	Once an efficient facility but now in disrepair; serves 4 garages	Engr. Mosaad Shafik
Nasr Garage	6-19-79	CTA	Cairo	B	?	Nasr Total 85 Pegasso Total 57 Avail 124	Insp;PPM Serv. & Repair	Total Vehicles			x	Dirty, oil covered; lack of spares, tools, equipment	Engr. Mosaad Shafik
Nasr Workshop	6-19-79	CTA	Cairo	B	?	All	Repair, Rebuild, Overhaul	All major components	x				Engr. Magic B. Garas; Engr. Mosaad Shafik

(11c)

28

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
El Amaya Workshop	7-2-79	East Delta Bus Co.	Cairo	B	30 eng/ mo. 8 bodies/ mo	all buses	Overhaul	All major components		x		Engr. Ashraf Gamaa Tawfik; Engr. Ahmed El Tohamy Ali
Kanal Garage	7-2-79	East Delta Bus Co.	Cairo	B	?		Insp;PPM Serv; Repair	Total Vehicles		x		Engr. Mahmoud Abd El-Salam; Engr. Atef Gerges Tawfik
Alexandria Garage	6-19-79	West Delta Bus Co.	[illegible]	B	?		Insp;PPM Serv; Repair	Total Vehicles		x		
Alexandria Workshop	6-19-79	West Delta Bus Co.	Alex	B	?		Overhaul	All major components	x			
Al Fayoum Garage	7-11-79	Upper Egypt	Al Fayoum	B	?	Maer Deutz (R) 24 (F) 2 Barrieros Total 11 Tata Total 21 Irennat'l Total 6 Ward 30 TAM 4 Avail 75	Insp;PPM Serv.; Repair	Total Vehicle		x	Some pits unusable because of flooding; generally dirty conditions; obsolete shop equipment	Engr. Mohamed Talla; Engr. Abdel Fatah Mohamed

79

SHOP NAME	DATE	OPERATOR	LOCATION	VEHICLE TYPE	THRUPUT	MAKE UP VEHICLES HANDLED	SCOPE OF SERVICES	COMPONENT SPECIALIZATION	ACTIVITY RATING GOOD	FAIR	POOR	COMMENTS	PERSONNEL
Benha Garage	7-7-79	East Delta Bus Co.	Benha	B	?	Nasr Total 11 Ward Total 38 Barreros Total 12 Irennat'l Total 5 Tata Total 18 Avail 84 5 makes total 144 avail 125	Insp;PPM Serv; Repair	Total Vehicle		X		Reasonable effort to clean Facility for visit; do partial engine overhaul	Chrm.A El Rahmar Mod Engr. Rahm Abd El Sal
Mansura Garage	7-7-79	East Delta Bus Co.	Mansura	B	?		Insp;PPM Serv; Repair	Total Vehicle		X		Reasonable effort to clean facility for visit; some pits flooded	Chrm.A El Rahmar Mod Engr. Rahmou Abd El Salem
Mansura Central Workshop	7-7-79	East Delta Bus Co.	Mansura	B	?	All above garage	Engine Rebuild	Engines	X			Facilities good, procedures and practices less than efficient	Chrm. A El Rahmar Mod Engr. Rahmou Abd El Salem
Port Said St. Garage	6-25-79	CTA	Cairo	B	?	Ward Total 240 Avail 170	Insp;PPM Serv; Repair	Total Vehicle			X	Dirty, oily Facility; no cleanup efforts shortage of tools and spares	Engr Mosved Shafik

SHOP NAME	DATE	OPERATOR	LOCATION	VEHICLE TYPE	THRUPUT	MAKE OF VEHICLES HANDLED	SCOPE OF SERVICES	COMPONENTS SPECIALIZATION	ACTIVITY RATING GOOD	FAIR	POOR	COMMENTS	PERSONNEL
Al Fayoum Body Shop	7-11-79	Upper Egypt	Al Fayoum	B	?	same as Al Fayoum Garage	Body rebuild	Body			x	Facility very limited	
Giza Garage	7-11-79	Upper Egypt	Cairo	B	?	Nasr Total 24 Barrieros Total 15 Irannat'l Total 10 Ward Total 26 TAM Total 7 Avail 51	Insp;PPM Ser; Repair	Total Vehicle			x	Facility very dirty; primitive access road facility more than 20 yrs. old	Engr. Wageih Abd El-Rahma Engr. Abdel Fatah Mohame
Giza Central Workshop	7-11-79	Upper Egypt	Cairo	B	?	All of above	Engine Rebuild	Engines			x		Engr.Wageih Abd El-Rahma Engr. Abdel Fatah Mohame
Al Muneeb Garage	7-10-79	CTA	Cairo	B	?	Irannat'l	Insp;PPM Serv; Repair	Total Vehicle	x			Engine steam cleaning available Refueling shut-offs Good clean garage	Engr. Moawad Shafik
El Giza Garage	7-10-79	CTA	Cairo	B	?	?	Insp;PPM Serv; Repair	Total Vehicle	x				

(13E)

31

SHOP NAME	DATE	OPERATOR	LOCATION	VEHICLE TYPE	THRUPUT	MAKE OF VEHICLES HANDLED	SCOPE OF SERVICES	COMPONENT SPECIALIZATION	ACTIVITY RATING GOOD	FAIR	POOR	COMMENTS	PERSONNEL
Benha Garage	7-2-79	East Delta	Benha	Bus	?	5 types 8% vehicles (Pegaso Ward IranNat'l)	Insp,PPM Service Repair	Total Vehicle	x			Clean facility though poorly designed.	Engr. M.A. Salem Chmn.Engr. A.E.Moderb
GMC/Auto Repair	7-14-79	GNCAR	Cairo	All	?	All	Rebuild	Body	x			Clean shop with good but, limited equipment	Engr. Fathy A313
Helwan	7-10-79	CTA (GCBC)	Cairo	Bus	?	Ward	Insp,PPM Service Repair	Total Vehicle			x	After only 2 months filthy facility and deteriorating concrete crumbling; electrical systems defective	Engr. A.M. Misrgo
Ameriya	7-22-79	Goods Transport Company	Cairo	Truck	?	Fiat-30 Saviem-50	Insp,PPM Service Repair	Total Vehicle		x		Poorly equipped shops & dirty, but reasonably organized. Virtually no test equipment. Special components sent out for rework.	Engr. M. Shiata
El Minya	7-20-79	Upper Egypt	El Minya	Bus	?	All	Insp,PPM Service Repair	Total Vehicle			x	In 1 year facility is greatly degraded. Poorly designed from many viewpoints	Engr. M.A.E. Mohamed
Qena	7-28-79	Upper Egypt	Qena	Bus	?	All-52	Insp,PPM Service, Repair Some overhaul	Total Vehicle		x		Some shops clean, others not. Needs test equipment and other shop equipment to complete capability.	Engr. M.A.E. Mohamed

(13g)

32

SHOP NAME	DATE	OPERATOR	LOCATION	VEHICLE TYPE	THRUPUT	MAKE OF VEHICLES HANDLED	SCOPE OF SERVICES	COMPONENT SPECIALIZATION	ACTIVITY RATING GOOD	FAIR	POOR	COMMENTS	PERSONNEL
El Minya	7-10-79	Goods Transport Company	El Minya	Truck	?	Fiat-30 Saviem-30	Insp,PPM Service, Repair	Total Vehicle		x		Special component (electrical) sent out for rework.	?
Abassia	7-24-79	GNCAR	Cairo	All	?		Rebuild	Engine		x		Good fuel injection shop and engine test equipment. Storerooms and workshops crowded. Poorly designed building for light & ventilation.	Engr. M. El Nomrossi
Div El Malak	7-25-79	Goods Transport Company	Cairo	Truck	?	Fiat Saviem	Overhaul & Rebuild	Engine Power-train			x	Facility too small and equipment inefficent.	Engr. M. Sheata
Mataria Garage	7-26-79	Heavy Transport Company	Cairo	Truck	?	Fiat Saviem Berliet		Total Vehicle		x		Shop in fair condition but much junk around.	Engr. Rizk
Mataria Workshop				Truck	10	Fiat Saviem Berliet	Major components	Engine		x		Many components repaired by private sector shops.	Engr. Mohamed
Aswan Garage	7-16-79	Upper Egypt	Aswan	Bus	?	Mercedes-Benz; Iran Nat'l; TATA; Barrieros; Ward; Nasr	Insp,PPM Service Repair	Total Vehicle			x	Poorly equipped, dirty shop with some test equipment.	Engr. M.A.F. Mohamed
Mahala Garage	7-21-79	GNC/ Rural Transport	Mahalla	Truck	?	Fiat Barrieros	Insp,PPM Service Repair	Total Vehicle		x to	x	Well-located but poorly equipped for maintenance or rebuild	Engr. Ismail Engr. Habib
Asiut Workshop Garage	7-19-79	Upper Egypt	Asiut	Bus	?	Ward-40 TATA-15 7-Barrieros Mercedes-5 Iran Nat'l-4	Insp,PPM Service Repair	Total Vehicle			x	Filthy, poorly equipped, pits full of water, oil & sewage. Shop poorly designed and laid out.	Engr. Fattah

(13h)

SHOP NAME	DATE	OPERATOR	LOCATION	VEHICLE TYPE	THRUPUT	MAKE OF VEHICLES HANDLED	SCOPE OF SERVICES	COMPONENTS SPECIALIZATION	ACTIVITY RATING GOOD	FAIR	POOR	COMMENTS	PERSONNEL
Mahalla Garage	7-21-79	Middle Delta	Mahalla	Bus	?	Barrieros-14 IranNat'l-13 Ward-12 Mercedes-5 TATA-1				x to	x	Poorly located poor access, tight quarters. Reasonably clean facility but poorly equipped.	
Zagazig Garage/ Workshop	8-8-79	East Delta	Zagazig	Bus	?	Ward	Insp,PPM Service Repair Rebuild	Total Vehicle		x		No testing facilities but well-laid out and therefore good potential garage only.	Engr. Tawfeek Engr. Elanligy Engr. Kassem
Ismailia Garage/ Workshop	8-8-79	East Delta	Ismailia	Bus	?	Ward Nasr	Insp,PPM Service Repair	Total Vehicle			x	Filthy, crowded & disorganized. Surrounded inside and out by junk. No work pits.	

OFFICE VISITS

ORGANIZATION	LOCATION	DATE	TYPE COMPANY	PARTICIPANTS
El Nile General for Direct Transport	Cairo	6-9-79	T	Engr. Armanios Benyamin Isaak; Engr Salah Mohamed Taha
Cairo Transport Authority	Cairo	6-11-79	B	Engr Hamed A. Ramadan; Mr. Solomon; Engr Moawad Shafik; Engr Said Morsi
East Delta Bus Co.	Cairo	6-28-79	B	Engr Mahmoud Abd El Salam
CIP/USAID	Cairo	6-7-79	B	Richard Aitkin
Middle Delta Bus Co.	Cairo	6-5-79	B	Engr Samir El Kaddusy; Engr Mohamed Mahmoud Salem; Engr Mohamed El Medaries; Engr Nabil Zaki Grarges
East Delta Bus Co.	Cairo	6-5-79	B	A. Tel Rahman Hodieb
General Nile Co. for Upper Egypt	Cairo	6-4-79	B	Engr Saad El Din Sabet; Engr Mohamed Shebli; Mr. Awwad Farrac; Mr. Nuassein Sabet; Mr. Mostage Abu El Kassem; Engr Allef Ab El Rahim
Alexandria Passenger Transport Authority	Alex	6-16-79	B	Engr Mohamed A. Rahman Amin; Engr Abdalla El Karmaty
West Delta Bus Co.	Alex	6-17-79	B	Engr Abail Yamin Moh. Ismail; Engr Sobhy Abul Fetouh; Mr. Abdel Shafy Ibrahim
General Nile Co. for Automotive Repair	Cairo	7-3-79	-	Chmn El Morsi Ahmed El Morsi; Engr Abdel Hakim Youssef
East Delta Bus Co.	Cairo	7-11-79	B	Mr. Wadie Asaad; Mr. Abd El Hady El Disooky; Mr. Mohamed Sami; Engr Atef Gorgis Taufik
General Nile Co. for Upper Egypt	Cairo	7-5-79	B	Chmn Saad El Din Sabet; Magdi Anas Mohamed Soltan; Giolson Girgis Ibrahim; Mohamed Mohamed Masood; Engr Wageih Abd El Rahman Abdel Rahim; Engr Mohamed Abdel Fatah Mohamed
General Nile Co. for East Delta Buses	Cairo	7-5-79	B	Engr Mahmoud Abd El Salam; Chmn Abd El Rahman Hodeib; Wadie Asaad
General Nile Co. for Goods Transport	Cairo	7-3-79	T	Chmn Ahmed Abou El Naga; Husson Ahmed Akab El Bab; Yakut Mohamed Badiri

whether in the private or public sector. These provided the basis for the site surveys, the Maintenance System Questionaire and the Vehicle System Questions. The responses are detailed in Appendix III to this document. A brief review of the responses to the questionaire shows clearly that the litany of good maintenance practice has been learned by heart by all of the companies; The visual evidence from the site survey also clearly indicates major discrepancies between intent and accomplishment.

All companies similarly define repair, periodic maintenance and overhaul with the common criteria of km run or the time equivalent thereof. All companies indicate that driver complaint and daily inspection are the two principal direct means for identifying problems. All claim to check liquid levels, pressures, and visually perceptible defects (e.g. lamp condition, belt condition, cleanliness, etc.) All claim to inspect vehicles for defects before giving them back to the driver. All claim to inspect reworked parts before replacing them on storeroom shelves.

One need only look as far as the closest available garage, stockroom or bus to see the vast difference between the fiction of the responses and the facts of facility and vehicle fleet condition. One must conclude either that there is virtually no quality control function in the maintenance function and no worker discipline or that badly maintained and unsafe buses are intentionally put back on the street daily with General Management and Government approval. The survey,has of course, revealed some mitigating circumstances - primarily parts shortages. The operations manager must put unsafe vehicles on the street or greatly curtail service and none of the interviewees revealed a willingness to stand up and be counted on that subject. Of course, the parts shortage problem itself is also the responsibility of management and is authored by the same General Managers and Goverment Officials. This will be evidenced when the results of the Vehicle System Questionaire are reviewed.

On the Maintenance Systems Questionaire all companies indicated that the average vehicle life is 7-8 years, but some vehicles are operated more than a decade (as long as 18 years). This greatly extended usage has a substantial impact on logistic support requirements from the viewpoint of quantity requirements and availability of obsolescent parts. The problem is further compounded by fleet composition, component acquistion source and storage practices as reported in the Vehicle Systems Questionaire.

The public sector companies are presently operating 12 different makes and models of buses - some of which are as much as 20 years old. There will soon be a new model introduced (Turkish Mercedes) and depending

36

on what happens at ATA, CTA and GNC with tenders that are presently outstanding, there soon could be four more makes and/or models. This is obviously too much, and too many for Egypt. 100% of the public sector truck companies' vehicles, and 75% of the public sector bus companies' vehicles are reported to be of foreign manufacture. For this reason, as far as can be determined from the questionaire, between 40% and 50% of all parts, units and supplies purchased for these vehicles are imported. This is a serious problem - what with the usual one year lead time that is general with foreign purchases, What makes the problem even more difficult is the fact that from 85% to 100% of the major components such as engines, transmissions, etc. and of the minor components such as injectors, starters, generators, etc., fall into the category of imports. A majority of local procurement is primarily restricted to chassis and body parts, fuels, lubricants, cleaning supplies, batteries and more recently, tires. (See Table 4.3)

Both truck and bus operators on the whole tend to store a large percentage of components and parts (50% for the four country bus operations, 72% for the five truck companies) at the local operating garages. This varies to some extent by company. East Delta, for example, indicates that a larger percentage is kept at local garages than does Middle or West Delta. All companies, however, indicate that about 80% of the major component spares are located in central stores. It is unfortunate and rather shortsighted to decentralize stores in general. Much better control can be maintained over material in a central storeroom, and it can be dispatched to the local storerooms on a when-needed, as-needed basis. Too often items stored locally tend to be in the wrong place, and records often don't adequately reflect their location - their needs at one location sometimes go unfilled when the part is actually in another local storeroom of the same company.

Truck companies tend to issue supplies, parts and units on the basis of a work order, while bus companies almost always require a requisition. This is rather typical of the general state of affairs with the bus companies - far, far, more paperwork than is required to accomplish its purpose. A work order - issued when work is commenced on a given vehicle, with one copy for the stores department - is sufficient to serve as an issue slip.

Table 4.3
VEHICLE ACQUISTION, SPARES AND OPERATIONS

BUSES

How are vehicles and parts acquired (%)	EΔ I	EΔ D	MΔ I	MΔ D	WΔ I	WΔ D	UE I	UE D	CTA I	CTA D
(1) Total Vehicle	90	10	80	20	86	14	NO RESPONSE		60	40
(2) Engines/Transmissions	90	10	85	15	100	ø			100	ø
(3) Injectors/Starters	100	ø	85	15	100	ø			90	10
(4) Chassis Parts	15	85	25	75	60	40			38*	62
(5) Body Parts	ø	100	20	80	70	30			38	62
(6) Tires	35	65	70	30	35	65			38	62
(7) Batteries	ø	100	20	80	10	90			38	62
(8) Fuel & Petrol Prod.	ø	100	ø	100	ø	100			38	62
(9) Cleaning Supplies	ø	100	ø	100					38	62

I-Imported D-Domestic *-Mercedes Fleet

Where are Items Stored (%)	EΔ CS	EΔ RS	EΔ G	MΔ CS	MΔ RS	MΔ G	WΔ CS	WΔ RS	WΔ G	UE CS	UE RS	UE G	CTA CS	CTA RS	CTA G
(1) Total Vehicle	ø	ø	100	ø	ø	100	100	ø	ø	NO RESPONSE			ø	ø	100
(2) Engines/Transmissions	80	ø	20	90	20	ø	80	10	10				100**	ø	ø
(3) Injections/Starters	30	ø	70	40	20	40	80	10	10				100	ø	ø
(4) Chassis Parts	30	70	ø	65	ø	35	50	ø	50				100	ø	ø
(5) Body Parts	30	70	ø	65	ø	35	70	ø	30				100	ø	ø
(6) Tires	20	ø	80	60	ø	40	100	ø	ø				100	ø	ø
(7) Batteries	20	ø	80	80	ø	20	90	5	5				100	ø	ø
(8) Fuel & Petrol Prod.	ø	ø	100	ø	5	95	60	10	30				100	ø	ø
(9) Cleaning Supplies	20	10	70	ø	10	90	75	ø	25				100	ø	ø

CS-Central Stores RS-Rebuild Shop G-Garage **Observors noted that this information is incorrect.

Table 4.3
(continued)

BUSES (continued)

	E△	M△	W△	UE	CTA
Fuel Consumption (Lit/100km)					
Barreiros SAETA 75		28	NO RESPONSE	NO RESPONSE	40
Pegaso Mod. 5032	32				?
Mercedes/Iran National	30	32			35
Nasr M230	30	26			
Mercedes/German 0302		40			
Mercedes/TATA	28	25			
Ward	40	48			
Annual KM/Operating Unit					
Barreiros		64,400	NO RESPONSE	NO RESPONSE	100,000
Pegaso	100,000				100,000
Mercedes/Iran National	140,000	73,600			100,000
Nasr	60,000	64,400			
Mercedes/German		73,600			
Mercedes/TATA	80,000	64,400			
Ward	12,000	78,200			

(17)

It is usual to measure the gross amount of parts and supplies in terms of monetary units per vehicle. The following Table details this information for the companies which have reported.

	BUS				TRUCK		
	E▲	M▲	W▲	UE	ATA	WORKS	GOODS
LE	2561	2196	2260	2617	5693	2763	2862

Average Bus - 3065 Average Truck - 2813

These figures, in themselves, mean little. In U.S. terms, they would all be high - but in Egyptian terms, they are probably (with the exception of ATA) not high enough, due to the necessity of importing such a high percentage of parts, with concomitant lead time and import duty costs. The two truck companies that reported have a somewhat higher average than the four country bus companies - probably reflecting the fact that all trucks are of foreign manufacture - and that they must import a larger percentage of their parts.

As a final aspect of Maintenance Systems, a brief review of the facilities is in order, including plans for the future.

4.1.1 Cairo Transport Authority

The maintenance facilities of the Cairo Transport Authority total fifteen. Eleven of these are branch garages where buses are parked overnight and periodic maintenance and light repairs are performed.

Four of the garages have associated engine overhaul facilities. The other four facilities are workshops where major engine overhaul and body rebuild work is done.

The Technical Team visited ten of the facilities to make on site inspections of their condition and to discuss the various aspects of bus maintenance with the garage managers and engineers. The age of the facilities visited varied from 21 to 9 years of age. These garages conform to a typical layout, with offices at the entrance end of a rectangular site of between 3 to 5 hectares, shops along one of the long sides, rooms for stores facilities along the other (with bus parking space behind) and three rows of work pits in the center where daily servicing and running repairs take place. On the end opposite the entrance are the bays and pits for periodic maintenance, greasing and washing.

The garage structures, except at the oldest facilities, are entirely of heavy reinforced concrete. Even the canopies over the work pits are of this type of construction. The yard surface is of stone blocks or concrete covered with many years accumulation of fuel oil, engine oil and grease. This surface is slippery and is, in the worst areas, unsafe for vehicle operation. The

work pits are usable but very dirty - also none of the pit lights work.

The small workshops are poorly lit because of dirty windows, if any, and lack of artificial lighting. In most cases the original fluorescent lamps have burned out and have not been replaced. Any artifical lighting consists of a few bare bulbs hanging from the ceiling. The floors of most of the shops are also slippery with oil.

Site drainage appears to be adequate at the garages because none of the work pits were flooded. At the Imbaba Garage drainage improvements were made this summer so that garage waste water is now pumped directly into the city system rather than onto the surface of an adjacent street, as was done previously.

One of the worst aspects of these facilities is the accumulation of all kinds of scrapped bus parts and even whole buses. Hundreds of engines, transmissions, differentials,tires, etc. bespeak years of accumulation. This material, besides being unsightly, creates problems for bus parking and maneuvering. Only one garage, El Basateen, had its area for scrapped parts hidden by a concrete wall. This helps to make this garage one of the best looking ones that we inspected. Also at El Basateen the bus parking area is separate from the maintenance and shop area, which contributes to less vehicle congestion and less tracking of oil into the shops.

The Nasr Central Workshop is the most impressive building structually. It is built of concrete with very high ceilings and large skylights. This results in a feeling of spaciousness and good natural lighting. There are some electric lights 25 to 30 feet above the floor which can be used for night work if required.

The Ameriya Workship is quite different. It is quite old, having been built in 1958, and much of the shop area has low ceilings with practically no natural lighting. In an attempt to improve the lighting, large irregular holes have been knocked in the concrete roof. The large central work area is better because here the building is constructed of concrete walls with steel trusses supporting a high corrugated metal roof. However, a row of small windows just below the roof is the only source of natural light and ventilation.

The rooms where they work on the fuel pumps and injectors are only slightly cleaner than average. Some of them have exhaust fans to improve working conditions, but none of them are enclosed and supplied with filtered air to protect these critical engine parts.

Expansion or Improvement

Because of the large area covered by most of the workship facilities, there appears to be no need of expansion. Since the garages are surrounded by other buildings, expansion of maintenance facilities would have to take place by building new facilities on new sites. In view of the fact that the CTA did not reply to our question on proposed improvements or expansion it appears that they do not have definite planning for the future.

However, two garages have been built since 1972 and are being used for city bus operations. These are the Port Said and Helwan garages from which the new Ward buses operate. These are under the jurisdiction of a new company called the Greater Cairo Bus Company, so they will be treated separately.

All of CTA's energy for physical expansion seems to have gone into a huge vehicle rebuild/assembly facility on a site adjacent to the Gisr El Suez Garage. At this point L.E. 3.5 million has been invested in this project and it is only about 50% completed. Construction has been halted awaiting a decision on the feasibility of acquiring funds to proceed.

The planned facility would be enormous; covering an area approximately 1000 meters by 500 meters, on two levels. When completed it would be used to either rebuild or build new, 125 buses per month. The basement level will consist of a large area, where vehicles awaiting renewal will be stored, a parts and supplies storage area and a bomb shelter. The ground level will contain three production lines, production equipment, special area workshops, cafeterias, washrooms, a mosque, offices and other related facilities. Employment in this facility is estimated at 7000 persons.

The scale of the planned output from this plant compared to the size of the existing CTA fleet is interesting. CTA now has about 2000 buses; at the planned rate of production this facility could renew or replace every bus in the fleet in less than 1½ years - and then continue to renew that fleet every 1½ years indefinitely. Obviously the plant capacity would be far in excess of CTA's requirements.

4.1.2 Greater Cairo Bus Company

This is a new company established to operate and maintain the Ward buses. The buses operate out of two garages - Port Said Garage in Cairo and the Helwan Garage, formerly used by CTA. The physical characteristics of Port Said are similar to those of the other CTA garages.

It has a large number of work pits - 24 of them, and they are so arranged that it is difficult to maneuver buses around them. However, the pits are relatively clean and usable. The small workshops along the periphery of the work area are dirty and do not have adequate lighting or ventilation. The bus parking area is separated from the work area. This is fortunate because part of this area is taken up with 60 buses awaiting repair. This high number is due to the many problems that have appeared in the Ward buses.

The Helwan Garage was opened this year. It also conforms to the standard CTA layout. Considering its age the physical condition of this garage is unbelievably bad. Concrete islands along the service bay are crumbling, concrete paving is breaking up, fuel pumps are damaged from being hit by buses, the buildings look old and everything is covered with grease and oil. The work pits are ankle deep in oily dirt; the original fluorescent lamps do not work and incandescent bulbs have been hung from them.

The condition of the shops vary; the machine shop is well-equipped, but the electrical and fuel system shops are not. Detroit Diesel-Allison maintains a well-equipped training shop and separate storeroom for warrantee parts. The general storeroom is inadequate for future needs. At the time of the visit, this garage was not in condition to maintain the 160 buses assigned to it.

4.1.3 Alexandria Transport Authority

Because this company did not reply to our survey questionaire, the following description of their physical facilities is based entirely on visits to their office and the maintenance facilities. The company has three facilities, two garages which were built in the early 1960's and a main workshop whose age is not known but which is very old.

The Sidi Bishr Garage, which is located in the center of East Alexandria, has two rows of nine work pits each, which are used for inspection, periodic maintenance and light repairs. The small workshops are located along the garage walls near the pits. A workshop and store for tires is located at some distance from the pits. The office building is near the entrance and a maintenance workshop building is next to it. The rest of the garage area is open yard for parking and storage of buses. The pit areas and parking yard is covered with layers of oil and grease, making vehicular movement hazardous and walking difficult. This garage has 269 buses assigned to it, but 64 will be retired by the end of this year due to old age. They have an average of 150 buses operational.

43

The Smouha Garage has two rows of nine work pits each, located in one corner of the garage. The small workshops are strung out along the entire length of one side of the garage. The offices are to the left of the entrance. This facility is adequate for servicing the 200 Ward buses assigned to it, however, it also is covered with a slick of oil and grease, which creates unpleasant and hazardous working conditions.

The main workshop is at Sidi Gaber, near the tramline car barn. Here they perform complete engine overhauling and body renovation. This facility is antiquated, crowded and much of the space is occupied by scrapped parts. Some of the equipment is serviceable, but this facility should be abandoned as soon as a replacement is ready.

The company is building a new workshop and garage in West Alexandria, but it will not be finished for another three years.

4.1.4 West Delta Company

This company has three workshops; the one in Alexandria is the largest, Damanhur is the next in size and Cairo has the smallest. There is a garage associated with each of these workshops.

There is a garage/workshop in Marsa Matrouh, with a site area of 4145 square meters and small branch garages in Mahmoudiya, Kafer El Dawar and Abu El Matameer. Two other small garages are under construction in Shubra Khit and Rashid.

The company considers its Alexandria facility to be in good condition in all categories. The Damanhur facility is rated good except for the water supply and sewer service which are being improved. The Cairo facility is only fair, with its water supply and sewer service also under improvement. The branch garages are considered to be in fair condition, even though they are new facilities.

Expansion or Improvement

An expansion of the Damanhur Workshop is underway. We were told that much of the work now being done in Alexandria would be moved to Damanhur when the new construction is done. However, in their reply to the questionaire they stated that they also plan an immediate expansion in Alexandria; we have no details on this. They also plan for longer term expansion to build garages in Kom Hamada, El Khatatba and Kafr El Zayat.

In addition to this, they state their need for additional building area for stores, and a new garage for the Cairo zone.

4.1.5 East Delta Company

This company has two facilities for major overhauling; one is in the Ameriya section of Cairo, the other is in Mansura. There are twelve maintenance garages for periodic maintenance and minor repairs at locations throughout the region.

The facilities vary considerably in age and condition. The oldest one is the Ameriya Workship and adjacent Kanal Garage, these were built before 1949. The workshop provides rebuild facilities (engine, transmission, body, etc.) for about half of the East Delta fleet of 1000 buses. It is too small and crowded to be able to perform its mission efficiently. The workshop is laid out in a "U" shape, the center being open and large enough for one bus to pass another, but too small to permit a bus to be turned around. Along one side of the workshop there are open sheds where major units are removed from the buses, and dismantled. Engines are dismantled, dirty, and the oil from the pans is allowed to run out onto the ground. A very small office is located on the other side and next to that are the engine rebuild shops. Beyond that are the body, paint and carpenter shops. Electrical and fuel system shops are located across from the office, through an alleyway. The whole scene is one of crowded confusion and appalling working conditions.

The central stores associated with this facility are in a three-story building; the first two floors are for parts storage, the third is for offices. Some fairly heavy parts must be carried up and down from the second level stores.

The adjacent Kanal Garage is also old, dirty and inadequate for its purpose.

The other main workship and garage, In Mansura, is at the other end of the spectrum from the one described above. The workshop part is the best such facility seen during this study. It is a new facility; operation was begun in April 1978. The construction of the buildings is of the traditional reinforced concrete. The yard area is paved with concrete that is so free of the usual oil and grease that it can be recognized as concrete. To the right of the entrance is the control office, storerooms for employee's work clothes, a used parts distribution shop and a well-equipped machine shop. In the center are located the engine disassembly and cleaning workshop, an engine assembly workshop, fuel system testing shop and an engine testing shop. Next to these shops are two clean work pits under a concrete canopy. This area is used for painting the buses after they have been repaired at the

body repair area. The body repair area is also located under a concrete canopy.

The buildings along the right side are of two levels, with stores on the ground level and offices above. Along the back wall of the workshop is found another engine assembly workshop, electrical shop, forging and sheet metal shop, welding shop and small stores.

The garage, which is immediately adjacent to the workship, is not in as good a condition. It was opened in 1969, and shows the inevitable toll of 10 years use. However, it is in better condition than many bus facilities of that age. The garage has a total of six pits for greasing, washing and repair and inspection. However, much of the inspection and repair work is done under or near a large concrete canopy in the center of the garage. Along the back wall are located the usual small shops to support the repair work. A large three-story building on the left contains stores on the ground floor and offices on the other two floors. These offices include those for the branch technical manager and the zone technical manager.

Besides this garage, they have in the Mansura region five branch repair facilities. At each of these branches a small group of mechanics perform running repairs. Each facility also includes a bus station, and buses are stored overnight. This takes some of the operating and maintenance load off the main garage. The branch facility in Mansura, which we inspected, is in deplorable condition. It is old, crowded and dirty. We have no information on the condition of the other branches.

Of the other ten garages we personally inspected four, namely, Benha, Zagazig, Ismailia and Port Said. The Benha and Zagazig garages are in good condition. Benha garage is much cleaner than the average, but it has a design weakness in that all inspection and repair spaces are dead-end. The backing in or out of these spaces is less efficient than the use of pull-through spaces. The Zagazig Garage, which was built in 1942, is better with respect to the work pit layout since they are all pull-through. Considering the age of this facility, it is in remarkably good condition. It is fairly clean, and parts of it have been recently painted. Like almost all bus garages in Egypt, much space is occupied by scrapped vehicles and parts which should be removed.

The condition of the Ismailia Garage, built in 1961, is much worse than the older Zagazig Garage. The street leading to the garage are unpaved and narrow. Because of its small size, buses are parked outside in the narrow streets, making it difficult to enter or leave the garage. The body work area is sheltered by corrugated asbestos panels, supported by steel trusses. Some of this area is sheltered by corrugated metal so rusted that it

looks like lace work. They have only one usable pit which is used for greasing. To work on the underside of the buses the workers lie on either sand or oily surface. Because there is no drainage, the area around a water faucet consists of a small oily pond, where the water seeps very slowly into the sandy soil. There is so much scrap material around the fuel pump that an opening has been knocked through the adjacent outside wall so that the buses can be fueled outside in the street. This creates further congestion on the access road.

The Port Said Garage is in fair shape except for a workshop building which was damaged by bombing. One room in the workshop is used for fuel pump and injector maintenance, but the building is unsafe in its present condition. The work pits are actually raised concrete ramps, required because of the high water table here. They are dead-end requiring the buses to be backed out. The fueling island, which is well-located in the center of the yard area, is unusual because the tanks had to be installed partially above the yard surface due to the water table. However, it is an attractive and efficient installation.

We did not inspect the Suez garage but understand that it has severe drainage problems because of its low elevation.

Expansion or Improvement

There are three facilities that are in this category. First, there is a new garage under construction since 1974 in Damietta. This will be a large facility, with a site area of 19,530 square meters and building area of 8000 square meters. There is a huge facility in Nasr City that has been under construction since 1971. It is practically finished, but the collapse of a portion of the roof has resulted in legal action which has delayed completion. The completed buildings are planned to house a main workshop, stores, cafeteria, mosque and administrative offices.

The layout consists of two long rectangular buildings, parallel to one another, connected by a high concrete canopy covering a parking area for 20 angle-parked buses. The bus parking is laid out as if for a bus station. The canopy is about 15 meters above the ground, and is supported by thin concrete columns. The bottom part of these columns will have to be made heavier to protect against impacts by the buses.

47

The roof over the building is the same height as the canopy, resulting in a cathedral-like scale to the building. The engine rebuild area is one room, 56 meters in length, and has a bridge crane which can be moved the entire length of the room. However, this movable crane system does not extend into the adjacent disassembly/cleaning room or the engine testing room. This will cause inefficient movement in the engine rebuild process.

The rest of the building is divided into large but separate rooms as is traditional in Egyptian bus facilities. A huge paint shop is included, without fans or air filters. The only area in which body work could be done is under the high canopy where the buses are to be parked. At one end of the building there are three pits to be used for final engine testing after being installed in a bus.

The present management of the company did not participate in the planning of this fantastic facility and are uncertain as to how to use it. While they need a new workshop to replace the old one in Cairo, trying to use this structure would present many problems. First, it is much too large; second, it is not laid out for efficient operation and third, it should be located more centrally in East Delta's operating area.

The third facility for expansion is to be built in Ismailia. The company owns a large tract of desert land in an industrial park on the outskirts of the city. They are planning to build a large workshop and garage arranged in the traditional hollow square design. In discussions with the top management we presented alternative designs which, in our opinion, would result in more efficient operation of the maintenance work. Basically this is a core-type facility with the various operations located in a compact but open arrangement to permit efficient flow of parts and materials. This arrangement would also allow closer supervision of the workers.

This type of design would permit economy of construction, particularly if prefabricated metal buildings were used in place of the traditional reinforced concrete. This type of building would also reduce the construction period required markedly, thus allowing use of the facility much sooner than if the concrete type of construction were used.

The management of the East Delta Company appears receptive to our suggestions on the above matter.

48

4.1.6 Upper Egypt Company

The operations of the Upper Egypt Company are conducted within a large service area from Cairo to Aswan and along the Red Sea Coast. Because of the size of the service area it is divided into three regions, with the major facilities in Cairo, El Minya and Qena.

The physical condition of the facilities we inspected varies from incredibly bad to fair. The worst were the Giza Garage and Central Workshop in Cairo and the Asyut Garage/Workshop. Both are very old; the Cairo facility was built prior to 1956 and the one in Asyut in 1938 by a private operator. Both are characterized by oily unpaved yards, terrible working conditions and a shortage of equipment. The conditions at Asyut are made even more difficult by the fact that 97 buses are assigned to this relatively small facility. Most of the buses are stored overnight at the Asyut bus station but the facility is much too small for this number of buses. The work pits are full of water and oil and the fuel pumps are so far back in a corner that the buses must back and fill several times to get into position to be fueled.

The facility in Fayum is a combination garage and bus station, with a body rebuild shop a few blocks away. The garage operates, services and maintains 95 buses of 7 different makes. The number of bus types here is an extreme example of a general condition prevailing in all the bus companies; their job is made more difficult by having to maintain so many different kinds of buses.

The garage is 10 years old and it looks as if it has not been cleaned since it opened. The work pits are unusable because they are full of water and oil. They work on the buses in a dirty area near the pits. Buses are washed by hand in an open area next to a wall. The facility includes three small engine overhaul shops.

The body shop is much older, and provides a minimal shelter of steel canopies with patched corrugated steel roofs. It includes a main spare parts store.

The El Minya Garage is large and relatively new, having gone into operation at the beginning of 1978. One would expect it to be a showcase, but it is not. Physically it is in good condition, with clean concrete paving in the yard area. However, because the building contractor has not yet finished the drainage system, the work pits have oil and water in them and there is construction debris in front of many of the small shops.

49

They are modifying the shop layout by installing brick walls in the openings between shops. They cannot conceive of working in other than small closed-in shops. There is an excessive amount of yard lighting here, as well as a large number of double light standards about 30 feet high around the perimeter and some within the yard area. Evidently those within the yard restricted bus maneuvering, because they have been sawed off at ground level and are laying as junk in the yard. They have also installed four very high floodlight towers with twelve lights on each tower. It has been our observations in older garages with floodlight towers that the lamps are not maintained.

The design and construction faults, and the sloppy housekeeping reflect basic problems in providing good vehicle maintenance facilities in Egypt.

The largest facility in the third region is the Qena Garage/Workshop. It is fairly new and is in the best condition of all the Upper Egypt facilities that we inspected. Most of the garage yard paving is clean; the only oily area is around one pit and in the area where they store the used oil in drums awaiting pick-up. There were several bus hulks occupying space in the yard, but fortunately they have other space in Qena where they can store bus hulks.

The engine rebuild shop is clean and well-lighted. Large overhead electric fans provide air circulation. Shops without fans have poor ventilation. The work pits are usable but dirty, and contain old bus parts.

This facility is a key one in Upper Egypt's operations because of its location at the point where the east-west highway to the Red Sea Coast meets the main north-south road between Cairo and Aswan.

The southernmost facility is the garage at Aswan. This went into operation in 1969 and is in fair physical condition. The access road is poor, and the yard paving in bad shape. They were filling holes in the yard surface with pieces of broken brick. The facility includes a parts shop for Fiat cars which sells parts to private car owners. A new storeroom to house tires and spare parts for Ward buses is being added. The pits are dirty but usable and the new parts store is quite crowded. The fuel injector work room is clean and has an exhaust fan.

Expansion and Improvement

The company has indicated plans to add additional administrative space at Beni Suef, El Minya, Sohag and Qena. A large garage is under construction in Helwan and a small one in El Gardaka. They own some desert land along the highway between Giza and Fayum. The only things on the site now are some of their derelict buses. They propose to eventually build a new garage/workshop here for the first region so that the obsolete facility in Giza can be abandoned. However, there is no other type of development near this site, and it does not seem a suitable place for near-term expansion.

4.1.7 Public Sector Truck Companies

There are six public sector companies under the Intercity Transport Authority which was established in 1961. Five of these companies operate and maintain trucks, the sixth company, Automotive Repair, performs major engine overhaul and body repair and rebuilding.

During the Study, we visited a total of nine facilities operated by the truck companies and the two facilities belonging to the Automotive Repair Company. On the basis of these visits it can be assumed that the condition of their maintenance facilities varies from very poor to good. The best that we saw was the Goods Transport's Garage in El Minya; the worst was the same company's main workshop in Cairo. These are the newest and the oldest facilities respectively, belonging to Goods Transport. Generally the truck companies provide a better impression on the visitor than do the bus companies. This is probably related to the fact that the truck companies have better operating conditions. Their trips are long-haul at uniform speeds and generally over better roads. However, even in the best garage we visited the work pits were full of water; despite the fact that the garage manager lived in an apartment within the garage.

The physical condition of the body workshop and the engine rebuild shop of the Automotive Repair Company is poor, but better than might be expected from their extreme age. The body workshop's original buildings are of steel and wooden columns supporting corrugated metal roofs. An addition built five years ago, is concrete. The main area of the engine rebuild shop is construced of concrete walls and covered by a high, sloped roof of corrugated panels, supported by deep long span trusses.

Large roof dormers and a window section along the roof ridge provides some light and ventilation. Large glass skylights in the roof provide additional light, but allow transmission of heat into the work area. The individual shops have poor lighting and ventilation. However, the fuel injector shop is clean and well-equipped. They have a large dynamometer shop and test the rebuilt engines at varying loads; this is one of the few facilities we saw where this is done. The entire workshop is too crowded to allow good working conditions.

Expansion or Improvement

The plans for improvement vary widely between companies. Goods Transport replied that the matter is under study. Transport Works mentioned plans to buy new testing equipment and install an overhead crane in the engine workshop. Heavy Transport plans to build a new spare parts store in Cairo; in Alexandria they will build a new service station and improve the drainage and sewer systems. Their long-term plan is to build a new workshop in Alexandria for overhaul of all truck components.

Direct Transport has a new facility under construction in El Zahra with a site area of 25,800 square meters. Their long-term plan is to build new branch facilities in Qena, Safaga and Suez. Rural Transport owns 6 feddans of land on the Cairo-Alexandria desert road for expansion. They plan to build a main stores facility on half of it and an expansion of the Alexandria branch on the other half.

52

4.2 Financial and Economic Information (Appendix V)

The acquisition of financial and economic information proved to be extremely difficult at the level of the operating unit (garage, workshop or overhaul facility). It was only slightly less difficult to acquire at the company level with few exceptions. In the end, much of the information needed was taken from the Ministry of Transportation. The Cairo Transit Authority was unable to provide the team with detailed information in time for it to be considered in the study (1976 information was not available until Nov. 10 and 1977 not until Nov. 3rd--both after the study team assignment was completed). The Alexandria Authority provided no information.

4.2.1 Accounting Systems

The public sector follows a standardized system of accounting as a legal requirement. In practice, however, there is a considerable degree of latitude in the formulation of accounts to the point where at times it is difficult to compare the accounts of the different companies.

The fiscal year coincides with the calendar year. Each company prepares an annual statement of its activities and situation as of December 31. The companies present an annual report to the Ministry of Transportation within the first six months of the new year. These are reviewed by the Technical Secretariat of the Ministry and approved by the General Assembly of the Transportation Sector which functions similar to an annual meeting of shareholders. The Assembly is chaired by the Minister and attended by representatives of the Ministry, the Technical Secretariat, the bus and truck companies, the Ministry of Finance, the Ministry of Supply, the Central Accounting office and the Ministry of Defense. The accounts are inspected, revised and approved by the Assembly. Recent revisions in accounts have concerned the setting up of new categories of revenues and the revaluation of inventory items, resulting in the reduction of net profit.

The Cairo Transport Authority and the Alexandria Authority are dependencies of their respective governorates. Their accounts are presented to the Ministry of Finance and the Governors. The core of the annual reports are the balance sheet, the current production account, and the production account and profit and loss statement. The balance sheet is a presentation of assets and liabilities. Terminology varies from U.S. standards, but the concepts are similar. Profits are entered as a separate item on the liability side and shortage or losses on the asset so as to balance the account. A lengthy list of reserves and provisions is carried on the liability side.

53

The current production account shows income from operations and other sources and related costs divided into salary and wages, operation needs and other expenses - depreciation, provisions and other minor costs. Miscellaneous costs and income are grouped into a category labeled "transferring income" (expenses), and usually add up to a significant amount. The profit figures in the production account may differ from the balance sheet due to the practice of carrying forward previous year's debt or previous year's profit on the balance sheet.

The most important account for the purpose of this study is the Production and Profit and Loss Statement. Operating costs are distributed to two cost centers : production and production services. Production includes everything related to the operation of the vehicle-wages of drivers and collectors, gasoline, oil, grease, spare parts, license fees and insurance. Production services refer to support services for the vehicles; maintenance, shops, garages, mechanics, service vehicles, etc.

Operating income from fares, scrap sales and other categories is balanced against operational expenditures to arrive at the operational profit. Finally overhead in the form of administrative, financial and non allocated miscellaneous costs are compared with the operational and miscellaneous income to secure the net profit and loss. The Cairo Transport Authority differs from other organizations in that spare parts are included as a service (maintenance) cost and not as an operations item.

4.2.2 The Maintenance Budget

These investigations failed to uncover a maintenance budget as such for the truck and bus companies, therefore the study team developed a maintenance budget where necessary detailed information was available.

For maintenance activities, it is necessary to examine certain production costs, (spare parts, grease and oil costs) as well as other operations related expenses, in addition to the production services account described earlier.

The Cairo Transport Authority separates its costs into operations, service (maintenance) and overhead, and is the only organization that routinely divided costs and revenues by facility. Each garage has its own statistics as do the operating regions. Maintenance categories include all maintenance items.

54

Discussions with responsible officials of the bus and truck companies reveal the absence of a cost system; the information is not even arranged in a manner that establishes cost centers. The CTA in this regard is more satisfactory.

Initial requests for cost and revenue information made to the bus and truck companies provoked interesting responses. Most organizations claimed to be incapable of delivering such statistics or would be "very difficult" at best. It was clear that the accounts were not kept in a manner that allowed ready access to facility information. Costs and revenues are not analyzed on an operational unit basis, but only on a company wide level. There is basically no financial information kept on the individual garages, and the administrative system is highly centralized, with very little feedback from the field.

4.2.3 General Financial Situation

Although not the sole determinant of the condition of a vehicle fleet, availability of sufficient funds is indispensible to satisfactory maintenance. In this respect, the general financial picture of the companies does not bode well for vehicle maintenance. Liabilities are very heavy in relation to assets, and the income is anemic. In the United States these companies would be in serious trouble. This is the conclusion in the absence of a detailed item by item audit of the companies which would undoubtedly turn up over-valued or questionable assets, parts inventories for obsolete vehicle types and double accounting of items.

Conventional financial measurements such as return on net fixed assets (a high of 4.2%) and the current ratio (less than 1) reveal a dismal picture for all bus companies. Truck companies are in somewhat better shape, with the current ratio exceeding 1. The return on fixed assets however, is not impressive with the exception of a high of 9.9%.

The accounts of the Cairo Transport Authority reveal the deficit financial situation of the Authority. In 1978, the Authority reported loans as totaling 148 LE million. This figure, larger than the fixed assets, is principally comprised of loans from the Ministry of Finance. Apparently the subsidies paid by the government are regarded as "loans". Not one bus or truck company returned statistics on individual garages or workshops during the general survey phase of this Study.

As far as can be determined, there is no record for unit costs of specific repairs, or routine servicing

and consequently no detailed study of labor requirements or input needs. In addition this means that no statistics are kept showing the level of performance for each shop in term of productive efficiency. Each shop is apportioned a share of the budget without study of its requirements or its use of the allocation.

The cost situation contrasts with the revenue side; it is evident that a more careful watch is kept on income and statistics are usually maintained on branch revenues. During visits to garages, forms were shown detailing income by each vehicle per day and per month. Each vehicle is reported to have a history of repair, but the actual time, labor, and parts required for the repair are not available. No tracing is made of rebuilt units which are transferred from one vehicle to another.

4.2.4 Costs

The financial information returned by the bus companies indicate a serious trend of rising costs in the past few years. The rate of increase varies from 26.1% to 46.1% for the bus companies, with the largest increases evident in operations and production services. Costs are affected by inflation in the economy and also by expansion of the level of service offered. All companies providing ridership and kilometer statistics show an increase in service. Paradoxically, a significant expansion of kilometers run did not result in a proportionate increase in rideship. It is not known whether this is a case of inadequate record keeping or an attempt to extend service to isolated less populated areas.

Revenues have also risen, but not at the same rate as costs, except for Middle Delta Company. In general the past 3 years show a tightening financial picture, with revenue/km remaining generally stagnant.

The accounts of the Cairo Transport Authority show that the operational loss has increased at a rate of 20.8% per year in the 1976-1978 period. Costs for the last two years for bus operations have increased by 21.9%, while revenues registered a growth of 9.3%.

Accounts of the truck companies show more moderate cost increases, although service costs for vehicles are one of the most dynamic items. Revenue has approximately kept pace with costs, and profits are reflected in operations accounts except for the large losses for the Heavy Transportation Company. A curious feature of the truck company accounts is the recording of profit in production accounts for all but one of the 5 companies for the period 1977-1978, while in the

balance sheet, all companies except one, report losses. The explanation of losses carried forward from previous years is the one given, but there must have been a long accumulation of such losses prior to 1977 to have such a generalized effect over the entire trucking sector. Even more curious is the Rural Transport Company which shows both profit and losses for the 1977-1978 on its balance sheet.

Based on the maintenance budget extracted for the bus companies, the figures on a per bus basis for 1977-1978 appear reasonable, although the differences in labor cost and parts cost make it difficult to use U.S. experience as a guide. The potential effect of the rising trend of cost upon maintenance activities is likely to be negative. Maintenance by its very nature, is a service to a vehicle fleet, and in itself, not an essential daily input into operations. Cost cutting in service area and frequency of runs has more immediate undesirable consequences than, for example, reducing the frequency of maintenance, or the supply of spare parts. The long run consequences of such a course are extremely negative but attractive to an inflation-harassed management.

For the public sector bus companies, the amounts dedicated to maintenance have increased in absolute terms from 1976-1978, but in relative terms, there is evidence of a decline in proportion to other budget items. This trend is suggestive of future troubles.

The rate of increase of maintenance expenditures for 1977-1978 generally lagged behind other costs, and the key item of costs for spare parts registered a very small growth.

The CTA accounts show that the organization has also faced a serious trend of price increases, although the rate is lower than that of the bus companies. Maintenance activities consumed a marginally greater portion of total resources from 1977 to 1978.

Total resources dedicated to maintenance is much less than for the bus companies, due principally to the tremendous burden of depreciation over a 4 year period. For 1977 and 1978, vehicle depreciation made up approximately 30% of total facility cost, while for the bus companies, depreciation is in the range of 15-17% of total cost. The value of spare parts used in 1978 represents a 39.1% increase over the 1977 total.

The CTA, despite its financial situation was able to increase its expenditures on vehicle maintenance. This is perhaps because the CTA is not subject to the "discipline of the market place". In this regard the CTA is in an advantageous position - it is not expected

57

to extract net income from a very difficult cost-revenue situation as are the bus companies.

The public sector truck companies did not provide sufficient details to create a separate maintenance budget. A rough combining of production service cost, which includes items extraneous to maintenance activity, shows that maintenance and other services have more than kept pace with the rest of the expenditures.

This allocation of resources dedicated to maintenance is generally quite significant (52-74%) and in the case of Transport Works, 74% is remarkable, and even questionable.

In summary, both bus and truck companies have been subject to cost increases for the past few years. Wages have been rising as have most inputs for operations. The companies have for policy reasons been unable to increase revenues at the same pace as costs increase. This trend appears to have produced maintenance cost control programs for the bus companies, and while the truck companies have not reduced maintenance programs, the truck firms are hard pressed financially. This will affect the ability of the companies to adequately maintain these vehicles, an effect which will become more pronounced in the future. In this respect the CTA is fortunate to have recourse to the Ministry of Finance.

4.2.5 Vehicle Acquisition

Depreciation of buses and trucks is calculated on a straight line basis, with no salvage value assessed. The useful life of a vehicle is estimated to be 4 years for the Cairo Transport Authority and 8 years for the truck companies and most bus companies. East Delta, due to its combination of urban and intercity service, evaluates the lifetime as 5 and 7 years. Should a vehicle provide service beyond this time, half of the standard depreciation charge is deducted to cover eventual replacement costs. Because of limited capital budget, the operational life of a vehicle is frequently extended beyond this time. In the bus company fleets the replacement problem is particularly acute, with some buses in service from 10-15 years.

An examination of the vehicle ages of the bus companies shows varying degrees of ability to replace older units - The picture is generally of a fairly old vehicle fleet, somewhat modernized by purchases of the past 2 years. East Delta and Middle Delta have the oldest fleets (about 1/3 more than 8 years old) and West Delta the most modern (70% 4 or less years old).

58

The buses in Cairo urban service are more modern than those on intercity routes. No vehicle put into service prior to 1973 is currently operating.

The truck companies generally have the majority of their vehicles within the 2-4 year range. There was evidently a surge of vehicle purchases in the 1975-76 period. Director transport however, appears to be in a difficult situation with 60% of the fleet nearing or passed the end of its useful life (6+ years). All these companies will confront the need to replace a major portion of their fleet as the 1975-1976 vehicles begin to wear out in the early 1980's.

Every year, each company prepares a projection of the coming year's operations. The vehicle fleet is analyzed and its adequacy in terms of the expected service requirements is assessed. From this exercise, an estimate of new vehicles needs is produced. No detailed analysis is made of the costs of keeping a given vehicle or vehicle type in operation. The estimation is made of operational time available in broad age categories and also the age of the vehicles is taken as a guide for replacement. An 8 to 10 year old vehicle, after extended service in the local conditions, is obviously ready for retirement.

The estimation of the new vehicle requirements is followed by the examination of the company's financial situation. Accumulated depreciation reserves and profits available for investment are measured against the capital needs for the new vehicles. The Ministry of Transport collects the vehicle requests from the sector and contacts the Ministry of Supply regarding available sources of credit. Should the available funds be insufficient, a request is made to the Ministry of Finance for a government grant to make up the difference. This is termed "an addition to capital".

The Ministry decides upon the availability of funds for the purpose, and notifies the companies of the decision. This grant is of central importance in the case of the initial 20% of the acquisition cost to be paid upon arrival of the vehicles. The bus and truck companies are not required to repay the grant, but are expected to finance the remaining balance from their own capital. The transportation authorities (Cairo, Alexandria) are not expected to be able to purchase their own vehicles, and the government pays the entire cost of purchase. There is never enough revenue to purchase all the vehicles needed by the companies.

The bus or truck firms are able to purchase vehicles independently, but when the purchase is large,

59

it is customary to unify the bids. In the case of the bus companies, East Delta has taken the role of negotiator, while for the truck companies, the General Nile Co. for Automotive Repair still is used. A committee of all the parties is appointed to draw up the specifications and agree upon the exact requirements of the vehicles. Should the number of new units be small, each company handles the entire acquisition on its own.

The drawing up of vehicle specifications and the issuing of the request for tender is followed by the receipt of bids, the examination of the bids, and the awarding of the contract. As with spare parts, this process takes around one year.

As it is general policy to request the bidder to submit financing proposals with their documents and this appears to be a crucial factor, given the limitation on resources for the companies. This may explain the bewildering variety of vehicles in the public sector fleet. In other words, the best package receives the contract. While this procedure may save money in the short run, the problems downstream of familiarization of the mechanics with many different vehicle types and the complexity of maintaining adequate inventories for each manufacturer of vehicles may well add costs which exceed the initial savings.

The large requirements of the bus companies assure a fairly large flow of buses in a continuous stream. The truck companies however, operating a much smaller fleet of vehicles, purchase units in large blocks at infrequent intervals. Their vehicle fleet is often composed of a few types of trucks, all from the same year. The advantage of having a brand new fleet is offset by having all vehicles wearing down and being repaired at an escalating rate year after year, with the consequent increase of parts and service requirements. Should resources not be sufficient to replace the aging units after the end of the economic vehicle life, serious operational difficulties are certain.

A central issue in the policy of vehicle acquisition is the role of locally manufactured vehicles in the context of public sector needs. The government owned Nasr company located in Helwan produces both buses and trucks.

The Nasr bus has been evaluated by the team as a good bus, tested in local conditions and adequate for the demands of service in Egypt. The capacity of the factory is around 600 units per year and plans are underway to expand the bus line. The price of the Nasr bus is comparable or lower than foreign competitors, and with the problem of customs duties, the differential is quite large; for example, a Nasr (heavy) bus at present

60

can be purchased for approximately 48,000 LE while a German Mercedes costs 70,000 LE plus a 40% customs duty.

Bus company officials have expressed satisfaction with the Nasr bus but state that they are not available in the quantities needed by the companies. Nasr is reported to have somewhat erratic production volumes and a backlog of orders. The Nasr production is destined for all of Egypt, including the various ministries, the military and companies required to provide transportation for their workers. In addition, the Nasr Company management likes to export buses when possible, in order to earn foreign exchange. The current volume is clearly inadequate for the potential market.

Nasr also manufactures trucks. Large number of these vehicles are seen carrying military personnel and servicing various governmental agencies. To the best of our knowledge, however, no Nasr truck has been seen in the public sector truck fleet, reportedly because the Nasr truck's cargo capacity (8-10 tons) is too small.

It would obviously be in Egypt's economic interest to manufacture a maximum of its own transportation equipment. The foreign exchange savings, a certain supply of spare parts for local sources, the rationalization of the vehicle type and the ability to incorporate improvements specifically for local conditions, are all large benefits accruing from such a policy. The secondary effects of employment generation and stimulation of industries to produce inputs for the vehicles would all be substantial.

Although examination of this issue is outside the scope of work, the effects of such a policy have important implications for vehicle maintenance. If the Nasr company could be induced to expand and diversify its production, and be responsive to the requests of the public sector bus and truck companies, a large step would be taken to simplify the maintenance operations of the companies. In addition, if other manufacturing firms could be attracted to Egypt, the increased production and the stimulation of competition in the local market would be a positive contribution to the local industrial base. Funds spent for transportation equipment would have a multiplier effect through the entire economy, thereby serving both company specific vehicle needs and national development goals. It is certainly a matter that merits further study.

61

4.2.6 Spare Parts

The basic supply of spare parts is included in the requests for tender issued by the public sector organization. The supplier of the vehicles is requested to submit a list of the spare parts needed for service for the guarantee period and for the anticipated useful life of the vehicle. These parts and prices are specified to make up a certain percentage (usually from 20%-30%) of the total FOB value of the contract.

There is general agreement that this percentage is inadequate for the requirements of maintaining the vehicles in operating condition, but it is not clear if the problem is the total value required as a portion of the tender or the relationship of parts supplied to those demanded. Even with adequate inventories, the bewildering array of equipment models and the diversity of shops and garages would produce difficulty in the distribution of parts.

The status of spare parts supply for the year 1978 shows that most bus companies consumed parts, at a rate between 1500-1600 LE per vehicle. This appears to be reasonable. The CTA parts consumption is substantially higher and may be explained by the differing vehicle mix and the demands made on vehicles involved in urban service. The truck companies show a greater degree of variation (1500 LE to 5000 LE).

An examination of year-end parts inventories and yearly parts usage, by deduction of parts purchased for 1977 and 1978, yields interesting observations. The parts purchased appear to far exceed the usage. All organizations with the exception of Rural Transport built up inventory in 1978 with increases varying from 47% to 138%. The CTA's inventory grew at a rate of 39% over the period. For the majority of the organizations, the margin between purchase and usage was very large. It is curious that such healthy growth in parts acquisition was registered in 1978 and one must question the purchasing policy that allowed such excessive purchases to take place.

All the public sector companies and authorities covered in the project have expressed concern over the difficulty of securing needed spare parts. Because the vehicle fleet is primarily foreign equipment, and because the foreign manufacturers do not maintain parts warehouses in Egypt, most spares are imported through direct contract with manufacturers.

Bus and truck companies are free to handle their own purchases, but the cumbersome legal procedure of

62

tenders and bids influences them to make large parts purchases which combine the requests of sister companies. Bus and truck management personnel have stated that the international tender procedure for parts uses internal funds allocated for that purpose within company budgets.

Negotiations start after the size of the purchase is estimated. A letter of credit for foreign exchange is secured from a local bank. The detailed request for tender is then published. Tenders are received, evaluated and a supplier selected by a committee of representatives of participating companies, a contract is worded and the receipt of the parts requested within a certain time, as specified by the contract. The time lapsed between identification of needs and receipt of parts is reported to be approximately 8 to 12 months.

The day-to-day requirements of operating a large vehicle fleet obviously cannot be met by the cumbersome international tender procedure without sophisticated spares planning and control.

For more urgent parts needs, the local tender is utilized. A request for tenders is published in the local press, bids received, evaluated, and the parts received in the space of one to two months. The problem is that there are limited parts stocks for trucks and buses in the warehouses of local parts dealers, and they are significantly more expensive than parts from other sources. For example, a public sector truck company faced a critical need for fans for FIAT trucks. The General Nile Co. for Automotive Repair did not have fans in stock because the original contract for spare parts had been exhausted. The stores department made a local tender and awarded the contract, securing the vital part. The price difference between the Automotive Repair and the commercial distributor was substantial - 19 LE vs 32 LE.

Emergency parts needs involving a limited amount of money can be authorized by branch director and stores supervisors. The amounts at the disposition of facility administration vary from 100 to 6000 LE. This fund is periodically replenished upon presentation of receipts to the central administration.

Discussions with officials of the public sector transport companies revealed that they consider the spare parts problem to be one of parts flow and not funds. They claim to have enough capital to pay for what they need, and do not experience undue hardship in acquiring foreign exchange. It is the time-consuming procurement machinery the public sector is required to observe that is the fundamental problem. A second

63

problem is the lack of a detailed and current inventory of parts stocks for all public sector organizations. A third problem is a lack of proper reorder points needed to assure an adequate inventory of items according to their rate of consumption plus acquisition lead time.

Improvement in the spare parts situation will reduce deadline time due to parts shortages and reduce the level of cannibalization of vehicles to satisfy parts needs. It would also assure that complete repairs are made using quality parts. The existing repair facilities show much ingenuity in adapting or inventing replacements for unavailable parts. The effectiveness of these makeshift items and the repair of units without replacing all worn items however, leads to repeated repair at frequent intervals and to shortened useful life for vehicles.

An additional problem inherent in the present parts acquisition policy is the guaranteed occurence of parts inventories for obsolete vehicle types. The time frame for parts purchases builds in a lag of approximately 9-12 months between identification of requirements and parts use. If the basis used to estimate needs and guide purchases is taken from previous year data, then the lag time approaches 2 years. An example of the final consequence of this procedure is the existence in the CTA's stores of 2,000,000 LE of spare parts for the scrapped Icarus bus.

4.2.7 Budgetary Projections

This section analyzes the method used to estimate future expenditures, particularly for maintenance. Budgetary information is taken from 1979 Estimated Budget.

During the second half of the year, the public sector bus and truck companies formulate a budget for the following operational year. Estimates of revenues and expenditures are made considering equipment condition, service demand and the precedents of previous years.

For truck companies revenues are estimated by evaluating the availability of the vehicle fleet for operations. Age is the only factor evident. Vehicles are placed in age groups and the percentage of time of service is calculated. This varies from 70% to 90% in two year increments from 0 to 10+ years.

The capacity of the vehicle is multiplied by the availability factor, the average kilometer run per day, the number of working days, and finally, by the average freight charges per ton kilometer to arrive at total revenues.

The bus companies use similar methods to determine vehicle availability, although the percentage of operational vehicles is the measure used. The available percentages vary significantly between companies and reflect different experience in keeping their vehicles on the road.

The Cairo Transport Authority evaluates its fleet by bus type and establishes an availability figure reflecting the condition and reliability of the vehicles. Availability of the buses for the 1979 projection ranged from 40% for Sava to 81.8% for Nasr (Heavy). Available capacity is multiplied by service days, average kilometers and the average fares. Middle Delta differs from the other companies by utilizing an average revenue per kilometer rather than a revenue per bus day figure. The other bus firms differentiate between urban and intercity service due to the revenue characteristics of the different types of service.

The kilometers per bus, per day are within range of 270-280 km with the exception of the Upper Egypt Company which covers the largest geographic service area (331 km). The revenue figures per bus, per day vary widely. Middle Delta's figures are very low, representing 28 LE of revenue per bus running the average 280 km. Upper Egypt, East Delta and West Delta's revenues/bus are approximately the same for intercity routes and about twice as high as for intracity routes.

Revenue figures are based on approximate guidelines. If accurate passenger figures were available, a revenue per passenger kilometer estimate would appear to more closely approach reality. The existing fare system does not permit the development of an appropriate statistical base.

The Cairo Transport Authority makes revenue projections assuming that passenger traffic grows at a rate of 7% per year, and that gross revenues will increase at the same rate regardless of the number of vehicles put on the road.

Expenditures for the public sector truck companies are estimated in the same manner. Replacement intervals for tires, batteries, fuel, oil and grease consumption are all consistent. A great range is evident in costs for these inputs, and it is obvious that either the inputs are not being secured from the same sources or some of the companies are adding a factor to their expense projections against unforeseen costs and inflation.

65

Of major importance to the vehicle maintenance study is the manner in which spare parts purchases and maintenance activities are budgeted. For the truck companies, a fixed amount per vehicle is integrated into expenditure projections. This amount, 1500 LE, is determined by the General Assembly for the public sector transportation companies. It includes all maintenance and spare parts, divided into either 1/3 or 25% for maintenance and 2/3 or 75% for spare parts. No account is taken of the age, characteristics or history of each vehicle type. The only exception to this rule is the 50% (750 LE) allocation for the smaller (8 ton) Italian trucks acquired by Goods Transport in 1978 and the allocation used by Heavy Transport and Direct Transport. Heavy allots 500 LE more than the basic 1500 LE for older vehicles in its fleet. The new vehicles date from 1977; old vehicles from 1975 or earlier. Transportation Works follows a different guideline, allocating 1250 LE for older vehicles and 1500 LE for newer ones. The new vehicles also use 1/3 of their maintenance and repair budget for provision against unforeseen contingencies. For Transportation Works, a vehicle is classified as old if it entered service in 1972/73; the 1975-78 trucks are regarded as "new".

The bus companies utilize the same operational inputs, and estimates of requirements for fuel oil, tires, batteries and grease should be made on a similar basis. The East Delta, West Delta and Upper Egypt Companies utilize similar methodologies for cost projections. Middle Delta's estimates, however stand out due to greater detail and differentiation by vehicle types. As with the truck companies, different costs for identical inputs raise questions as to procurement policies or the effect of added margin included in expenditure projections.

When budgeting for spare parts, the bus companies utilize different formulae. The least sophisticated method is that of the East Delta Company, which projects 750 LE in spare parts for a Ward bus, presumably because these buses have been in service under twp years, and 1400 LE for all other models. Information submitted by this company indicates that it operates 9 different vehicle types which range from 1 to 18 years of service.

The West Delta Company uses a parts consumption per day estimate to establish parts costs. The consumption rate varies from 1 LE/day to 4 LE/day depending on vehicle age.

The Upper Egypt Company expresses parts needs as a function of vehicle type. Ward, a bus in service since 1977 is budgeted the same amount of parts as the rest of the vehicle fleet with the exception of Iran

66

National and German Mercedes. These other vehicles (Tata, Barrieros, Nasr) are over 4 years old. Iran and German Mercedes acquired in 1976-1977 are allocated 3000 LE/year in spare parts.

Although the East Delta, West Delta and Upper Egypt Companies use age as the principal determinant of parts requirements, these rates, which reduce with age, are at variance with the general expectation of parts demand as a function of age normally considered to develop at a gradually increasing rate and becoming quite dynamic as the vehicle wears out.

The Middle Delta organization provides more information on parts requirements than the other companies. Each vehicle type is assigned an average parts demand, not entirely determined by age. Spare parts are also broken down into foreign source, local source and materials used in repair. These parts statistics demonstrate that Middle Delta has apparently examined each vehicle type to establish the frequency of breakdown and repair.

All the bus companies are facing serious problems with their fleet of Ward buses. These vehicles have been projected to consume parts at a rate similar to the general experience with new buses; a very low maintenance expenditure for the first 2-3 years of service. New vehicles are usually expected to demand approximately 750 LE/year in spare parts. Previous experience, however, does not seem to apply and the 1979 operating accounts show substantially higher maintenance costs for Ward bus operations.

While this material is still being analyzed for use in 1980 budget estimates, the indications are that the new Ward bus has been using parts at a rate of 3,400 to 3,500 LE per year.

The bus and truck companies utilize 3 or 4 years' experience to project other categories of costs: wages, fringe benefits and miscellaneous items. The number is frequently the average of the past few years. Expected change in legal fringe benefits or regulations are incorporated, as are the salary increments for the employees which are based on years of service. All projections are reported to be evaluated each year by the technical departments to assess their accuracy. In practice, however, they did not change in any significant way for the period analyzed in this report.

67

The Cairo Transport Authority does not budget spare parts for the first 2-3 years of a vehicle in service, as it considers that the 30% of the vehicle purchase price that is supplied in spare parts under the international tender procedure is sufficient. After this period, it is estimated that 25% of the value of the vehicle will be consumed in spare parts each year. This practice would signify that as the vehicle ages, the amount of spare parts available would decrease in line with its value.

The New Greater Cairo Bus Company estimates that its vehicle will require 1400 LE of spare parts and 400 LE of miscellaneous maintenance equipment. Since the Company is of recent creation with new buses, this formula does not vary with the age of the vehicle.

4.3 Organization and Management (Appendix VI)

This discussion of organization and management has been reserved for last, so that it can be placed more in perspective with operational realities.

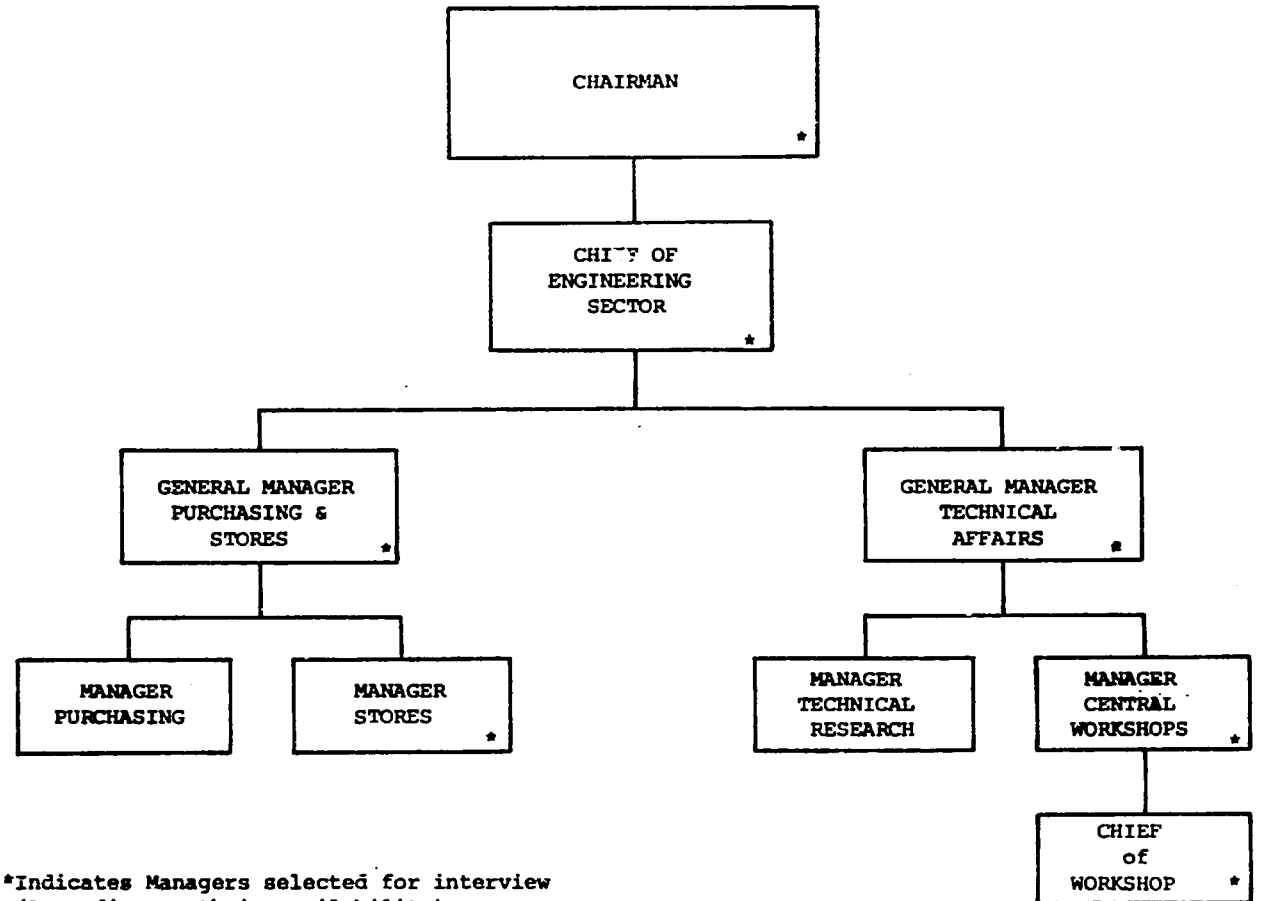
The preceding sections have described poorly equipped shops lacking tools and equipment that are considered commonplace elsewhere. Many shops have been described as "filthy" and a few have been considered marginally acceptable.

In many shops, tools that are available remain unused, or are unusable for lack of spares or supplies. Managers seem to be genuinely concerned with training and seem to make some effort at improvements but their efforts lack focus and coordination, yet all of these shops were once new. At the roots of it all is management.

First, there is insufficient management. There is a surplus, perhaps, of management personnel but they do not manage the enterprise in which they are engaged. Lines of authority and responsibility are not clearly defined; they intermingle, diverge, fade out, get lost in the shuffle of obscure titles, and they may not be desired. Responsibility is passed upward; authority is jealously guarded and retained.

Second, there is a deliberate, long standing, and apparently, desired cultural bias against closing the lines of management communications and directions. In short, there is a sizeable gap, a vacuum, between the managers and the doers. This is symbolized in titles, it is emphasized in pay scales and it is encouraged by tradition. These observations were substantiated through a series of interviews with managers of six public sector bus and truck companies. The areas of concentration were: organization, planning, review, delegation, control, motivation, communication and the key functions of the manager: planning, execution and review.

The interviews were concentrated in the engineering sector of each company. The organizational structure is typified by figure 4.1. The interviewees themselves ranged from highly cooperative and enlightening to extremely reserved and cautious. The information gathered ranged from accurate to deliberately distorted. Many of the interviews were conducted with people besides the interviewee present. This was sometimes extremely disruptive. Also, with rare exception, office business was conducted as usual during the course of the interviews resulting in constant interruption by people telephoning or simply bursting into the office unannounced. Although this too, was disruptive it did cast light on the manner in which normal business is conducted at the companies.



*Indicates Managers selected for interview
(Depending on their availability)

Figure 4.1

TYPICAL ENGINEERING SECTOR ORGANIZATION

The findings of the interviews with respect to organization plan elements can be summarized as follows:

- Policy Definition
  As far as can be determined, nothing in the way of company objectives has been developed as a part of an overall organization plan. This is perhaps the most crucial deficiency in the management function of the companies and is one of the reasons why the company executives find themselves embroiled in the day to day operations of the fleets.

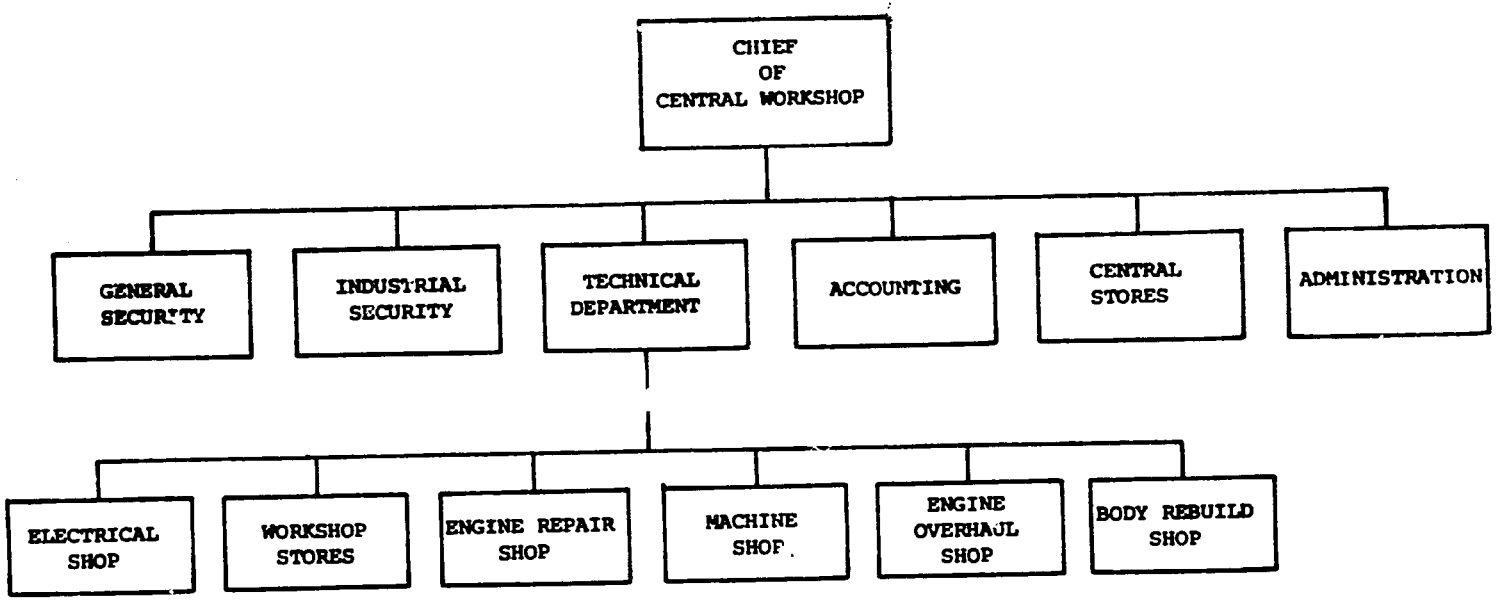
- Organization Description
  As a part of the Study, an organization chart was secured from each company. Although some organizational arrangements vary from company to company the structure of each is functional in nature.

  Figure 4.1 through 4.3 show typical structures for the engineering sector, central workshop and branch garage, respectively.

  As would be expected, in many instances the direct connections between subordinate and superior indicated on the charts do not reflect reality.

  There are two main reasons for this confusion over lines of authority. First, the major problems faced by managers of all levels in the engineering sector are of a technical nature relating to spare parts, equipment and material shortages. As such, the managers spend the bulk of their time dealing through the technical department. Second, virtually all the managers in the engineering sectors of the companies are engineers. The main focus of their education and experience is in technical areas with little, if any, formal training in managerial techniques. Used to "taking the bull by the horns" and lacking an appreciation for clearly defined policies and procedures, they approach their jobs, at all levels of management as if they were each personally responsible for supervising the work in the shops. This situation makes consideration of anything beyond the day-to-day operation of the company almost impossible.

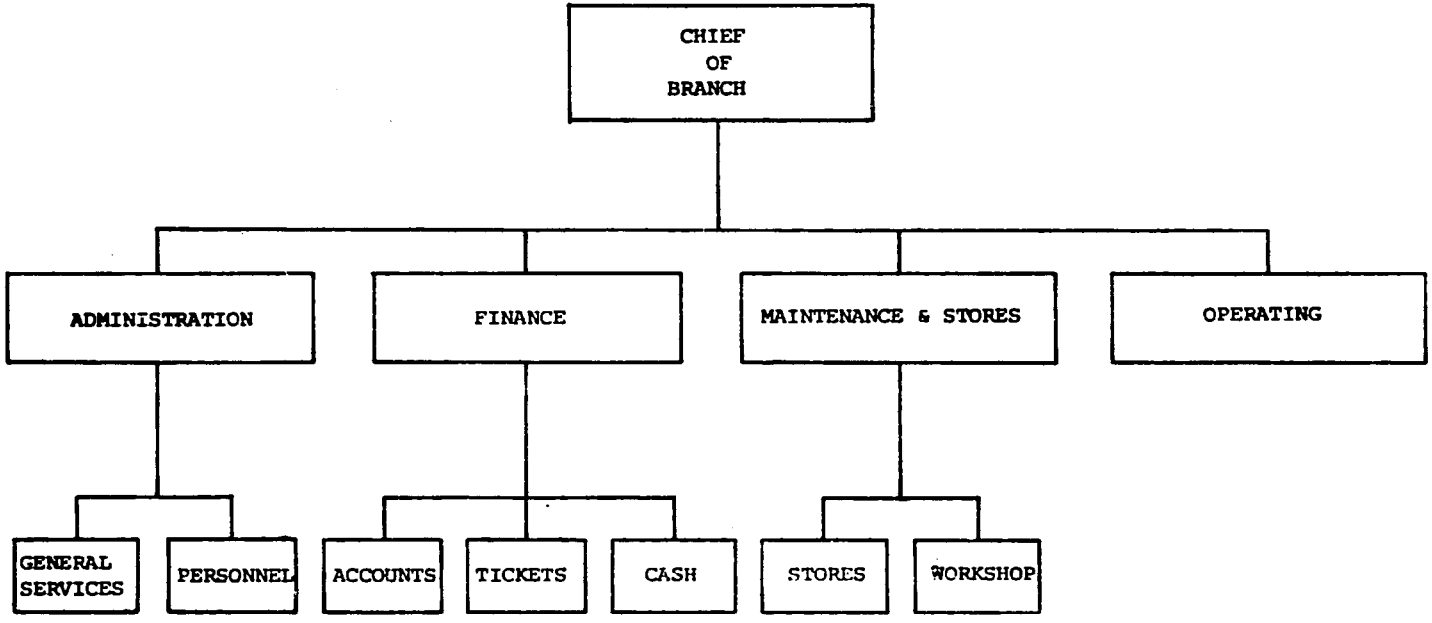
71



CENTRAL WORKSHOP ORGANIZATION

Figure 4.2

72



BRANCH ORGANIZATION

Figure 4.3

Figure 4.4 shows the various positions within the company hierarchy (here specifically for the engineering and equipment sector) along with the corresponding pay grade for each. This aspect of organization brings out another example of the "mystique of the engineer". Engr. Hasaballa, Manager of the Athar El Nabi Garage of CTA, claimed that there were individuals in the administrative section of his branch who had much more seniority and held a higher pay grades than he. But since they weren't engineers, they could never expect to advance to a branch management position. No matter how high they advanced in the salary scale, they would always be subordinate to an engineer.

- Position Descriptions
  Each company has developed a document that contains job descriptions for each position. Appendix VI shows the job descriptions for the positions that were selected for the interviews. As can be seen, no set format is followed in developing these descriptions neither among the companies nor within them. In some cases the descriptions don't even specify who the individual reports. Core functions and authority are the most clearly stated portion, although they are often vague. Specifications of lateral relationships and standards of performance are virtually non-existent.

A review of the responses to questions concerning position responsibilities shows that the manager's perception of his job often varies considerably from the position description. About the only instance where a manager's responses conformed exactly to the position description he merely referred to the position description and checked off the three that looked most important to him.

None of the public sector bus or truck companies studied in depth, establishes objectives as a part of an overall organization plan.

Each does develop a five-year plan but there appears to be no consideration given to the adequacy of the company organization for executing plans to achieve stated objectives. Certainly, there is no systematic participation in execution of the plan by managers at the various levels of the company.

The plans deal almost exclusively with revenue projections, new vehicle acquisition, equipment replacement and facility, maintenance and expansion. Little

74

LEVELS OF MANAGEMENT

POSITION	GRADE
Chairman	First Undersecretary
Sector Chief	Undersecretary
General Manager	General Manager
Manager	1st Grade
Chief of Division (workshop manager)	2nd Grade
Chief of Shop (engineer)	3rd Grade
Supervisor (shop foreman)	4th Grade
Technician (mechanic)	5th-6th Grades

Figure 4.4

or no attention is paid to such questions as rehabilitation and upgrading of the maintenance function.

The only managerial level at which any information about the five-year plan can be secured is at the sector level. No manager interviewed below the level of sector chief knew much about the five-year plan beyond the fact that there was one. These lower level managers have little or no responsibility for the execution of any portion of the plan. Execution is performed almost exclusively by the top managers of the company. This situation makes the execution haphazard at best. Consequently, objectives are almost invariably never reached.

Since there is no overall organization plan nor any attempt made to establish qualitative objectives, or standards, the maintenance facilities of the company are uneven. Some, such as Mansura Central Workshop of East Delta Company are quite good. Others, like the Giza Central Workshop of Upper Egypt Company, are horrendous.

Quality then, is a matter of the garage or workshop manager's personal discretion. Some, such as Engr. Mahrous of the Mansura facility are highly self-motivated and push themselves and their subordinates to perform remarkable feats of improvisation in order to overcome the lack of direction and support from the company. Many are far less motivated or downright discouraged and pretty much pursue their jobs as a day-to-day reaction to ever mounting crises.

In all cases though, the workshop and garage managers themselves seem to feel the current situation is entirely normal. They accept the fact that they alone are responsible for developing projects that aim to upgrade the quality of the facility. It seems they never have considered the idea that such projects could be a part of a company plan to improve conditions and establish uniform standards for all facilities. Such ideas stem from the almost total lack of knowledge of basic managerial techniques that exist at all levels in the companies. Since at present the companies offer little in the way of management training, such misconceptions are likely to persist.

To a very large degree, delegation of authority is not a characteristic of the management function of the public sector bus and truck companies. This was especially apparent in the interviews with the engineering and equipment sector chiefs.

Complaints of incompetence among subordinates are made by sector chiefs They claim that their subordinates are incapable of making even minor decisions without first consulting them. Consequently, a large portion of their day is taken up with trivial details.

76

The problem, of course, goes much deeper than incompetence among the subordinate managers in the technical sector. First of all, position duties and responsibilities are not clearly spelled out and consequently, the subordinate managers are unsure of the scope of their positions. Second, the sector chiefs themselves do not have a clear idea of what the function of an executive should be. Time and again when they were asked to name their major responsibilities, they responded with things like: finding solutions to branch technical problems or drawing up maintenance and repair plans for the workshops. With executive officers spending the bulk of their time working on details which are more properly within the scope of duties of workshop or branch management, it is no wonder that their days are long and chaotic and that they have no time to consider the future direction of the company.

This situation is another example of the chronic lack of managerial skill within the public sector bus and truck companies. These men are engineers and their expertise lies in technical areas. Having no firm understanding of management principles nor access to training in these principles, they perceive their jobs as largely technical in nature. They are engineers first and managers second.

Control is an element of management closely related to delegation. It is a form of impersonal supervision, designed to inform the manager promptly whether or not events are conforming to plans. An important component of control is the establishment of procedures to deal with problems or contingencies that happen on a recurring basis.

At all levels of management in the engineering and equipment sectors of the companies, three problems continuously cropped up.

- Shortages of spare parts, equipment and materials
- Shortage of skilled mechanics
- Bus and truck breakdowns while in service

When asked if any set procedures had been developed to cope with these problems, the response was negative. It seems that each new crisis is handled as if it was happening for the first time.

The spare parts shortage and the shortage of skilled mechanics is largely due to factors beyond the control of the company managers. All public sector bus and truck companies must follow the cumbersome tender process when restocking parts and materials or reordering equipment. Also, wage and incentive policies set by the government discourage attempts to train mechanics to an adequate level of competence. A skilled mechanic can make far more in the private sector and would leave the public sector at the first opportunity.

77

Still, some procedures could be developed at least to reduce the impact of these problems. As noted earlier in this report, a better system for inventorying spare parts on hand at the various stores facilities could be implemented to allow for quicker and more accurate determination of what is on hand within each company.

The present alphabetic system used by some of the companies permits the stocking of the same part in different locations depending on what the stock clerk chooses to call it. With a more efficient inventory system in place, procedures could be developed for quickly determining if a particular part in short supply is on hand somewhere within the company.

At present though, clearly defined procedures delegated to appropriate managers do not exist in the companies and here again, unevenness characterizes the response of the various companies to the problems. The more imaginative managers find ways to get around them. Others can barely cope.

Motivation exists in an organization when individuals are permitted a high degree of opportunity to move ahead, expanding their responsibility commensurate with the rate of expansion of their ability to accept responsibility. Promotion by merit is the key component of motivation.

During the interviews, the managers were asked if in the event of promotion or transfer, they could recommend one of their subordinates as a replacement. The answer varied considerably and in some cases the interviewee looked positively baffled by the question. There were three common responses:

(1) No, they are not experienced or competent enough.
(2) Yes, but I'd only make a recommendation if requested by the Board.
(3) Yes, but all promotion decisions are handled by the Board.

Admittedly, some of the managers may not have been entirely candid. Many were reluctant to say anything that might jeopardize their position and in this case, they weren't going to highlight the qualities of a possible rival.

When asked about their future prospects with the company, most of the managers could give nothing specific in terms of anticipated promotions.

78

The responses to questions concerning promotion opportunities within the companies point up two factors that work against motivation. One is unclear lines of promotion. Very few managers had any notion of the promotional opportunities available to them at their particular level in the organization. Indeed some of the lower echelon managers seemed resigned to the idea that they had gone as far as they could go in the company. This first factor stems from the second: that promotions are not chiefly by merit nor along clearly recognizable promotional lines since all managers are appointed by the company Boards. This being the case, it is more common to see a senior manager whose previous position was with another company or in another area rather than one who came up "through the ranks".

Considering the question of motivation within the companies also brings out another aspect of the mystical faith in engineers. If a competent administrator and manager (who is not an engineer) and an engineer are both potential candidates for a position, the engineer will invariabley be picked. In some cases, engineers supervise non-engineers who are several pay grades above them.

Motivation can also stem from undesirable consequences that could result from failure to perform duties and responsibilities adequately. The ultimate consequence, of course, is dismissal. This aspect of motivation in the public sector bus and truck companies is non-existant. No standards of performance nor system of review exists in any of them. Therefore, it is extremely difficult to establish accountability or to evaluate management performance. Further, dismissal for incompetence or even outright dishonesty is so uncommon that it is removed as a consideration in a manager's performance of his duties. All dismissals must be handled by the Board in conjunction with the General Syndicate of Transport Workers. (All employees, managers as well as workers,are members of the Union) The process is so cumbersome and time consuming that it is rarely used.

Neither positive nor negative motivaton exists to any great degree in the companies. This being the case, the motivation to be a competent and effective manager must be from within. Such self-motivation is evident in the attitude of some of the managers. Most though are like the majority of people everywhere, they need to feel that rewards will follow positive results and that the "game is fair". Otherwise they approach their work with the attitude of doing the bare minimum necessary to get by.

As a final subject of management, the topic of communication was analyzed. Effective communication in a business organization is a two way flow: downward from top management to middle management to employees and upward from employees to middle management to top management. In addition, there should be a capability for lateral communication: line to line, staff to staff or line to staff. Communication upward, downward and laterally should be clear and unambiguous and the system should provide a feedback capability so the person or group sending the communication knows that the information is understood.

The most serious deficiency found in downward communication is the almost total lack of dissemination of company goals and objectives to the middle managers. To the extent that goals and objectives are drawn up at the sector level, they remain there and are not communicated to the subordinate managers within the sector.

The engineering and equipment sector chiefs all claim to hold regular meetings with their middle managers. The middle managers in turn claim to hold meetings with the workshop and branch managers. As best as could be determined, these meetings are in fact held fairly regularly.

When asked what was discussed at these meetings the managers almost invariably responded that technical problems were the main topic. (Spare parts, materials, and equipment shortages). Since objectives and goals are not established for the various levels of management they are not discussed. The meetings are primarily "brainstorming" sessions.

Several exposures to the office environment of the public sector bus and truck companies are enough to demonstrate that orderly upward communication is seriously lacking. Subordinates just walk in unannounced and the managers are constantly harassed by telephone calls. At times, offices are literally full of people with questions for the manager. Several of the managers interviewed tried to control the flow during the session but only one was successful. Gate keeping, it appears, is pretty much unpracticed.

The weekly and monthly meetings mentioned above also provide the opportunity for upward communication to the higher levels of management. This, in fact, seems to be their primary function since the topics of discussion usually concern shortages at the workshops.

Finally with respect to lateral communication, the only point where there is a significant degree of lateral communication is during the meetings of the Board. The sector chiefs are all present at these meetings and can exchange information to the extent they deem necessary. In the middle management levels, though, lateral communication among the functional sectors takes place hardly at all. One example uncovered during the interviews

was the case of emergency reorders of parts. Technical affairs general managers and workshop chiefs must deal directly through the financial sector to obtain funds. By and large, the sectors seem to exist as almost entirely separate entities with liaison carried on only at the top.

81

5.0 THE DETAILED SURVEY AND COMPANY SUMMARIES

The results of the General Survey indicated that it would be desirable to examine a few facilities in greater detail for several reasons. First, to characterize the best and worst aspects of a variety of facilities based on ownership, type of service offered, type, make and quantity of vehicle handled, and a preliminary assessment of relative efficiency. Second, to develop standards and measures of effectiveness for comparing company, region and branch performance. Last, to define solutions to observed problems that can be generalized for use in a greater number of prevailing situations.

5.1 Implications derived from the Detailed Survey

Nine facilities were selected for more intensive study in order to try to establish measures of performance, and for exemplary facilities, standards of performance suitable for use in evaluating the performance of other units.

Five of the nine facilities were operated by CTA and were selected on the basis of indexes relating theoretical and actual Bus-Days/month and kilometers with recorded breakdowns/month. The facilities were also grouped according to fleet mix and function. The net result was the selection of the following:

- Two groups of the Mercedes type. Even the worst of these was better than the best of the other types. The garages selected were:
  - El Mounib : the very best facility overall in the system
  - Ather El Nabi : the worst garage for the type

  The premise was that the comparison of the two would facilitate identification of substantive factors contributing to performance differences.

- Nasr garage/workshop as an example of a complex facility from the viewpoint of fleet mix and function. It was premised that differences attributable to these two factors might be revealed by comparison with Ather El Nabi. As a point of interest all mixed fleet operations had substantially poorer performance indexes than single vehicle facilities employing Mercedes or Nasr buses.

- Port Said garage is an example of a Ward bus facility, even if with only limited operational history.

82

A fifth garage was added at the request of the Chairman; Imbaba. It was his opinion that the facility was superior to El Munib even though the selected measures indicated otherwise.

The data base used for developing CTA indexes is included as item A of Appendix VII.

The remaining garages were selected from among the numerous facilities of the General Nile Companies. Shubra was selected from Middle Delta Bus Co., Mansura from East Delta; Giza from Upper Egypt and finally Ameriya from the Transport Company. Emphasis on the Bus Companies is merely indicative of their more pressing need for help.

Extensive information was extracted from the records of CTA greatly facilitating the analysis of their operations. The results of these studies are provided in the following sections.

Unfortunately, comparable information was not developed by the Greater Nile Companies until too late to be incorporated in this phase of study. The raw data is provided as item B of Appendix VII.

5.1.1 Analysis of CTA Facility Operations

In order to analyze the performance of CTA in general and those of the facilities selected for detailed review, it was necessary to retrieve historical operational data. It is interesting to note that in spite of voluminous record keeping, this was a virtual impossibility without a special effort by someone intimately familiar with the files. No such information had been collected, analyzed, or reviewed in the recent history of the operations at any level. A second purpose for this exercise thus became evident. It was to demonstrate the value of performance information for management decision-making, and to point out the nature of management decisions required if vehicle maintenance operations were to be significantly improved.

Decisions that became evident at the level of the Chairman or Regional Director included (1) to shut down an entire facility and redistribute its work and people; (2) to reallocate buses between facilities to better equalize vehicle usage and provide the operational flexibility of standby buses; (3) to develop and employ quality audit teams to randomly check the quality of the maintenance effort at company facilities; (4) to develop task forces for the purpose of investigating

83

systemwide problems recognized through performance standards reported by each facility, (5) to develop procurement policy with respect to vehicle make based on shop and vehicle performance.

As a case in point Item B of Appendix VII presents a series of data concerning engine breakdowns with respect to operating garage and source of overhauled engines. An examination of engine breakdowns during calendar year 1978 reveals that some garages are consistently worse than others in this regard, and that some experience periods during which breakdowns are excessive. Between January and April, Gisr-El-Suez and Mezalat were having terrible problems and relatively speaking, so was Ather El Nabi of the Mercedes group. Between May and August, Nasr became worse than usual - as a matter of fact, it was by far the worst shop in the system. It also is the site for CTA General Management. The same characteristics continue during the last four months of the year. Would it not have been beneficial to launch an investigation into this situation when it became apparent through the display of appropriate performance information?

The investigation when carried further reveals:

(1) That there is a distinct difference between garages as far as failure rates for a particular engine type that has been overhauled in the set of facilities.

- The average life of Pegaso engines in the Ameriya garage is 30,000 km while that in Mezalat is only 19,000 km.

- A major difference between performance may be attributable to the source of supply of the reworked engines, in particular, the product of the North Unit Workshop in comparison with the East Unit Workshop. (15,660 vs. 30,880).

Would it not have been wise to shut down the North Unit engine overhaul facility in order to determine the trouble?

Finally on this same subject, if one were to compare the performance of the overhauled Pegaso engines (whatever the source) since 1978 with that of the Mercedes overhauled in the South Unit Shop, one would find a startling difference in performance - e.g. an

average life of [illegible] km vs 10,000 to 30,000 [illegible]. The shape of the failure curves are even more significant. The Pegaso curves indicate engines failing during the early break-in-period (period of infant mortality) while the Mercedes failures are more indicative of random events.

[illegible] to develop the argument for performance standards detailed information was prepared for the group of three Mercedes garages for the period June 77 thru May 79. This information included the following:

(1) Monthly breakdowns by component

(2) Mechanical efficiency as measured by:

- Scheduled vs.actual buses in service
- Scheduled vs.actual operating hours
- Scheduled vs.actual running kilometers
- Total down time

(3) Passengers carried and income

(4) Technical condition of buses monthly by category (in service, in maintenance, in workshop, in garage, awaiting repair, awaiting scrap)

(5) Worker absences (Drivers, Collectors,Technicians)

(6) Rate of engine failure (frequency by km).

Most of the breakdown data was plotted in order to observe trends, variability, and population norms.

It became apparent, when co-plotting the data of the three Mercedes facilities that there were significant differences between Athar-El-Nabi and the other two. It was also noted that Muneib was significantly better than Imbaba. A brief search for cause was conducted to illustrate the investigatory process. The search extended into the basic data for each garage in order to explain trends and population shifts. The details are provided in Appendix VII. Item C but the results are briefly summarized as follows:

- With all other things being equal, in order to explain the fundamental differences between the three Mercedes facilities, it was determined that a major contributing factor was the qualifications of shop management personnel;

85

- each garage had approximately the same number of mechanics per bus
- but the distribution among foremen, work leaders and highly or very skilled workers in Muneib far exceeded that in Ather-El-Nabi and Imbaba
  52 vs 25 or 23
- considering only management personnel (foremen, leadmen, and high skilled)
  Muneib had 22
  Imbaba had 14, and
  Ather-El-Nabi had 7

Therein lie the differences!

It is estimated that about 16 people in these categories (3, 6 and 7) are required to properly staff a garage.

- The variability and trends in breakdowns are not so easily explained. It does appear however that some may be vulnerable to material problems e.g.,tires, clutches, and brakes. This might also be attributed to equipment or process failure. The reasons were not researched because the point to be made is that the observation of these data should and can cue remedial action by an alerted management.

- Finally, there is evidence that a change in management at Athar-El-Nabi may have had an initially salutary effect on the facility's performance in mid 1978, although trends in same problem areas are ominous.

5.1.2 Implications derived from GNC Detailed Survey

As was noted earlier, the bus workshop in Mansoura, belonging to the East Delta Company, was one of the facilities studied in greater detail. The following is a summary of information gathered and a discussion of implications for the future course of bus maintenance in Egypt.

The Mansura workshop began operations in April, 1978. Its site area is about 7740 square meters, of which area approximately two-thirds is covered by buildings or canopies. The impression given by inspection of the shops and talks with the manager and shop engineers is that this is a well-managed and efficient workshop. Generally they have the equipment needed to do their job.

However, there are still problems. The workshop manager indicated that his main problems are:

- Shortage of spare parts
- Shortage of handling equipment for heavy items
- Shortage of skilled mechanics

Despite these problems they are able to overhaul 25 engines per month.

The question then is, why is this workshop cleaner and better than others of equal age? Our conclusion is that it is because of the higher quality of management and engineering supervision. On his own initiative the manager planned and executed a reorganization of the workshop which increased its output. Also, each shop within the facility has an engineer and foreman supervising the work. We were told that the engineers take a very active role in quality control. For example, the dimensions of a crankshaft from a disassembled engine are measured by an engineer and a written work order is made directing what is to be done. Before the crankshaft leaves the machine shop where it is reground, the engineer there checks the dimensions. Then, when it is delivered to the engine assembly shop it is again checked by that shop engineer before being installed in a rebuilt engine. If this care extends to all of their rebuild work it should result in a superior job.

There are two factors that prevent this workshop from being more efficient. One is the lack of up-to-date testing equipment; for example, their one old dynamometer needs repairs. The other factor is that they rebuild six different types of engines, due to the Egyptian policy of buying buses from various countries. For this type of company they should have to work on only two engine types, one, for short haul buses and the other for those making long express trips. This would ease their spare parts problem and enable their mechanics to concentrate their skills.

Our conclusion is that an analysis of the Mansura workshops reconfirms the results reached from the CTA reveiw regarding the way to improve the standard of bus maintenance facilities in Egypt. The higher management should centralize its unit rebuild work and staff these facilities with the best managers and engineers they have. They should also equip these workshops with good testing equipment and make sure that trained workers use this equipment on all rebuild units before the buses are put back in service.

5.2 Company Oriented Summaries

The previous part of this section has been devoted to a functional summary of the results of the Detailed Survey. In this section a slightly different perspective is offered, one in which, where possible, the company is examined as an entity considering its functional characteristics as a whole.

5.2.1 The General Nile Company for East Delta

This company is the largest of the four "country bus" operators in the public sector. It owns nearly 1,000 buses (operating about 80% of them at any one time) and covers a territory extending from Cairo to El Arish and from Damietta to Suez. The company maintains a wide assortment of buses, operating an enormous number of routes (intercity and Intracity). Due to its size and relative importance, the team spent considerable time and effort in gathering and analyzing data on this company.

East Delta buses comprise seven different fleets, are of various manufacture, and were purchased at various times over the past 19 years. Analysis shows that their buses average 6.01 years of age--a figure much lower than might have been the case, because of the large infusion of Wards, 410 vehicles, in 1977 and 1978, with a concurrent phasing out of the older vehicles. The age weighted by annual kilometers operated is 5.16 years, somewhat more than the 4-year average age that would result from the stated policy of retiring buses after eight years of service. These buses are maintained and stored at two central workshop facilities (Cairo and Mansura) and 13 garages--almost all of which also do unit overhaul work.

Eight operational facilities were visited in addition to the general offices and the yet-to-be completed central workshop and stores facility. The overall impression is one of unevenness; an attribute common to all companies studies. The unevenness extends to all facets of the operations--facilities from the worst (Damietta) to one of the best (El Mansura); vehicles from perfunctory maintenance, service and cleaning to fairly good; personnel from poorly trained, unmotivated individuals to well-disciplined, reasonably well-trained teams; housekeeping from slovenly to so-so. In effect, East Delta typifies public transport in Egypt.

The facilities visited included the Cairo Central Workshop and Central Stores and El Kanal Garage in Ameriya, Cairo. The Cairo Central Workshop and Central Stores is the major center for unit rebuild and vehicle body and chassis overhaul for the company -- but is hopelessly overcrowded and obsolescent. It will be replaced next year by a new facility in Nasr City. The El Kanal garage, adjacent to the central workshop, is equally inadequate, and is likewise scheduled to be replaced by the Nasr facility.

The Benha facility is a small garage, but very strategically located in the East Delta scheme of operations. 84 buses, representing 5 different manufacturers, are based here. While nominally only an operating garage, a small unit rebuild operation is done here, but without proper equipment and testing devices. The garage itself, while clean and orderly, is poorly laid out making any kind of service line flow impractical.

The Mansura facility is a combination central workshop and operating garage, serving the northwestern sector of East Delta's operation. Here, 144 buses of 5 makes are serviced, repaired, maintained, stored and operated; of which 125 are in service daily. This facility is only 2½ years old, and has good potential, although the basic layout is, again, poor. The central workshop at Mansura is reasonably well-equipped with tools and machinery, but testing devices are notable by their absence or disrepair.

The new central repair facility site in Nasr City has been under construction since 1971. At present, construction has been delayed until culpability for a collapsed roof that occurred during construction is determined. Only the central workshop facility, planned to replace the one presently at Ameriya has been constructed and this is practically complete. The operating garage, slated to replace El Kanal, has not been started. Neither has the training center.

The workshop buildings are far too mammoth, too poorly designed, and too unsuitable to their task to ever be efficiently usable by East Delta in their planned role. If and when completed, this facility should be assigned some other role more in keeping with its dimensions, such as replacing the outmoded facility now occupied by GNC for Automotive Repair.

The Zagazig facility proved to be one of the better operating garages visited but unfortunately, was too small and on the surface, unexpandable to properly undertake its dual operating garage/unit rebuild role.

The Ismailia Garage is totally devoid of any positive aspects--incredibly filthy, cramped, and poorly equipped. Even so, it was attempting to rebuild units in addition to performing its garage activities. Plans are presently under way to replace this facility at a 2.5 Ha. site outside the city proper, in what is now a desert area.

Port Said facility combines unit rebuild with operating garage. It is much cleaner and better laid out than the Ismailia facility, but damage to one of the buildings inflicted in the 1967 war has left it partially unserviceable and has caused overcrowding to occur in the serviceable areas.

Finally, Damietta was visited and this is probably the worst example of an operating garage visited during the entire study--a genuine pit. A new garage and workshop are presently under construction, but were not visited.

An analysis was made of the responses given by East Delta to the general survey questionnaire, comparing them wherever possible, with visit observations and, as with other companies, there was a sizable difference between the answers to the questions and reality. The driver is supposed to make a rather thorough before, during, and after operation check. To the best of the team's knowledge, little, if anything, is done on a daily basis by the mechanic unless specifically requested by the driver. Each driver is assigned a regular bus, and it devolves on him to keep it running between periodic inspections which come at intervals of 4,000 km (3,000 km for air-cooled Magirus-Deutz engine in the Nasr buses). The driver also usually fuels his own vehicle, and tops off the various fluids. The seeming lack of direct daily inspection by the mechanical department will be commented upon at more length shortly.

The listing of periodic maintenance performed is reasonably complete in that it covers the various parts of a bus that need periodic attention. It also reflects the thinking of management as to what should be done. Unfortunately the observed condition of the buses belies the intent. Many of the "required" replacements obviously are not done.

It might also be notice that nowhere in the litany of checks, adjustments, repairs and replacements is there a required unit exchange, which is the basis for preventive maintenance.

According to East Delta, unit repair and rebuild are accomplished at all 13 branches as well as in the two central workshops. The chief distinction of the

90

central workshops is that they do complete body and chassis renewal as well. This spreading of the unit rebuild function has been noted previously - and is common to most of the companies.

Although East Delta provided information concerning overall mechanical efficiency, comparable information could not be acquired from other companies, therefore there is no method for comparing one Egyptian system with another. The following table quantifies some of the more common maintenance efficiency standards not monetarily related, along with the generally accepted U.S. norms, which should be used for reference purpose only.

MAINTENANCE EFFICIENCY MEASURES

Measure & Significance	US Standard	East Delta
Technical & service manhours per thousand km operated (measure of effectiveness of manpower, given positive results in other areas)	10-13	66
Fuel consumption in km/liter (US standard based on same average speed attained by East Delta with similarly sized equipment)	3.5	2.90
Oil consumption in km/liter (US standard is minimum acceptable level before engine overhaul of any single bus.	180	163 (average all fleets)
Distance operated between engine overhauls-diesel engine in thousands of kilometers	400-800	100

There seem to be some discrepancies in the area of logistics based on the answers given to the questionnaire. These were probably caused by the viewpoint of the answerer. For example, in the logistics section of the questionnaire, East Delta was asked what percent of parts have been on order but not received 10 days or less; 10-30 days; 30-90 days; 90 days or more. The answer? 100% 10 days or less, denoting that there was no problem in parts supply.

In the maintenance section however, another question was asked concerning the amount of vehicle downtime. This was answered as follows:

"It is difficult to indicate the average length of downtime for these reasons:

91

The spare parts are not available (This is the main reason)".

It is known through visits to the garages and talks with the officials that there is a very definite and all-pervading shortage of parts--parts for all types of buses, and in all categories of parts. In East Delta, as throughout all companies, the approach to maintenance is - replace if possible, repair if not, or if impossible, remanufacture or do without.

Another major problem noticeable both from questionnaire answers and from observation is the lack of proper tools. Not the lack of tools in total but proper tools. There are enough lathes, crankshaft grinders, milling machines, brake lathes, and metal shears to take care of the entire country but there are many more lacks. For example, there is not one combination brake lathe/lining cutter, a necessity in any American bus garage. At no East Delta shop was there any evidence of use of micrometers or torque wrenches in the engine rebuild shops or in the machine shops. Hand tools are also conspicuous by their absence. Bodywork is a process of hammering out - tools such as Porta-powers simply do not exist.

Logistics play a large part in the status of the equipment at East Delta - both in the large proportion of imports and the inability to trace or locate parts in storerooms. Although "operations" were beyond the scope of this study there are certain operational characteristics that influence the maintenance picture. Passenger loads, route structures, operational days per bus, kilometers per bus are all very demanding. Thus the maintenance program which already suffers from equipment, facility and personnel inadequacies, has in addition the burden of unusual demands.

According to East Delta's officials, an increase in the level of skills among their employees is a major priority item. A total of 900 employees on all levels are proposed to be retrained over the next five years. Most of this, it is assumed, would take place in the proposed Nasr City site, on which construction has not yet started. It is possible that some training could be done at the Ministry of Transport training center, some by various experts in East Delta offices, and even more through on-the-job training. A major lack, clearly, is qualified instructors on all levels. education and training must start at the very highest level--the root structure of the organization must be altered in order for the company to become truly viable and this change can only come from within, and can only be initiated at the highest levels.

92

The outstanding impression one receives in working with this company is one of sheer size; any company that operates almost 1000 vehicles and which employs almost 9000 persons is large by anyone's standards. With headquarters, two main workshop and thirteen garages spread over a large area of northeast Egypt (given the current state of telephonic communication) it is also rather an unwieldy organization. There appears to be no clear chain of command--there are overlapping responsibilities on headquarters region, and branch levels; and numerous ways--upwards, side wards, and downwards--to "pass the buck". In practically every operating garage that was visited, one saw evidence of this lack of organization and lack of trust in the organization. Authority is never delegated by the branch manager and technical director of the branch they must sign their own names to practically every scrap of paper passed, and there are reams of it. There are thirteen separate forms having to do with logistics alone some of them having as many as six or seven copies! Many of these forms are clearly superfluous - being merely rehashes of other forms thought necessary by a particular user. For example, the "After Delivery Inspection in Stores", a special form used on which the storekeeper makes a record of items received instead of just checking them off on the delivery manifest.

The next general impression one receives is one of "unevenness". Some garages are quite good and others are very poor.This may have something to do with the age and utility of the basic structure, but it would appear to be connected more with the personality of the individual branch manager and the way he wields his authority (autocratically in most cases).

There is, however, no denying that the garage structure--its suitability to its purpose, its design, its capacity, its amenities, its appearance, and its age--has much to do ith the character and quality of maintenance performed The relationship between filth and poor maintenance is quite striking.

Another rather vivid impression received was that of unevenness in the application of authority. Although autocratic authority was exhibited on all levels--Chairman, Division Head, Region Chief, Division Manager--there was a lack of assertiveness about substantial matters of policy. As an example, a strong impression was received that the upper echelons of the company realized trying to do unit overhaul in the garages is wasteful and counter-productive, but it is permitted because the branch managers want to do it in-house. Again, the chairman and his staff know that

93

their garages are unbelievably overstaffed and filthy; but for some reason they are unable to enforce a resolution of this servicing contradition, either by reducing the number of employees, shifting some to buildings and grounds maintenance activities or increasing production. (It seems incredible that any bus should ever leave a garage in less than perfect order with the number of people available to keep it that way!)

Another general area of concern lies in the almost total lack of testing facilities and procedures throughout the company. Although every garage visited rebuilt engines, not one had a working dynamometer. (Mansura Central Workshop had a dynamometer, which for some reason was not being used. Engines were being run in on the floor alongside of it). Not one electrical test bench (though most garages had them) was functional, all electrical unit testing was on a makeshift basis. Not one shop had a functioning Magnaflux unit for detecting small cracks and metal fatigue in critical parts. Not one garage had facilities for analyzing used engine oil for signs of excessive engine wear or other incipient problems. Not one shop maintained records on individual vehicles or fleets of vehicles that would enable the determination of the physical condition of the vehicle or fleet. In short, everything is done on the basis of guesses or on the failure of a piece of equipment. There is no real knowledge, no hard facts other than actual failures to show that a rebuilt unit will function properly or that a unit is nearing the end of its useful life.

This makes clear the next observation: There is no preventive maintenance done in any of the East Delta garages. Every unit change is on the basis of a failure, never is it changed before failure--the basis of preventive maintenance. The only lip service given to the concept is the periodic inspection, which is little more than servicing.

Finally taking maintenance in the overall sense of the word, the company, in total, does what can only be described as an unbelievable job of keeping buses running under near intolerable conditions.

One final observation. It would appear that the company overall cannot discipline itself to follow a given plan. It is obvious that whatever was in the official mind when the new Nasr City workshop was on the drawing boards does not pertain now. This facility is large enough to undertake all the unit rebuilds for all the transport companies and authorities in Egypt; and yet the existing plan for East Delta is to continue to do

unit rebuilds if not at each garage, at least on a regional basis, with four regions being the basis of present planning. Whether the existing plan has ever been thought through on physical facility, operating organizati ., and logistics bases is unknown, but it is doubtful.

To reiterate, East Delta is a large company: There are very few in the U.S. than can compare with it for size and area of coverage. It could become a bellwether for all the GNC companies if its manager ent could be re-educated, retrained, and redirected toward more common sense management e.g., learning to manage by "exception", learning to delegate responsibility and authority, learning to streamline their avenues of communication and control, learning to recognize the value of planning at every level, learning how to summarize and use the data that are collected to increase their capabilities as managers; in short learning to manage rather than to decree, and using management tools to generate usable information, not paper.

95

5.2.2 The General Nile Bus Company of Upper Egypt

The Upper Egypt Company is probably, overall, the public sector company with the worst maintenance facilities, the most expansive route structure because of its length and linearity, and the most difficult logistic requirements for the same reason. As with the other companies of the system, maintenance management information from any source (financial, logistics, operational) is virtually absent at the local level and not readily detectable at the level of central administration. As with the other companies, the life of about 50% of Upper Egypt's vehicle fleet exceeds 4 years (some exceed 10 years).

Visits were made to the facilities at Aswan, Kena (Qena), Assiut (Asyut), Mallawi, Al Minya, Beni Suef, El Fayum and El Giza (Cairo).

From a maintenance systems viewpoint, none of the facilities visited have any maintenance system per se. They generally change oil and filters (when they have filters) and lubricate at 3,000 to 4,000 kilometers. Periodic maintenance, except on newer buses, consists of the repairs required to keep the equipment on the road.

The El Giza Garage and Central Workshop, including engine rebuild facility is the worst in all of Egypt with the possible exception of Assiut which was also indescribably bad.

The El Giza facility is very old, very dirty, has no hard stand and is filled with junk. As a central repair facility it is more of a liability than an asset. The shop finds it difficult to hire and keep technicians or drivers, mostly because of the unbearable working conditions. The company desperately needs a new central repair facility. A number of alternatives are available for consideration.

It was learned, for example, that a site had been tentatively selected for a new facility about halfway from El Giza to El Fayum. It is only a sand waste in the desert where the company now stores old derelict buses. There is no water, no electricity and no buildings or habitation visible in any direction. The area may be in the vicinity of one of the new desert cities contemplated, if and when it ever materializes.

Another alternative is the El Minya Garage and Workshop which operates, services and maintains 88 buses of 5 different makes and models. There are no cleaning facilities for either buses or maintenance shops. The shop area is relatively new, built in 1977 with a large area of cement hard standing. An excellent area

lighting system has recently been replaced with huge football field-type flood lights. The shop is the poorest equipped of any in Upper Egypt, but with the best possibilities. The funds spent on the lighting system could well have been spent on tools and equipment. A fair job of lubrication is performed here, but the rest of the maintenance is very poor.

Further study should be made to determine if this facility should be improved and equipped as a central workshop (since it offers the best physical facility).

A final alternative is the facility which is the hub of the Upper Egypt facilities at Kena (Qena). This facility is near Luxor and at the junction of the east-west highway to the Red Sea.

The Kena Garage and Workshop operates, services, and maintains 50 buses of 6 different makes. This Garage is supported by the usual allied trades shops including a well-equipped machine shop and engine repair shop. This shop has definite possibilities for improvement and should be considered as a central repair facility for Upper Egypt.

The remaining facilities along the way to Aswan are marginal at best. The Mallawi Garage and Bus Station is a very small facility supporting only 25 buses of 5 different makes and models. The facility has no hard stand and only lubrication or very minor repairs can be accomplished at the site.

Beyond Mallawi is Assiut (Asyut), a busy college or university town. This facility, like that at El Giza is more of a liability than an asset.

There is a garage in Sohag, about halfway between Asyut and Kena; it is much the same as the facility at Mallawi, not much better than a sheep corral.

The Aswan Garage, which is the southern terminal of the Upper Egypt facilities, operates, services and maintains 59 buses of 6 different makes and models, dating from 1964 through 1977. The average number of buses in operation is 48.

The garage and supporting maintenance shops are 10 years old, poorly equipped and in need of the support of a central rebuild facility.

All the garages and workshops of Upper Egypt are in need of a central rebuild facility as well as a central spare parts supply system. None of them are capable of providing these services for themselves under their present condition and with their lack of tools, poor equipment, poor management and untrained technicians. Nor should they from the viewpoint of maintenance efficiency.

The Upper Egypt Company very badly needs redevelopment in every phase of its activity.

5.2.3 General Nile Company, Middle Delta

The Middle Delta Company serves three Governates between the branches of the Nile from the Mediterranean to Cairo. Their buses average 700,000 km/year and work an average of 300 days per year. The Company has 517 buses in its fleet with about 40% over 8 years old; some are over 15 years old.

As with all other bus companies in the public sector, they have problems obtaining spare parts and need shop tools and equipment. The Chairman acknowledges the need for training in all phases of operations management and especially advice on how to bridge the gap between mechanics and upper level suppervisors. He also noted the severe shortage of shop foremen. He commented on the fact that most capable men are in great demand abroad at much higher salaries than are available in Egypt.

A number of facilities were visited during the course of study including the following, but there is nothing new or startling to report.

- Shubra Garage and Workshop visited during the general survey and again for an in-depth study. A classic facility with all of the poor layout, inadequate equipment, disorganization and cleanliness problems of a typical public sector Egyptian maintenance facility.

- Mahalla Garage and Workshop. A somewhat cleaner facility that services 6 different makes of buses and that tries to make more repair and rebuilding than the facilities can handle.

- Tanta Central Rebuild Facility (under construction) is a huge facility capable of being developed as a major central rebuild and overhaul facility or alternatively, as a new bus manufacturing facility.

In summary, from the perspective of this company as with the other companies, there is an occasional facility which, from the viewpoint of appearance and operations, indicates that something better than the norm can be achieved. Through all, however, there are certain common undercurrents that drag the systems down. In the technical area its shortages of parts; in the personnel area its shortage of trained management personnel; in the facilities area its poor layout and design. It is these factors that require the concentrated effort of government in the form of assistance programs.

98

5.3 Recommendations for Specific Companies

This section of the report presents some intermediate recommendations suitable for consideration by the companies as part of an overall strategy for improvement. Most are directed to East Delta because they are a belweather and provided a sufficient data base for more detailed analysis.

Their frankness and the openness of their top management permitted the team to gain a perspective not otherwise attainable. On the basis of our discussions we suggest that the major thrust of maintenance program improvement for each company should follow a two-step process.

- First, increase the efficiency of all shops to demonstrable in-house standard.
- Then raise the in-house standard in order to increase efficiency.

(1) In order to reach the same standard throughout, the bonus (incentive) system needs serious thought. Existing bonuses are given for the purpose of making wages paid by these public sector companies more competitive with those paid by the private sector, and with foreign employment. This is understandable, given that wages cannot be increased. But the basis on which the bonuses are awarded can be counter-productive. The major basis for award is that the buses stay on the road, operating a regular schedule without consideration of the overall condition and cleanliness of the bus, or what serious damage may be happening through continual operation in less than good condition.

Bonuses might better be based on such aspects (for drivers) as maintaining schedule (presently part of the drivers'bonus plan); not violating the company's rules; keeping the vehicles clean inside; and maintaining a certain safety record. Mechanics and shop workers could be awarded bonuses based on improvement: Improved oil consumption statistics on buses in their charge; improved road failure records; and once certain stated goals had been reached, maintenance of that level would be the basis for award.

(2) Plans for all future facilities (office, operational, mechanical, logistical) should be carefully thought out in advance so that they can and will do what is intended of them, efficiently and effectively. At present there is too much slavish following of old forms simply because "that is the way it has always been done"; too much of not thinking a process

through to see if it might not be done better a different way; too much of not adapting to new and improved technologies; too little use of common sense.

(3) East Delta is certainly large enough and wide-spread enough to permit separation of functions. It is obvious that unit rebuild can be done much more efficiently and effectively by trained personnel in properly equipped facilities. East Delta should begin now to prepare plans for the centralization of unit rebuild, and the redesign of each of the branches to use existing space to better advantage. (Almost all of the branches are hopelessly over-crowded and could do with internal re-organization). It is indeed a shame that the central rebuild facility has been constructed on the scale that it has, and that it has been constructed in Cairo (even more so, in Nasr City). The site is remote from most of the route system).

Cairo is far from being central to the region served by East Delta. In fact, a distance based accessibility model was constructed, weighted by the number of buses based at each of East Delta's facilities and this model proved that the most advantageous place (among present operating locations) for East Delta's central shop, was Zagazig. Cairo came in seventh in the survey.

This type of decision may require the selective closings of shops, the redistribution of vehicle fleets and the redistribution of shop equipment.

(4) Clean-up, paint-up, fix-up campaigns are a high priority. There should be all-pervading, starting with the executive offices and working down to the smallest, most remote garage. Not until this is done will any permanent benefit inure to the system. These campaigns would include the complete removal of all scrap and trash from yards, roofs, storage areas, rooms, wherever; and the periodic removal of this accumulation from then on.

(5) Then, in order to raise the standard, adoption of the exchange system of maintenance should be high on the list. This will require, of course, a sufficient supply of repaired units, and new systems to ensure proper collection and distribution of all units and parts. Individual garage storerooms should be stripped of all parts not needed for their basic role of running repair, periodic maintenance and servicing; the parts sent to the central storerooms to be stocked, if needed; offered to other companies if not, or failing that, be scrapped and removed from the premises.

(6) A re-education, re-training and re-orientation program is, of course, a requirement before anything else can reasonably be done; and should be commenced as soon as possible. It is not necessary that special classrooms be constructed for this. Most of it should be on-the-job; during and after hours.

(7) A reorganization of the entire management information area is in order. This would start with a re-thinking of the need for all forms, the elimination of those that are unnecessary, and the redesign of the rest, so as to impart maximum information with minimum effort on the part of both sender and recipient.

(8) The development of a new type of bus would seem to be imperative--a bus with a much stronger frame, more easily maintainable and exchangeable major and minor units, wider aisles, and better ingress and egress. This could well be handled as a design change to the Nasr bus if the company were willing to accept the challenge.

6.0 GENERAL CONCLUSIONS AND RECOMMENDATIONS

As a result of this Study, many serious problems with Public Sector Bus and Truck Vehicle Maintenance have become apparent. Solutions, however, are not quite so readily apparent. In this section the problems are identified first, followed by some general recommendations for improvements. Finally, specific recommendations are offered in the context of potential future actions by the sector or donor agencies.

6.1 A Punch List of Problems

In order to relate problems identified during the course of Study directly with the original subjects being investigated, a series of "punch" lists have been prepared. The items on a list are not necessarily independent or exclusive to one subject area, but are characteristic deficiences.

6.1.1 General Management Problems

- Problems with National Policy
  - Purchase policy predicated on lowest first cost instead of lowest life cycle cost
  - Freedom to buy anywhere instead of encouraging buy-domestic backed up by delivery guarantees
  - Parts procurement procedures far too cumbersome
  - Top managers away from posts far too frequently on non-productive training junkets
  - Inability to adequately discipline workers
- Problems with Company Policies and Practices
  - Managers poorly qualified; many technocrats few trained in management principles
  - Too few middle managers
  - Managers unable to convert theory to practice
  - Mismanagement apparent in many areas: poor purchasing policies; inadequate or inaccurate planning factors; lack of quality control; improperly maintained vehicles; inefficient use of personnel (do not even try to maximize productivity of labor, even in labor intensive jobs)
  - Lack of use of management information
  - Lack of use of even most simple forms of Management Science
  - Lack of use of even most simple management tools

- Problems with Organization
  - Span of control excessive at high levels
  - Too many levels of management at lower levels (sometimes 1 on 1)
  - Objectives unclear
  - Responsibilities unclear
  - Virtually no delegation of authority
  - Few decision makers
  - Lack of quality audit
  - Lack of operational audit
  - Lack of planning at operational levels
  - Lack of cost audit
- Problems with Personnel
  - Working conditions generally inadequate by western standards
  - Low pay scale causes large labor turnover
  - Lack of incentives for managers and lack of ability to discipline workers
  - Cultural habits: lack of respect for equipment, lack of cleanliness, lack of initiative, lack of interest, lack of discipline, lack of hope (?)

6.1.2 Physical Facilities

- Excessive numbers of rebuild and overhaul facilities
- Poor shop layout concepts
  - Inadequate maneuvering room
  - Management remoteness
  - Space over partitioned
- Over designed facilities (too massive, too long to build, too costly)
- Facilities indescribably filthy
- Inadequate lighting
- Inadequate drainage
- Access roads inadequate
- Poor locations of facilities
- No apparent plant engineering function

6.1.3 Equipment

- Lack of trouble shooting equipment and testing equipment: engine analyzers, engine dynamometers, brake testers, light alignment testers, etc.
- Lack of mechanized tools with built control features: compressed air torgue wrenches, automatic pressure guages, etc.
- Lack of powered lifting equipment: pneumatic, hydraulic, electric
- Lack of spare parts to keep anything but very basic equipment operating

6.1.4 Maintenance System Concepts

- Badly fractionated facilities, skills, supplies and equipment because of self-sufficiency motive
- Insufficient dependence on unit replacement concept
- Excessive record keeping, no analysis and inadequate inventory management tools (computers, reorder points, etc.)
- Vehicle life extended far beyond reasonable length
- Fleet compositon based on too many types severly compounding parts problem
- Parts policy shows little understanding of wear-out curve
- Re-use of used parts severly shortens life expectancy of repaired components
- Many parts purchases far exceed usage resulting in obsolescent inventories
- No field maintenance capability for on-the-road breakdowns (trouble squads)

6.1.5 Logistic Support System

- Primitive methods of inventory control and inventory management
- Inefficient procurement policies
- No unit costs assigned to parts records
- Some stockrooms totally disorganized
- Stocks badly fractionated among facilities with no efficient mechanism for parts locating and redistribution
- Many stockrooms crowded with obsolescent and scrap parts

6.1.6 Financial and Economic

- Maintenance budgeting primitive
  - Planning factors do not reflect experience
  - Some assumptions irrational
  - Allocation process appears arbitrary; no evidence of tie to operating statistics
- Accounting for costs primitive
  - No evidence of unit costs or other unit performance standards (labor or material)
  - No evidence of cost centers in rural bus or truck companies
  - No evidence of cost accounting
  - Costs for some supplies and materials can vary 30-80%
- Life cycle costs not used as a criterion for vehicle replacement
- Virtually no data at facility level

104

6.1.7 Training

- Very little evidence of OJT or formal training at management level
- Lack of coordination in or between sectors for facilities or programs (MOT, CTA, MOI, MOE)
- Present facilities not utilized to capacity
- Planned facilities vastly over designed for function
- Excessive use of out-of-country training for new vehicles

It is basically this punch list that is elaborated on and addressed in the following pages of this section.

6.2 Basic Transport policy

First considering the nature of transport organizations from a policy viewpoint, the common denominator of the public sector transportation organizations is that all are wholly-owned government entities. The three kinds of organization, however, have differing missions and characteristics. A grave problem that has been observed in this study is the lack of a clear purpose, and often the creation of regulations that conflict with the declared financial nature of the organization.

6.2.1 Urban Passenger Service

In urban transport, there has been a determination that this type of service will not be self-financing, and that the transport will be provided at below the cost of producing it. Fares have been controlled for long periods and allowed to marginally increase only as a function of the progressive unification of the fare system. In the past year, there has been a move to control the apparently uncontrollable cost of the CTA by decentralizing operations.

For the urban service, what is required is a central decision on whether transport can be self-supporting. Costs should be controlled as closely as possible and the decision as how to charge for these costs should be made. Creating new companies in order to increase fares sidesteps the issue and is not a solution.

105

6.2.2 Intercity Passenger Service

The intercity bus companies are currently in a quandary. They provide a public service, but are companies and not to be subsidized for operations. In the context of their regulations, however, they are unable to effect their revenues and to a great extent costs are not variable. With the exception of small adjustments such as a 10% increase in 1973 to cover higher defense taxes and another 10% in 1976 for LUX bus service only, the basic structure of the fares has been unaltered since 1964, the date of the creation of the current configuration of bus companies.

On the cost side, the entire sector has been subject to price escalation of all inputs beyond the control of any organization. In the Egyptian system, even such usually variable costs as wages are not in practice determined by the employers. Employees are not dismissed except for very grave reasons, and most senior company officials could only recall one or two cases of such an event. The government regulates the wage scale, decrees bonuses on holidays and each year a new step in the salary scale is allowed on the basis of seniority. The rapid escalation of costs is evident from company accounts. Costs in the intercity companies has been increasing at the rate of 33% per year over 1977-1978.

If revenue is fixed and costs cannot be adjusted, how is a profit possible? This question must be asked. Since most companies have recorded profits, one must question the cost and revenue accounts. A bus company official indicated that the tools at his disposal for the improvement of the financial situation included reduction of overtime, restriction of bonuses, delay of purchases and the dispatch of LUX or Deluxe buses to serve ordinary bus routes. The net effect of these measures would seem so minor, and the resistance of workers and riders so likely that they cannot prove adequate. It is a testament to the true nature of these organizations that they must resort to such inventive actions in order to improve their profit and loss figures.

From the government the companies secure assistance in the acquistion of new vehicles. The Ministry of Finance puts up some of the initial price of the buses, calling it an "addition to capital". Accounts show grants ranging from 25,000 to 50,000 LE with some as large as 1.4 million LE The extent of this subsidy, however, does not appear to be very large, and it is not utilized to make up operational losses. When measured against the array of taxes and fees paid by the companies to the public treasury, the assistance for the purchase of vehicles is further reduced.

The existing system in which the companies operate gives the impression of a patchwork that has evolved over the past twenty years, without any coordinated plan, into a complex array of regulation and practice combining to have an unintended negative effect on inter-city service. As is the case with urban transport, a fundamental decision has to be made--is transportation a subsidized public service or a self-supporting activity? If a commercial activity, the companies should be able to charge according to costs, providing a system is established to determine these costs. If it is to be a public service, the government should openly subsidize the companies on a per passenger kilometer basis, provided the costs of providing that service are known. The current situation is unsatisfactory from any viewpoint, the organizations are never sure of their mission and the management expends hours on the creation of profit in extremely difficult circumstances.

6.2.3 Truck Companies

The public truck companies are capably negotiating increases in freight rates in line with increasing operating costs. The restrictions on price increases apparently does not apply to cargo transport. Actual revenue figures for one company showed an increase in ton kilometer revenue from 1978-1979 of 8%. Despite this greater freedom the truck companies do not appear to be very robust financially. Furthermore, they are incapable of purchasing their vehicles from their own resources.

There is no reason why truck companies cannot be independent financially while being government-owned. This is the preferred alternative for heaping subsidies to a minimum. Furthermore it is obvious that much more can be done to reduce overlap in service areas and interchange of cargo from company to company. The rationale for the present structure of five companies and the division of labor between the organizations is the product of decisions made a decade ago. Alternatives to the present system, including the centralization of the companies and garages under one organization, or the use of private trucks to haul public sector cargo must be considered. Given the employment practices and financial situation prevailing in the public sector, this may well be the least cost alternative.

6.3 Management Policy, Procedures and Organization

As publicly held enterprises, the public sector bus and truck companies must operate under government mandated directives and constraints that render them much less flexible than companies in the private sector. In general, the companies must:

- participate in government efforts for full employment
- provide transportation services to the poor (primarily through very low fixed fares) follow set procedures for ordering new equipment, materials and spare parts
- make a profit

Given the conflicting nature of these directives and constraints, even a highly skilled team of managers would find it impossible to satisfy them all. And as the management survey indicated, managerial skill is in short supply in the companies.

Still it would be short-sighted to conclude that the public sector bus and truck companies could not benefit from the use of sound managerial techniques. Certainly no one can argue that the companies are at present employing their limited resources to the best possible advantage.

Two major tasks must be undertaken:

(1) Development of an organization plan for each company.
(2) Training of company management in basic managerial techniques.

6.3.1 Development of an Organization Plan

A program for developing an organization plan can be broken down into six basic steps.

(1) Establish the company objectives both long and short-term--lack of clear objectives is one of the critical shortcomings of managment of the public sector bus and truck companies.

(2) Establish the critical success factors that affect the attainment of those objectives: Each objective should be evaluated in terms of what internal or external factors affects its attainment within the alloted time.

(3) Rank the company elements, such as sectors, departments or functions in order of their influence on the success factors: This should be done for each objective.

(4) Develop an ideal organization structure that will favor the activities related to the critical success factors: From the information gathered so far, an ideal organization structure could be developed.

(5) Modify the ideal structure to achieve a satisfactory compromise between the existing structure and the ideal structure: Basically, the following precepts should be observed:

a. Minimize, as much as possible, organizational realignments.
b. Use existing organizational structures and relationships when feasible.
c. Minimize to the extent possible personnel shifts, both vertical and lateral.
d. Plan to use currently employed personnel whenever possible in new organizational areas.

To implement such a plan requires thorough training of management personnel at all levels of the companies. A suggested approach to this training will now be presented.

6.3.2 Training of Company Management in Basic Managerial Techniques

In order for the organization plan to be properly implemented, the managers within each company must have an understanding of basic managerial principles and techniques and how these relate to their positions and to the plan itself.

What is needed, is a program of on-the-job management training. This program should have three basic features:

(1) The program should not unduly disrupt the manager's day-to-day functions. Many managers have stated that they are reluctant to participate in management training programs because work piles up while they are gone. A program whereby the manager is only required to participate in formal classroom training several hours per week would cause minimum disruption.

(2) The manager must see the practical application of what he is learning. This would be accomplished mainly through the development of projects for each course participant. These

projects could aim at improvement of the functioning of the manager's department or perhaps be related to planning for fulfillment of company objectives. Review of progress toward project completion would be a fundamental aspect of the program.

(3) The program must be self-sustaining. Certain designated individuals, in addition to mastering the program material, must themselves be trained as instructors. Once trained, these instructors would take over the program eventually making it controlled and directed by the companies themselves.

The focus of this program should be from the general manager level on down to the branch and workshop manager level (see Figure 4.4).

For the chairmen and sector chiefs, a management seminar is recommended. Most managers at this level are aware of management principles and techniques. The task of the seminar would therefore be twofold:

(1) It would demonstrate to them how these principles and techniques could be implemented in their companies.

(2) It would introduce the concept of the organization plan and provide them with basic information about how to develop such a plan for their companies. The goal would be to get these managers thinking in terms of an organization plan to gain their support for the upgrading of managerial skills within the companies.

Development of organization plans and comprehensive training for middle managers would be long-term programs. Also, to be effective these programs would have to be adapted to the social and cultural conditions that exist in Egypt. A certain amount of experimentation would have to be carried out before a large scale effort could be undertaken. For this purpose, the initial application of the organization plan and management training programs should be applied to the Greater Cairo Bus Company. Figure 6.1 illustrates the organization structure of the company. The Greater Cairo Bus Company would provide an excellent means of testing the introduction of improved management techniques to the public sector bus and truck companies because:

110

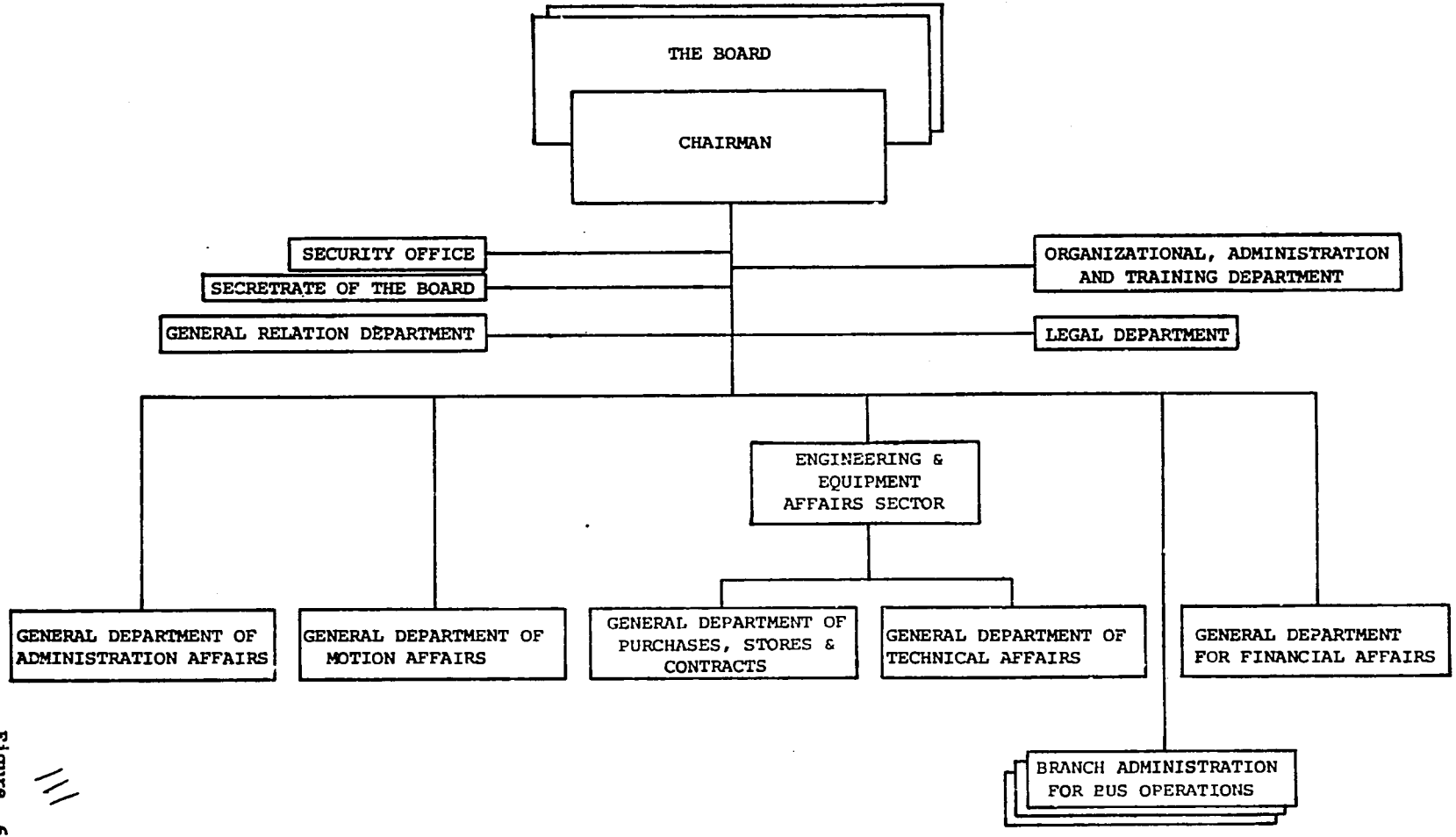


Figure 6.1

GREATER CAIRO BUS COMPANY
TYPICAL COMPANY ORGANIZATION

(1) It is a new company and therefore more flexible than the older established companies.

(2) It has a relatively uncomplicated organization structure.

(3) It is small with only 400 buses divided between two branches.

Using the Greater Cairo Bus Company as a "testing ground", the means of implementing organization plans and management training programs for the other public sector bus and truck companies could be perfected. The program could then be expanded to encompass the whole public sector transportation system.

At the company level itself much could be gained from the pursuit of this type of program. There are managers at all levels of the companies who are frustrated with the present state of affairs and eager to learn new approaches to performing their managerial tasks. With the support of these individuals a properly conceived and executed program could have a great deal of impact on the operation of the public sector bus and truck companies.

6.3.3 Management Science

As part of the management training program a concerted effort must be made to introduce all levels of management to management information and some of the tools of modern management science. Concepts of quality control, economic order quantity, operational analysis and the like can do much to facilitate the more efficient application of resources and the audit functions necessary to assure efficient performance of the individual and the organization.

As a first step, performance standards must be established that reflect the performance required in order to achieve company, sector and branch objectives. Performance can then be tracked and quantitative assessments made of relative efficiency.

Thus as discussed in Section 5, information related to the comparative efficiency of garages facilitates the identification of poor performance and leads to an analysis of cause - poor equipment, poor material, inadequate labor, etc. In a similar manner, the analysis of a single unit's performance permits the manager to observe trends in the quality of its performance that may signify maladjusted equipment, poor shop procedures, inadequate services, etc.

112

6.4 Financial and Economic Policy and Procedures

The budget estimates provided by the bus and truck companies underscore the difficulties facing the finances of these companies. The basis for many of the projections is extremely weak. The current system appears to function because the rough estimates contain sufficient leeway to cover most contingencies. But greater precision would allow a more efficient use of resources.

Vehicle availability should be determined by a thorough study of the condition of each vehicle and be founded upon factors which move beyond age as a sole determinant. This study is the same one to be used to fix the opportune time to replace the unit.

More data is needed to determine with greater precision the kilometers to be run as well as the revenue to be derived from operations. Flat averages of kilometers and revenues for the great variety of routes can obscure more than it reveals.

Given equal preventive maintenance, equipment such as batteries and tires should last approximately the same amount of time for identical vehicles. Consumption of fuel, oil, and grease should also be approximately the same for similar types of service. One of the most curious results from an examination of the budgetary projection is the variations in cost for oil, grease, batteries, and tires, all presumably for the same vehicles. The public sector should make every effort to purchase required material at the least cost. If one company has uncovered a cheaper source, it should reveal it to the others. If it is padding its cost to guard against inflation or poor planning, this should be made clear in the projection.

From the viewpoint of maintenance, the weakest portion of the budget projection is the estimate for spare parts consumption. The truck company division of maintenance and spare parts needs is entirely too mechanical. Many other factors including age, vehicle type and preventive maintenance and overhaul history, are necessary. A fixed amount for all vehicles is inadequate for planning purposes. The situation in the bus companies is somewhat better, in that age plays a central role. However, other considerations such as the frequency of repair of a specific bus type are not determined entirely by age. Each bus also has its own parts demand, with prices that are different for each component. Parts demand that does not increase as a function of age after the initial break in period does not correspond with general experience in vehicle operations.

113

Parts requirements must be based on detailed feedback. Once again, the general statement has obscured the necessary detail for establishing requirements and controlling costs. Middle Delta appears to be the only company that has established part demands for each bus type, which are based on actual experience not just age factors. The establishment of different parts demand of each type of bus and the mix of local and foreign sources for parts are crucial elements in effective planning of maintenance activity.

The problem areas that need to be addressed in order to establish more efficient financial and economic planning and operations are the following:

1) The absence of a cost system
2) The diversity of vehicle types
3) The flow of spare parts
4) Coordination within the transport sector
5) The character of Transport Organization.

6.4.1 Cost System

The fundamental underlying deficiency of the financial planning system is the lack of fiscal control in the form of cost accounting. Despite the impressive volume of records being maintained by the organizations, the information is either not properly utilized or it is inadequate for accurate planning. This dilemma spans the entire sector, although it varies in degree between organizations.

This study has uncovered no facility with data on the costs of performing various maintenance tasks. Furthermore, accounts do not accurately separate operations from maintenance expenditures. The Cairo Transport Authority did possess facility costs and it separated expenditure into operations, maintenance and administration, but no breakdown into sub-units available[1].

Effective management is impossible without detailed knowledge of costs. Planning is inadequate unless costs and output are assigned to cost centers. At each level, output should be measured against inputs to establish needs and evaluate efficiency. There is no other way to control expenditures, judge performance pinpoint problems or develop feedback in order to verify the outcome of management decisions.

---

[1] The CTA is currently moving to computerize its accounts, and institute a cost accounting system. Properly designed, this system should be adequate for financial control.

A cost accounting system is required. Forms used to record tasks performed should be revised in order to satisfy the informational and data needs of various administrative levels. Each unit or facility should be divided into cost centers, with appropriate subunits down to the smallest functional division.

Production in terms of measurable output - engines rebuilt, transmissions repaired, vehicles inspected, etc., should be recorded along with total input costs, both material and manpower. Once adequate data is assembled, standard input costs for various operations can be established and used for planning and efficiency evaluations. There is no other way to gain control over costs. This cost accounting system should be implemented in conjunction with the computerization of the costs and operational data.

The effectiveness of the cost system will only become a reality if verification of the quality of the work performed is possible. Although this is not a financial problem per se, it has implications for the final cost of maintaining equipment. If as claimed, there are inspection staffs in the facilities, the activities of these staffs should be expanded to record not only the life of an overhauled part, but also the completeness of routine servicing and safety inspections. Work teams (engine, brakes, transmission, etc.) should be identified and their output tracked. Poorly performed servicing or incorrectly repaired components must be traced to their origin and corrective measures taken. Investigation of equipment failure or accidents must be carefully conducted to isolate causes.

Inspection of facilities could be reinforced and emphasized through the creation of an independent team of technically proficient employees who would be established in central or regional offices, to visit the workshops and garages on an unscheduled basis and randomly select a vehicle or a repaired component to evaluate the quality of the labor in a given unit.

It must be emphasized that these measures are to enable problem areas to be identified and to accurately tailor corrective action; more training, a complete set of tools, enough parts. Appropriate recognition should be given to superior performance, perhaps through bonuses, or added benefits. The object is to communicate to workers that management is concerned about the quality of their work so that a good employee is satisfied that his work is appreciated, as well as to stimulate workers to take their tasks seriously.

115

6.4.2 Diversity of Vehicle Type

Operating 4-5 different kinds of vehicle is a serious problem in the public sector transportation organizations. The reason for this diversity appears to be shopping for the best terms for financing purchased vehicles. This policy is short sighted if no consideration is taken of the costs involved in keeping the vehicles in operation. Direct financial costs are incurred in keeping accurate parts inventories for each vehicle, in training mechanics and technicians in the care and operation of an unfamiliar piece of equipment, and in the post-delivery adapting of a vehicle to the service requirements of Egypt.

A thorough study should be performed by the Ministry of Transportation with the collaboration of the bus and truck organizations to determine the "life cycle" costs (acquisition and operating) and the useful life of the different trucks and buses that have been used in Egypt. Ranking as to the suitability and total cost in local conditions should be made, and the results followed as a guide when purchasing vehicles. The present practice of each company purchasing its vehicles on a sector-wide basis should be encouraged and made policy. Serious consideration must be given to the potential role of locally manufactured vehicles. Factors to be included in the analysis are the foreign exchange cost, the additional cost involved in modifying a vehicle to local needs, the time involved in securing spare parts outside Egypt and the price of training local mechanics by foreign experts. Externalities flowing from the local manufacturing of trucks and buses as well as spare parts will be large, and are properly to be included in the study. Such an analysis would objectively determine the most beneficial course to be followed in the purchasing of trucks and buses for the public sector transport organizations. This however, must be oonsidered in the context of the national economy and the requirements of the other consumers of these capital goods.

6.4.3 The Flow of Spare Parts

One of the largest problems in the maintenance field is the supply of spare parts. Although the quantity of resources will be a limitation, the central problem in Egypt appears to be the flow of parts. Adjustment in the present policies of purchase and distribution will greatly extend the effectiveness of available resources. The present system is cumbersome and inefficient, resulting in unnecessary deadtime for vehicles and improper repair procedures. An 8-12 month wait for a spare parts order is entirely too long. Also the lack of central control over parts inventories and the absence of a formal policy of inter-company parts interchange is very costly.

The international tender procedure utilized for large parts purchases should be modified to shorten the time between need identification and receipt of the part. Continuing and up-dated direct contact with the manufacturer and a central library of parts suppliers specifying past experience in terms of reliability of delivery, part quality and price will do much to replace the existing tender system. This centralized information would perhaps be located in the Ministry of Transport. An estimation of spare parts requirements could be transmitted to the suppliers for a cost quotation in a fairly short time. This would allow for quick determination of the best conditions and placement of the order.

The major problem with a streamlined parts purchasing system is accountability. The system must be subject to periodic auditing of the quantities and prices to ensure that the best interests of the public sector are being served. This would require the establishment of an independent auditor.

As noted in the previous section the current practice of the bus and truck companies to band together for large quantity purchases should be encouraged and institutionalized. Because of their different demand and scale, the Authorities should continue to handle orders separately.

The system of parts distribution must allow for the maximum use of the parts inventory. Each facility may maintain an accurate record of its stock, but this information should be centralized in company headquarters for ready access and continuing analysis in order to begin acquisition at the opportune moment. The company parts inventories should be available to other organizations and interchange of spares be permitted on a sector wide basis in order to minimize vehicle deadlining and incomplete repair actions. In the long term, a computerized system to track inventories would be advantageous for each individual organization and for the entire transport sector.

6.4.4 Coordination within the Transport Sector

At present institutionalized coordination between the transport organizations is minimal. Bus and truck companies handle their operations and determine priorities for investment independently. Common interest and personal inter-relations enhance the informal area of coordination to include the sector wide purchase of foreign vehicles and spare parts.

Formal coordination is substantially reduced and there is a wide-latitude for the ambitions of company directors. This independence leads to a waste of resources and duplication of effort. The penchant for

spectacular sized new facilities, far beyond the needs of one organization, has been seen in the East Delta, Middle Delta and Cairo Transport Authority. These over-designed facilities represent millions of pounds in investment. Plans for tire retreading equipment, engine overhaul capability, and frame straighteners all are made in isolation, without regard to the maximum utility of the limited investment capacity in Egypt.

A central authority is needed to analyze investment decisions and reduce overlap in facilities. This organization should be composed of representatives of the transport sector and of the Ministries of Transport and Finance. The decisions should be weighted in favor of the transport organization. It should be empowered to review and sanction investment plans to ensure their necessity and the required scale for efficient operation. Wherever possible, existing capability should be utilized to its full capacity prior to additional investment. Immediate decisions should be made regarding consolidation of facilities in Cairo and centralization of rebuild and overhaul in all sectors.

6.4.5 The Character of Transportation Organizations

All the organizations analyzed in the Vehicle Maintenance and Feasibility Study are publicly owned and provide transport services. Beyond these fundamental characteristics, however, there is a great deal of confusion concerning the nature of the individual organizations.

The truck companies are classified as commercial organizations, and their accounts generally reveal profits from operations. They serve almost exclusively the government sector, and their capacity is a small portion of the national trucking capability.

The service provided by the companies is a mixture of exclusive geographic zones and shared metropolitan areas. All companies carry general cargo and some have specialized freight. There appears to be no over-riding logic to this system of 5 separate companies serving the public sector. The division of service areas does not conform to a systematic approach to freight business and it is clear that the purpose is not to provide rate competition.

Action should be taken to consolidate the trucking companies and reduce overlap in their service areas. This would make more efficient use of vehicles. Interchange of cargo between the companies is required to extend the range of the individual firm and decrease duplication of service.

A longer term effort to examine the structure of the public trucking sector should be undertaken to examine the advantages of centralization of garages and workshops and perhaps even the consolidation of all companies into a central authority.

Much more than the truck companies, the bus companies are harmed by an institutional confusion fostered by the formal structure in which they have been placed. As commercial organizations they are required to cover expenses. Direct subsidies are not granted, and public assistance is limited to a portion of vehicle purchase cost. Revenues are fixed, and the fare schedule has not been subject to a significant change in over a decade. The national government has repeatedly refused to accept any upward adjustment in fares.

Costs are subject to continual escalation, beyond the control of any company. Vehicles, spare parts, gasoline and oil expenditure can be curtailed only at the expense of service. Labor costs are not variable to any great degree, because dismissals are virtually unheard of and annual raises are decreed by the government without considering the financial consequences. The current situation is one of a slowly tightening fiscal situations and of desperate maneuvers to create a positive operational account in the face of all obstacles.

A basic effort must be made to clear away the debris of the past 20 years. The pending requests to exempt the companies from some taxes, or to allow them to retain taxes for their use as well as eliminating customs payments are all makeshift measures, of limited effectiveness.

If intercity transport is to be a net revenue generating activity, companies must be free to adjust their fare structure to reflect the cost of providing transport service. With a cost accounting system in operation, detailed verification of cost will be possible, and companies could be permitted to collect revenue sufficient for operating expenses, administration and vehicle purchase, without recourse to the public purse.

Should transport service be determined to be a public service, not intended to cover its costs, then this must be made clear, and a direct subsidy paid on a per passenger kilometer basis to meet costs and depreciation charges. In this case, a cost system would be used to limit the level of subsidization.

These decisions will put the intercity service back on the true purpose of the operations, to provide dependable, economic transport for the intercity traffic. The general thrust of the recommendations in this section are toward the more effective use of resources already at hand in the public sector transport organizations. The problems identified are principally systems problems and do not require heavy outlays of funds for correction. These steps are a first priority, involving streamlining, centralization, collection of basic data, dissemination of information and coordination. These measures are required prior to moving to the subsequent level of action. Only after efficient utilization of existing potentials and resources, is it reasonable to examine the need for additional resources.

6.5 Physical Facilities

A remedial action program with respect to facilities can appropriately be divided into immediate action programs, intermediate action programs and long range strategies. An overlap in time frames might well be substantial because of the numerous facilities involved and the budgets required.

6.5.1 Clean-up of Garages and Workshops

One of the most obvious problems noted in all of the garages and workshops visited during the course of this Study has been the lack of cleanliness. Because of improper maintenance and parts disassembly procedures, a thick film of fuel oil, crankcase oil, other fluids and grease are spilled onto surfaces around the work pits. Besides causing filthy conditions in the pits, this material is picked up on the bus tires and tracked around the yard area. The continuance of this practice for many years results in a build-up of black slick overlay on concrete paving. Where there is no paving it results in a mixture of dirt, oil and grease that is impossible to maintain properly.

The result is a surface unsafe for vehicular travel and in many cases for walking. Even where work pits are well-drained, they are so dirty that workers in most other countries would refuse to use them. The surface area around the pits is usually the worst, but the shops where engines and gear boxes are disassembled are sometimes as bad. This is due to the fact that when the parts are disassembled, the fluids are not contained and disposed of properly. Also, because diesel oil is used to hand clean the disassembled parts, the residue of this operation becomes part of the problem.

Another contribution to the mess is made by the old scrapped parts, wornout tires and bus hulks occupying large amounts of space. In the smaller facilities this material restricts the working and vehicle maneuvering area drastically. In all cases it gives the facility the appearance of a junk yard, rather than an efficient operating garage. Because of a lack of new parts many garage managers cannibalize the scrap to keep their buses running. However, this does not excuse the amount of unusable junk that we observed. We were told that the slowness of disposal of this material is due to the bureaucratic requirements which were set up to insure that operable items are not sold as scrap. This results in the scrap piling up until a high-level committee can survey the material and verify it as disposable.

121

The buildings themselves are usually very unattractive. Windows are dirty or broken, burnt-out lights are covered with dust and cobwebs and painting, even of interior walls, is a rare occurrence. Cleanliness in parts storerooms varied widely; some were covered with dust, while in others it was obvious that quite a bit of effort was made to keep the parts clean. The lack of rain in Egypt makes the dust problem a major one.

Because of the large amount of dust and dirt, the condition of the fuel injector shops is critical. Although generally these are kept cleaner than the other areas, they should be dust free. A dirty fuel injector put back into a vehicle will soon have to be removed again for maintenance.

In two of the best garages of the Cairo Transport Authority, namely Al Basateen and Al Munib, the area around the fueling and greasing operations were relatively clean. We were told that in these facilities, the fuel pumps, hoses and dispensing nozzles, lubrication equipment, including the air compressors and lube guns are furnished and maintained by the fuel and lubricant supplier. The fuel dispensing equipment was in excellent condition, and the hoses equipped with automatic shut-off nozzles to prevent over-filling of the fuel tanks. The lubrication oil was stored in non-leaking drums. The lubrication pits were equipped with an oil drainage pumping system that carried the drain oil directly from the vehicle oil sump to an underground holding tank, from which it is pumped to oil tankers or oil drums, to be hauled away by the oil supplier.

Air compressors and lubrication equipment were in excellent condition, which probably improves the morale and work habits of the lubrication personnel.

The fact that these superior conditions exist at these two garages leads us to the short-term recommendation that the same arrangements with fuel and lubricant suppliers be entered into for all the garages. Of course, this would not guarantee a clean garage. That can only be achieved by continuous pressure by the management. First, a massive clean-up should take place, using heavy brooms, brushes, scrapers and shovels. Then the debris should be hauled away to some disposal area, not dumped in a corner of the yard or just outside the gate. Then, management should institute daily cleaning procedures on the part of every worker. Cleaning should be considered part of even skilled workers, not just relegated to a lowly few. The acquisition of powered cleaning machines for the larger areas is recommended to reduce the time involved and to upgrade the status of the cleaning operations. The disassembly and cleaning of engines and other parts should be strictly controlled. Cleaning machines using hot water and detergent should be available at each facility and operated by trained workers.

122

Once clean working conditions are achieved, the workers will be more receptive to keeping themselves cleaner. The present practice of allowing them to work in sandals should be stopped, for their sake. Work shoes and attractive work clothes should be provided each worker and arrangements made for regular cleaning of the work clothes. The fact that some of the facilities we visited were being kep clean proves that the dirty conditions are not a cultural problem. It can be corrected by good management practices.

The procedures for disposal of scrapped items should be simplified. The responsibility for deciding what can be sold as scrap should be left to the garage manager, subject to occasional checks by higher authority. Bids for removal of this material should be received at close intervals so as to keep the amount in the garage down. The scrap should be stored out of the way and screened from the operational areas.

6.5.2 Improve Lighting and Ventilation

Because of the lack of building maintenance, both the natural and artificial lighting in the shops is not adequate for the work involved. Dirty windows stop most of the outside light from entering and practically all of the original lighting fixtures do not work. Their replacement by bare bulbs hanging from the ceiling provides a glaring light, not necessarily adapted to the varying light needs within the work areas.

Only one garage visited had pit lights working. This is a particular problem for the city bus systems which must perform their daily inspections and much of their minor repair at night. The use of a drop light is not adequate for such work.

Because the Study was performed during the summer, the team became acutely aware of the poor ventilation in most of the small shops; the natural movement of air is poor because the facilities are built of many separate rooms. Only in some of the fuel injector rooms and some storerooms were there fans to provide the cooling effect of moving air.

Each company should arrange for a detailed lighting study of one of its facilities to determine the existing illumination levels and compare this with the levels required for the particular work in each area (100-120 foot candles). The group or firm making the study would then prepare lighting plans and specifications to enable the company to provide its workers with proper lighting for their work. The cleanup and painting described in the short-term improvement should be done before this study is made so that improvement in light levels from the effort can be taken into account.

123

The ventilation improvement could be planned by the company's management and engineers. In most cases the installation of small exhaust fans would be sufficient to provide enough movement of air to improve the comfort level somewhat.

The major effort should be made in the fuel injector and automatic transmission workshops. For these operations where cleanliness is critical the air brought in should be filtered at all times and cooled during the summer to provide for the workers comfort.

6.5.3 Pave Yard Areas and Improve Access Roads

In many of the older facilities the garage yards and access roads are unpaved. This is hard on the buses and the workers. Some of the access roads are so rough that just driving the bus into the garage creates suspension and steering breakdowns. Also the travel of buses over dirt access roads causes dust and dirt to drift into the garage and workshops aggravating the problems of cleanliness discussed earlier. The unpaved yard areas make a cleaning program almost impossible, therefore, this work would have to be done in some of the garages for the clean-up described as the short-term effort to be completed.

Each company whould have one of its engineers conduct a survey of the extent of the unpaved areas at their facilities. A suitable road section for the loadings imposed by their buses should then be designed. Bituminous concrete paving should be used in order to complete the work quickly. This can be accomplished with a minimum of contract plans and paperwork. Bids could be accepted on the basis of costs per square meter of paving and payment based on area of paving completed.

6.5.4 Correct Drainage Problems

Throughout most of Egypt the chief drainage problem seems to be water entering the work pits in areas with high water tables. The solution for this case is usually to install pumps. If the problem is severe as at the Shubra Garage/Workshop of the Middle Delta Company, the pumps need to be run continuously to prevent the pits from filling up again at night. This creates a problem if there is no night shift. As a result, at this facility, the pits are still not used because the nightly backup into the pits keep them too dirty to be used.

At the El Minya Garage of the Upper Egypt Company the drainage problem results because construction of the drainage system was not completed by the building contractor.

124

Drainage problems tend to be site specific. Because of the generally low rainfall and the tendency for Egyptians to make do with unpleasant working conditions, these problems are allowed to linger without a solution. The garage manager in each case should be charged with the responsibility of preparing a plan for corrective action and upper management should take steps necessary to implement the plan. Where water table is a very bad problem, service ramps should be built and pits filled to eliminate the problem.

6.5.5 Build New Facilities in a More Compact and Efficient Design

The standard design of garages and workshops in Egypt appears to have been based on a military fort. The entire site is surrounded with a high concrete wall and the shops are usually built along two sides of the wall. The work pits are located in the "parade ground" area, and the rest of the open yard is used for bus parking. In some of the garages the maintenance area is more compact because the shops were built in a line through the middle of the facility and the buses are parked behind them.

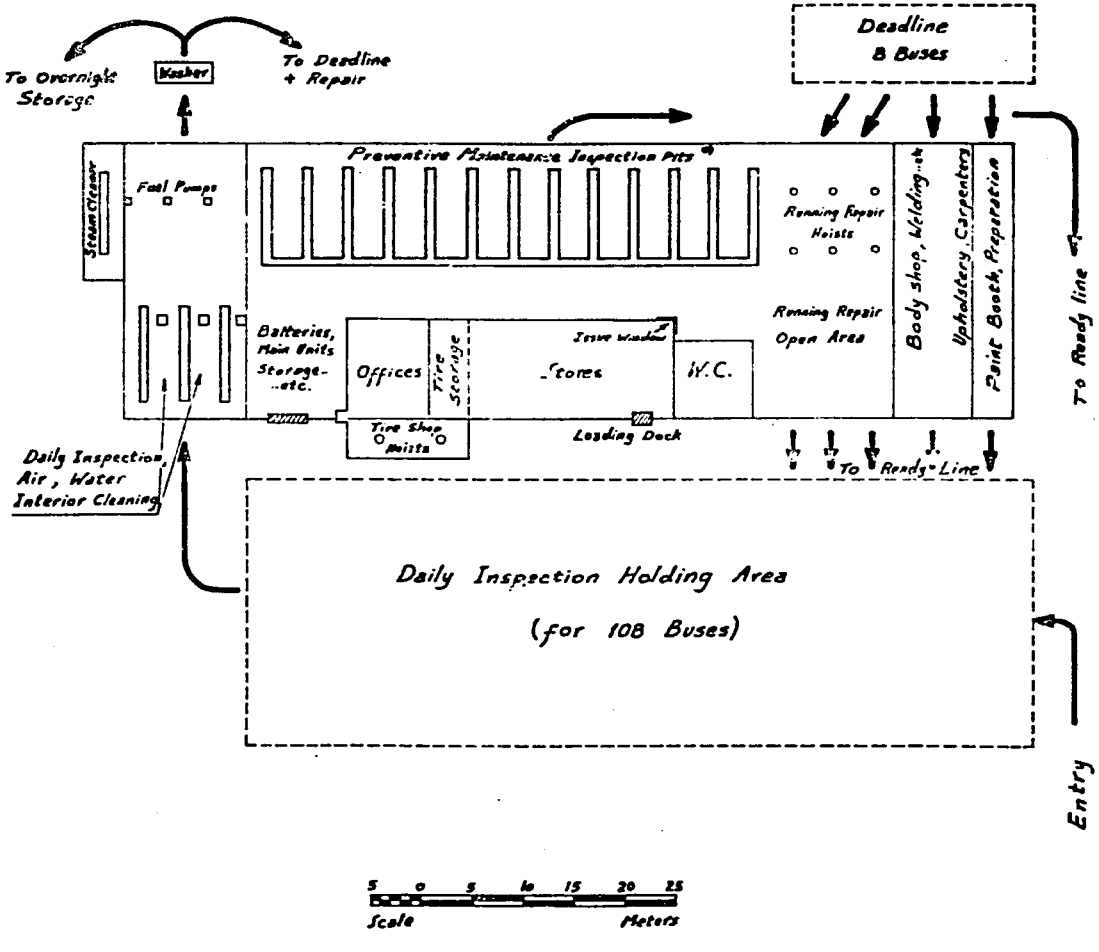
However, in either case, the fact that the shops are separate rooms constructed in a long line creates an inefficient working arrangement. The amount of walking required between the pits, shops and stores in a large Egyptian garage is quite wasteful. This type of layout also make overall supervison very difficult. There are too many hiding places.

Another problem of facility design is the exclusive use of reinforced concrete for the buildings and even the pit canopies. This results in high construction costs and long construction periods. Construction of a new maintenance facility takes about five years; this means that the company is using the old dirty facility being replaced for a much longer period than is necessary.

We recommend in the long run that new maintenance facilities planned by the companies be designed with the buildings in a compact core, and that more use be made of steel construction. Included in this report are sketch plans illustrating the shop layout recommended.

Figure 6.2 shows a possible scheme for a maintenance garage capable of keeping 200 buses operating. The total area under cover is only 2576 square meters; the covered area of Egyptian garages of the same capacity is from 4000 to 20,000 square meters. The basis of this design is that the working areas are compact, with ready access to the stores, and ease of supervison from the manager's office. The buses would move from the inspection holding area, onto the three inspection pits. During

125



*) Rear Engine Buses Back in

Total Area Under Cover = 2576 m²

Fig. 6.2

GARAGE AND WORKSHOP WITHOUT ENGINE REBUILD

(104)

126

the inspection the interior of the buses would be quickly cleaned by mechanical means. Then the buses would be moved forward to be fueled and the oil topped. After that a certain proportion of the buses would move quickly through an automatic washing rack. Within a period of a few days all of the buses would be washed.

If the inspection reveals no repairs are needed, the bus would be driven to the overnight storage area. Those buses needing work would be parked in the deadline area near the other end of the building. From there they would be moved into the repair area along three lines. This is in contrast to the present practice of having buses under repair scattered in various locations around the garage yard. Tire changing would be done in a separate area near the tire storage room. The parts store is only large enough to carry fast moving items so that there would have to be good coordination between individual garage stores and the main store.

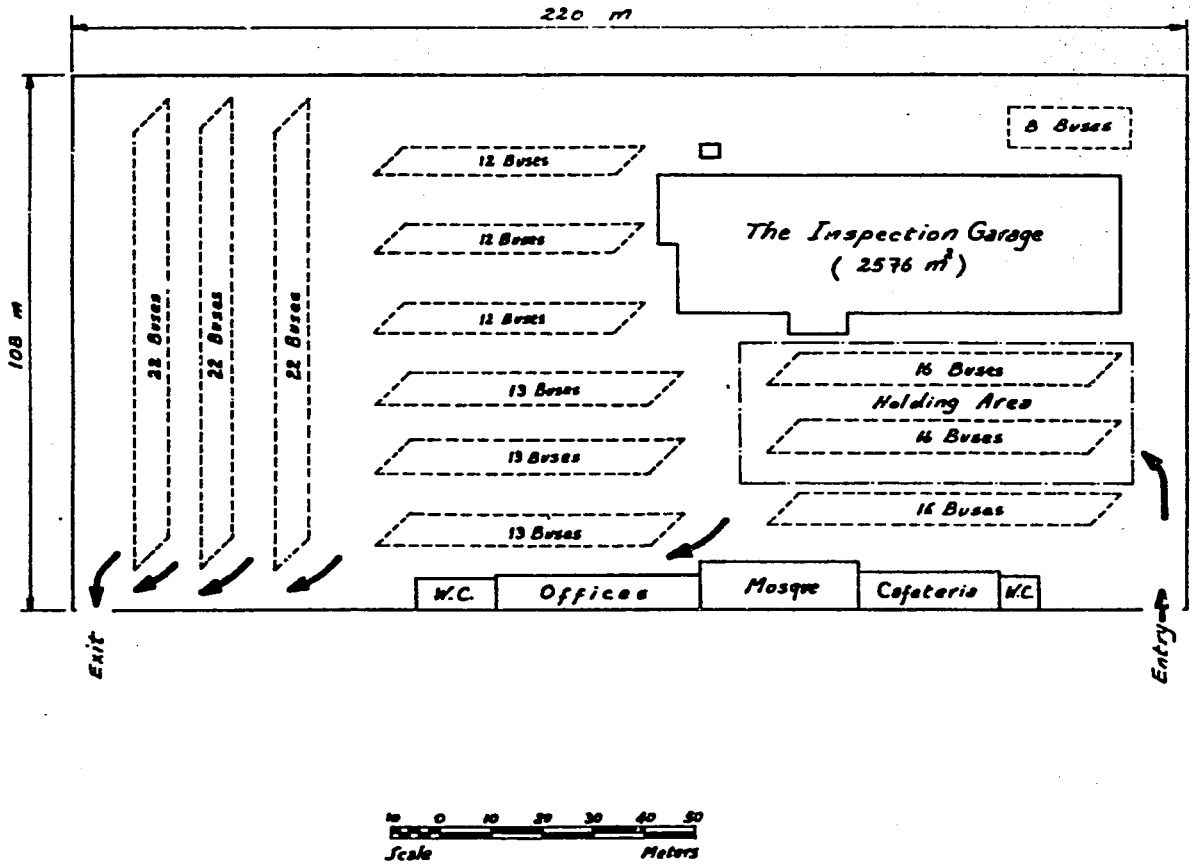
Thirteen pits are shown in the garage for preventive maintenance. Rear engine buses would back in and there is a work area along the back end of the pits where most of the maintenance activity will occur. Body work and painting would be done in flow-through shops at the end of the garage building.

Figure 6.3 shows the site plan for the entire facility. The garage is near one corner, leaving open yard area for bus parking. The administrative offices, mosque and cafeteria are located along the front wall of the building. The flow through the garage would be controlled by having all buses enter at the right and leave through the exit gate on the left. Even with the "loose pack" parking layout shown, the total site area for this facility is only 23,800 square meters. This is smaller than most of the newer garages.

It should be pointed out that this design makes two assumptions. The first is that the number of garage workers is kept to those actually required to do the work. There is no extra room for non-productive workers. The second is that no large amount of space is shown for scrapped items and bus hulks. As recommended elsewhere, these should not be allowed to accumulate in the garages as is now the case.

Figure 6.4 shows an efficient arrangement for a central workshop in which engine rebuilding and body renovation is performed. This facility is large enough to support ten maintenance garages as described previously, so that it would be sufficient for a 2000 bus fleet. The total ground floor area is about 2100 square meters. Shop and general offices on upper levels occupy 800 square meters.

127



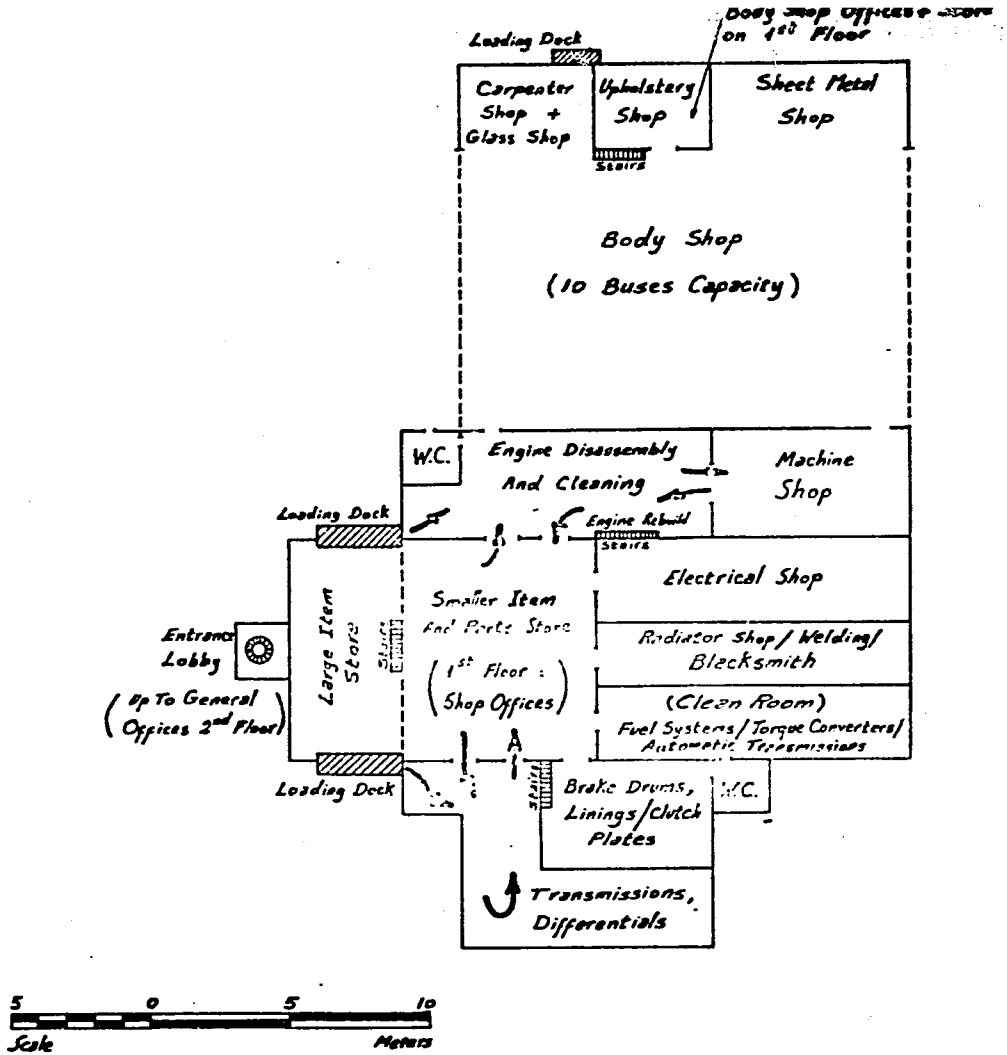
Operating Buildings + Mosque
992 m²

Fig 6.3

GARAGE SITE PLAN

(106)

128



Ground Floor Area	[illegible]	m²
Office Area (1st + 2nd Floors)	204	m²
Total Area Under Roof	2996	m²

Fig. 6.4

CENTRAL WORKSHOP
INCLUDES ENGINE REBUILD +

(107)

129

The area is small because its operation is based on the unit exchange system rather than the existing labor intensive system in which many workers are kept busy repairing items that quickly break down again. This is a critical point because construction of this type of workshop would have to be accompanied by a change in company policy. There also must be strict testing and quality control of all work done. The drawing shows a "clean room" for work on the fuel systems and automatic transmissions which require a dust free environment. If these measures are taken, the rebuilt engines will last 3 to 4 times longer thus reducing the bus breakdowns and the amount of workshop time per bus considerably.

In the previous section describing the problems in design and building of new maintenance facilities in Egypt the length of construction time was mentioned. For various reasons, one of which is the use of rather massive concrete structures, it appears to take at least five years to build a new garage. This inordinate construction time could be reduced significantly by using pre-engineered steel buildings. By keeping the amount of actual on-site construction operations to a minimum the total length of construction time could be held to one year. If the bus company was not willing to accept a building made entirely of steel, they could still save time by building concrete block walls with a steel frame roof.

6.6 Maintenance Systems Concepts and Logistic Support

A number of recommendations have been made or alluded to in the areas of Management,Finance and Facilities which relate to the overall subject of Maintenance Systems Concepts and Logistic Support. These include concepts of: centralization of functions; maintenance teams; audit teams; vehicle standardization; unit replacement; management and operating efficiency; design specifications and training.

In each of these areas, there are specific recommendations that can be offered for implementation as follows.

6.6.1 Centralization of Functions and Unit Replacement

Although the history of the development of public sector bus transportation indicates that centralization of maintenance functions existed at one time and was abandoned because service was poor, it appears that the scale has now become unbalanced in the other direction and there has been a proliferation of facilities at the branch level which severely dilutes skilled labor, parts inventories equipment and physical facilities to the point where most shops produce nothing but junk instead of repaired or overhauled components. It is recommended that the trend be reversed and that rebuild and overhaul services be reestablished at least on a company basis for most components, and in the case of certain components such as engines and transmissions be established at the sector level. The analagous situation for CTA would be the region and Authority. Concurrently, the concept of unit replacement should be incorporated as part of the maintenance concept.

It would not be unreasonable, considering the size of the sector operations, for the three Delta companies to operate, overhaul and rebuild facilities as a unit with one rebuilding engines and transmissions, another rebuilding minor components including injectors, starters, generaters, etc. and the third concentrating on body and chassis rebuilding and overhaul.

A number of facilities have been identified with the potential for providing these services. The Tanta Facility of the Middle Delta Company, for example, has the potential for body and chassis work on a grand scale. The East Delta Facility at Nasr City also has the potential for a major rework facility, or alternately, the potential also exists at Mahalla. The West Delta has the potential for centralized activity at Damanhur.

131

In the CTA the potential for consolidation exists at the Nasr facility and also at the new facility at Gisr El Suez. The development of these facilities should be encouraged by the Ministry of Transport and Governate of Cairo.

6.6.2 Maintenance Teams

There is no evidence of an organized approach to on-the-road maintenance. The consequences of this lack of maintenance planning is disabled buses which remain out-of-service a disproportionately long time for problems such as tire failure, fan belt failures and other defects that might be remedied by road maintenance crews.

It is recommended that each branch garage be equipped with a light weight pick-up truck equipped with an air compressor, tire changing equipment, a set of general mechanics tools, an oxy-acetylene cutting and welding outfit, and other supplies for making emergency road repairs. Heavy duty tow-trucks should be assigned to major overhaul facilities for removing major breakdowns to garages for required maintenance actions.

6.6.3 Vehicle Standardization and Design Specifications

It has been pointed out in a number of places in this report how the large number of different vehicle types provided by the public sector adversely effect the efficiency and costs of public transportation. The problem is further complicated by non-standard vehicle procurements. Although the public transport ridership requirement of Egypt is not unique it does substantially differ from the ridership found in Europe and North America. Hence one can hardly expect an off-the-shelf bus to gracefully withstand the onslaught of the average Egyptian ridership (or mobs). Finally maintenance standards will not be as high, mainly because maintenance activities are more labor intensive than capital intensive and this alone introduces a higher degree of variability into the system.

On the basis of these considerations, it is recommended that procurement of vehicles for public sector transport be limited to at most, two makes - the Nasr and the Mercedes, and at most four models including a luxury bus for long haul intercity traffic. The design of the Nasr vehicles should gradually evolve to better adapt it to the local demand giving consideration to factors such as those outlined in Appendix VIII(A Bus Designed with Egypt in Mind). The Nasr vehicle is rugged and has many more parts produced locally than any other vehicle and also has the potential for greater parts availability from the local market.

132

The Mercedes vehicles have proven their ruggedness and their maintainability. One need only look at the performance figures in Section 5 of this report to recognize their superiority. Perhaps the rational behind their selection can best be stated in the following terms. "Given the least common denominator of poor maintenance, which vehicle, because of its simplicity, ruggedness, reliability and maintainability, can best survive?" The answer appears to be Mercedes.

6.6.4 Management and Operating Efficiency and Audit Teams

The measure of effectiveness of management and operations is performance relative to standards. Managers have indicated they know that truism, but very few have converted that knowledge to practice because they do not appear to understand how to do it. Neither do they appear to understand that the determination of the effectiveness of performance is a function of audit or quality control. On numerous occasions managers cited work as being accomplished that obviously was not done - they did not bother to check and are staffed by personnel who either didn't check or didn't report.

It is recommended that these efforts be undertaken to alleviate this problem.

First, at the level of company and regional management, an operations analysis staff should be organized whose purpose is to measure performance and improve operating efficiency. This would require a team of perhaps 5 or 6 professionals with a strong background in management science, statistics, operations and finance. simultaneously at the level of the branch and facility a quality control function should be established for the purpose of tracking performance and conducting investigations into trouble areas as they become apparent from analytical services.

Second, performance standards should be established for all maintenance operations in order to provide suitable measures of effectiveness for exercising management control.

Third, micro and mini-computers should be utilized and management information systems developed that will supply the data storage and manipulation support for the performance monitoring program. Such installations must use memory devices suitable for an environment of power failure i.e., utilize emergency energy sources in order to assure retention of the operating data base.

These computer systems can also facilitate more rational management of spare parts inventories.

133

6.6.5 Training

The subject of training is always difficult to deal with because it has the aura of respect normally associated with motherhood - hence being negative on training is like being for sin and against motherhood. Nevertheless, at the risk of being ostracized, it appears that there are excessive vocational training facilities planned and in being, while at the same time there is a total inadequacy of OJT for managers at any level.

Further, the design of training programs and facilities is such that where they do exist, it is virtually impossible to carry the training into the field because operational facilities are so poorly designed and organized. Any self-respecting graduate of a vocational training program would leave the public sector at the first opportunity.

Better training for managers will go a long way toward solving this problem and is of a higher priority than increased vocational training. A joint team approach would be preferred, one in which a specialized management training team would work side by side with resident company counterparts. Over a period of 3-5 years the expatriate team would phase out and the trained counterparts take over both operations and training programs.

A pool of resource capital must also be committed that would facilitiate the introduction of special equipment or other forms of support as needed to properly execute the program.

7.0 SOME SUGGESTED ACTION PROGRAMS FOR A.I.D.

It is always a difficult task for an agency with a development mission to select projects for the placement of funds. Particularly when the number of opportunities far exceeds available funds.

In order to ascribe some priority to program opportunities the following criteria have been applied:

(1) The degree with which the opportunity can be adapted to the cultural, social and political constraints of the system.

(2) The degree to which the opportunity can yield benefits when applied in context with the remainder of the system.

(3) The likelihood of success for the project.

(4) The cost of the project.

(5) The impact of project failure on the U.S. image.

(6) The degree to which the application of funds provided can be controlled by donor.

(7) The extent of competition between prospective donors to provide funds for this particular type program.

But first, some generalities,

- Any attempt at improving public sector maintenance in Egypt requires a selling job to all levels of management.

- The potential exists to vastly improve the maintenance system; there are exemplary facilities, operations and management personnel that prove the point. These individuals should be motivated to extend their role in developing the maintenance system of the public sector.

- In the most general terms, as noted earlier in this report, the major problems appear to derive from three shortages:

  - shortages of major components and parts
  - shortages of trained management personnel
  - shortages of properly designed and equipped facilities

  These, of course, can and will be translated into specific programs in which A.I.D. might wish to participate.

135

- There are several major policy issues which must be handled by A.I.D. if donor funds (favorable loan or grant) are to be used effectively.

Above all of the operational problems and issues, there are a host of operational policy issues and practices which bear on the maintenance problems but which we feel are beyond a direct solution by A.I.D. There are ways to attack these, however - by placing caveats on assistance. As a case in point, consider the matter of coordination.

A sign of the lack of coordination in the public sector transport is the planning of investment by the various organizations. The CTA, Middle Delta and East Delta are currently investing or have invested large resources in facilities that are over-designed, and of a scale far beyond their present needs. The new workshop and rebuild facility of the CTA begun in 1972 near the Gisr El Suez Garage, has been partially completed at the cost of 3.5 million LE. Completion will require another 7 million LE and equipment needs a further 3 million LE. Middle Delta's new Tanta Central Workshop and Training Center has consumed from 3-4 million LE and will need 5-6 million LE more to finish. East Delta's new Cairo region central workshop/storeroom/ garage will reach a construction cost of 3.5 million LE when completed sometime in 1980.

In a similar manner, the truck companies operate their port to destination traffic with little regard for each other. Interchange of cargo and transshipment nodes between firms are unknown. The logic of having five separate companies serving Alexandria and Cairo as well as the patch-work distribution of governorates has apparently never been questioned, but affects fleet maintainability.

The centralization of overhaul, assignment of vehicles, limitation on numbers of makes and models, procurement practice (tender process and replacement cycle) are all coordination problems that might be attacked by placing caveats on loans or grants.

While shortages of properly designed and equipped facilities include those necessary for the conduct of overhaul indicated earlier, the problem of facility adequacy extends far beyond that single aspect of operations. The garage, the key facility of the preventive maintenance program is poorly designed and equipped for its function. It is in general, also poorly organized (a management training problem), poorly administered (a management training problem), and improperly staffed (a management training problem and vocational education problem).

134

Therefore, it is recommended that high priority be given to:

(1) Funding the development of garage/periodic maintenance facilities.

There is a need for new garage/periodic maintenance facilities to replace obsolescent and inadequate facilities currently being employed. These facilities should be designed in a manner substantially different than is current practice from the viewpoint of layout and construction method.

A CONDITION OF LOAN OR GRANT SHOULD BE ADHERENCE TO A U.S. SPEC FOR LAYOUT OF BUILDINGS AND EQUIPMENT, AND IMPLEMENTATION OF OJT MANAGEMENT TRAINING PROGRAM.

As part of the garage facility, properly-equipped road service trucks should be supplied for each garage constructed.

REHABILITATION OF GARAGE UNITS IN THEIR PRESENT OPERATING MODE IS NOT CONSIDERED A FEASIBLE OR DESIRABLE USE FOR A.I.D. FUNDS.

Investments may approach $4-5 million per unit, including equipment, but the unit should be specifically designed for a high labor intensity operation.

(2) Alternatively, there is an immediate need to remedy inspection and testing equipment inadequacies in periodic maintenance facilities.

A CONDITION OF SUPPORTING THE EQUIPMENT SHOULD BE LARGE SCALE CENTRALIZATION OF OVERHAUL FUNCTIONS and their removal from garage or garage/workshop facilities. This would free-up space and facilitate rework of some of the more promising units.

As was seen when describing the component and part shortages and facilitiy inadequacies, the subject of training frequently appears in connection with other factors. It is our contention that it should not be considered out of that context. Vocation training, for example, without accomplishing other changes is simply pouring money down a rathole. On the other hand, suitable management training may effectively block the rathole, allocating resources in a way that allows vocational training to be more effectively applied.

Therefore, it is our recommendation that FIRST PRIORITY be assigned to the development of a Management Training Program.

There is a desperate need for management training in the public sector bus and truck maintenance systems; on-the-job training. Such training could be provided by a team of specialists working hand-in-hand with their Egyptian counterparts for as long as 3 to 5 years. A team might consist of 5 people and ideally should work with one or more prototype facilites that can be considered a training ground, e.g., Greater Cairo Bus Company, because it is Ward, and we have a stake in making it fly; East Delta because they have the will.

The investment required could be as much as $1,000,000 per year for two teams, plus $500,000 per year in expenses to facilitate project accomplishment. UNDER NO CIRCUMSTANCES SHOULD PROSPECTIVE EGYPTIAN PARTICIPANTS BE SENT TO THE STATES FOR ANY OF THIS TRAINING.

Looking at the shortage of major components and parts from the viewpoint of causality, the program opportunities can be developed as follows:

- Improperly overhauled components require more frequent overhaul and generate higher parts consumption.

- Improper overhaul in turn, partly results from a lack of parts BUT IN ADDITION from

  .. Insufficient or improper test equipment
  .. Improper facilities in which to conduct overhaul.
  .. Too many makes and models diluting available facilities, equipment and trained personnel.
  .. A lack of adequately trained supervisors and technicians:

     .... too few supervisors
     ... no understanding of quality control
     ... little understanding of necessary work habits

- Finally, one can not be sure that a part or component shortage really exists because there is no way to establish stock levels among items distributed to local stockrooms.

Therefore, it is recommended that high priority be given by A.I.D. to the following projects:

(1) There is an immediate need for centralized engine overhaul facilities. The CTA and East Delta Company would benefit most from such facilities because of the scale of their operations. A.I.D. should invest in facilities such as these under the following circumstances:

138

- Presently planned facilities should be converted to this use with structural changes as necessary to facilitate process flow.

- Start-up and three years of management by U.S. expats with host country trainees followed by two years of host country management with U.S. expat observers.

(2) There is an immediate need to implement more sophisticated methods of logistics management including computerized inventory control systems with remote terminals in garages (but probably not in storerooms) and parts distribution services through a centralized dispatcher. An anscillary requirement would be reliable communications between CTA facilities by radio link. The same system could dispatch road service trucks and tow trucks for vehicle recovery.

Much has been written about public sector bus needs and little about trucks. That's because in relation to truck operations, it is many times larger and more visible from a social, economic and political viewpoint.

It has been noted elsewhere in this report that the truck companies do well in most areas. But as with the bus companies, they would benefit from a centralized engine overhaul facility. This would be a suitable place for A.I.D. to allocate funds, again with the proviso that all garage/ workshops relinquish such activity in its entirety.

It is also recommended that A.I.D. sponsor a study of public sector truck frieght operations because there appears to be a need for evaluating truck operations from the viewpoint of routing and cargo handling. BUT THESE ARE OF LOW PRIORITY.

Finally, some suggestions with respect to vehicles. DO NOT ENCOURAGE THE PURCHASE OF ANY IMPORTED BUS. PARTICULARLY NOT SOPHISTICATED AMERICAN VEHICLES. DO ENCOURAGE THE DEVELOPMENT OF LOCAL SOURCES OF SUPPLY. A JOINT VENTURE WITH AN AMERICAN DESIGNER/BUILDER MIGHT BE A WORTHY VENTURE.

The terms of reference for the time frame and attributes of each of the suggest A.I.D. actions is as follows:

The first priority project, Management Training, is long-term, but gets high marks on all criteria: It will tend to adjust the system to the needs of the project and can point to examples within the current social, cultural, political and operational framework. The cost of the project is not excessive and it is a low visability approach. The funds are closely controlled by the donor and there is no evidence of donor competition.

The next highest priority projects, Centralized Engine Overhual Facilities or New Garage/Periodic Maintenance Facilities are mid-term. They are of much higher visibility and will be controversial in some quarters. The results, however, can be dramatic. The funds would not be under direct control of the donor although caveats and phased release of funds would facilitate control. There appears to be little competition in this area among donors.

The alternate of reconditioned garages rather than new garages is mid-term only because of the caveat. By itself, it could be much less costly in terms of donor funds but taken with an investment in centralized overhual facilities would be quite costly--but also quite effective. Again, there does not appear to be a rush of donors.

APPENDIX I

GENERAL SURVEY QUESTIONAIRE

APPENDIX I

GENERAL SURVEY QUESTIONAIRE

IN ORDER TO FACILITATE THE COLLECTION OF INFORMATION THE VEHICLE MAINTENANCE TEAM REQUESTS THAT THE FOLLOWING INFORMATION BE PROVIDED FOR EVERY GARAGE, MAINTENANCE SHOP AND OVERHAUL FACILITY OF THE PUBLIC SECTOR BUS AND TRUCK COMPANIES.

VEHICLE MAINTENANCE INFORMATION SURVEY

Name and Location of facility _____

_____

MAINTENANCE ECHELON

1. (a) Describe generally the definition used by your organization for:
   - Repair Facility
   - Maintenance Facility
   - Overhaul Facility

   (b) What type of facility is reported at this location

2. For each of the above, what criteria are used for initiating repair, maintenance or overhaul:
   - o Driver Complaint
   - o Testing Program
   - o Mileage
   - o Time in Service
   - o Other

3. Describe preventive maintenance inspections that are performed on a daily basis.
   a. Before Operation
   b. During Operation
   c. After Operation

4. By whom are the inspections performed?

5. What is done to correct any defects noted?

6. Describe periodical maintenance services that are performed on the following basis:
   a. Weekly
   b. Monthly
   c. By Kilometers

7. Describe the causes of vehicle downtime in the following areas:
   a. Engine
   b. Transmission
   c. Differential
   d. Brake System
   e. Steering System
   f. Cooling System
   g. Fuel System
   h. Electrical System

8. Indicate the average length of downtime for each item indicated above.

9. Describe those mechanical failures that are attributable to vehicle accidents.

10. Describe what vehicle breakdowns are attributable to the driver.

11. Describe your driver training program.

12. Describe incentive program for operators with the best driving records.

13. What vehicles are put on easy routes or are they rotated over various routes?

14. What is the average life by type of vehicle?

15. Are service items always available?

    a. Oil Filters
    b. Fuel Filters
    c. Air Cleaner Cartridges

16. Are spare parts and/or assemblies available from direct exchange for use in periodic maintenace:

    a. Fuel pumps
    b. Fuel injectors
    c. Water pumps
    d. Starter motor
    e. Generator/Alternator
    f. Voltage regulator

MAINTENANCE EQUIPMENT

Maintenance equipment is divided into two categories "General Purpose Equipment" and Special Purpose Equipment".

GENERAL PURPOSE

17. Describe the maintenance equipment available in the shops

    a) Machine tools (lathes, mills, grinders, cutters, drills)

    - Type
    - Make
    - Quantity
    - Age
    - Capacity

    b) Sheet Metal Tools (shears, brakes, presses)

    - Type
    - Make
    - Quantity
    - Age
    - Capacity

c) Cutting & Welding (Arc welders, gas welders, spot welders)

- o Type
- o Make
- o Quantity
- o Capacity
- o Age

d) Lifts

- o Chain hoists; capacity and number
- o Hydraulic lifts; capacity and number
- o Pneumatic lifts; capacity and number

e) Other

18. Describe the Special Purpose maintenance equipment available in the shops:

a) Engine Maintenance and Overhaul

- o Engine lifts; capacity and quantity
- o Cylinder Boring Mill; capacity and quantity
- o Valve grinder; capacity and quantity
- o Crankshaft grinder; capacity and quantity
- o Fuel Pump and Injector Benches; quantity
- o Jigs and fixtures

b) Transmission Maintenance and Overhaul

- o Gear cutters
- o Jigs and fixtures

c) Differential

- o Gear cutters
- o Jigs and fixtures

d) Suspension and Steering

- o Bushing presses
- o Bearing presses

e) Brakes

- o Cylinder rebuild benches
- o Drum Lathes

f) Electrical

- o Rotor turning
- o Collector/Commutator turning
- o Rewinding benches

19. Identify and describe general service equipment used for maintenance and overhaul purposes:

a) Wash racks ----- Quantity

b) Lubrication racks----- Quantity

c) Compressed air systems -------Pressure

d) Hydraulic systems --------Pressure, pumping rate.

e) Cleaning systems ------- Type, quantity

20. Identify types and quantities of testing and trouble-shooting equipment in use by Facility.

- o Engine Analyzers
- o Dynamometers
- o Brake Testing Machines
- o Front-end Alignment Tester
- o Other

21. Provide general plans or diagrams for each facility in the organization showing:

a) Equipment layout in each shop

b) Process flow through total facility and in each shop.

22. Identify whether shop is set up on basis of:

- o Production line
- o Station
- o Line and station

23. Provide a list of Maintenance and Repair Manuals, Overhaul Manuals and Maintenance/Overhaul specifications available at each facility. Define for each:

- o Type
- o Edition date
- o Quantity
- o Location of manuals in facility

24. Provide a list of Parts Catalogs, Periodic Factory Bulletins, and other Reference and Instructional Materials in the Facility and Shops

Provide the following information about each:

- o Type
- o Edition Date
- o List of changes and effective dates
- o Location of material in facility and shops

25. Provide one copy of each form used to control and record Maintenance and Overhaul activity for each facility. Provide brief description of the flow of paperwork indicating point of origin, who exercises quality control and ultimate destination of form.

26. Describe special tools that are stocked for each operating component. Define:

- o Type component
- o Type tool
- o Quantity
- o Replacement rate of tool
- o Location of tools

27. Describe how special tools are controlled

- o Availability
- o Quality

28. Describe what general hand tools are available, in what sizes, quantities, where stored, and how controlled.

29. What is annual budget for:

- o Maintenance of shop equipment
- o Special tools
- o General hand tools
- o Shop reference manuals
- o Shop training manuals

30. What is the percentage of time that maintenance equipment is available to perform its function. Indicate this information for each type of equipment described in items 17,18 & Indicate, by type, the average down time whenever maintenance equipment is out of service.

31. In what manner is quality control exercised over maintenance activity.
For example:

- o what percentage of repaired parts are inspected
- o what percentage of rebuilt assemblies are tested
- o are incentives awarded to workers that produce good units
- o are penalties exacted on those who produce bad units.

PHYSICAL FACILITY INFORMATION

32. Description of type of work done

33. Floor area of building

34. Number of work pits

35. Number of buses now serviced at facility

36. Optimum number of buses that could be serviced at this facility

37. Total area of facility site

38. Area available for building expansion within site.

39. Describe any plans for improvement and/or expansion

    a) Immediate

    b) Longer term (3 to 5 years)

40. Describe physical condition of buildings and site

    a) Structurally
    b) Ventilation
    c) Lighting
    d) Water Supply
    e) Sewer Service
    f) Site drainage

41. What is main area of physical improvement needed in this facility?

42. What year was facility built?

I. Logistics

	A. Purchase/Acquisition/Manufacture where purchases are made for	% Manuf. in House	% Purchased or acquired International	% Purchased or acquired Local	% Leased
Please supply a copy of each form used by your organization in the acquisition of parts.	1. Vehicle (Buses, Trucks, Cars)				
	2. Major Units (engines, Transmissions, etc.)				
	3. Small Units (Injectors, Starters, etc).				
	4. Chassis Parts (Springs, Fans, etc)				
	5. Body Parts (Panels, sheet metal, glass, etc)				
	6. Tires				
	7. Batteries				
	8. Fuel & Petroleum Products				
	9. Cleaning Supplies				

	B. Storage Where are items stored	% at Central Stores	% at Engine Rebuild Shop	% at Operating Garage
Please supply a copy of each form used by your organization in parts storage - inventory forms, parts locations, etc.	1. Vehicles			
	2. Major Units			
	3. Small Units			
	4. Chassis Parts			
	5. Body Parts			
	6. Tires			
	7. Batteries			
	8. Fuel & Petroleum Products			
	9. Cleaning Supplies			

	C. Issue/Disbursement How are items issued a.To sub-storeroom b.to Final user	% by written requisi-tions	% by work order	% by verbal order	% no record
Please supply copies of Issue/Disbursement forms - requisition, receipts, work orders, perpetual inventory forms, etc.	1. Vehicles a. b.				
	2. Major Units a. b.				
	3. Small Units a. b.				
	4. Chassis Parts a. b.				
	5. Body Parts a. b.				
	6. Tires a. b.				
	7. Batteries a. b.				
	8. Fuel & Petrol Products a. b.				
	9. Cleaning Supplies a. b.				

	On order-not received	or less	days	days	90
	(1) Major Units				
	(2) Small Units				
	(3) Other Parts				
	(4) Tires				
	(5) Batteries				
	Vehicles out of service due to lack of:				
	(1) Major Units				
	(2) Small Units				
	(3) Other Parts				
	(4) Tires				
	(5) Batteries				

II Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated;

A. Structural Details:

Name & Manufacturer's Model: _____

(1) Engine _____
(2) Body _____
(3) Transmission _____
(4) Rear Axle/Differential _____
(5) Steering _____
(6) Seats _____

B. Mechanical Details:

(1) Type Engine (Diesel, Gasoline) _____
(2) Fuel Consumption _____
(3) Oil Consumption (100 km/Litre) _____
(4) Annual km's operated per unit _____
(5) " hours " " " _____
(6) Number of units operated _____
(7) Maintenance Cycle (interval between periodic inspections _____

C. Operational Details:

- Buses
  - (1) Length of Body (Meters) _____
  - (2) Width of Body (Meters) _____
  - (3) No. of passenger seats _____
  - (4) Maximum Passenger Capacity _____
  - (5) Conductor/Collector required? Yes _____ No _____

- Trucks
  - (1) Length of cargo compartment (meters) _____
  - (2) Width " " " " _____
  - (3) Is cargo compartment enclosed? Yes _____ No _____
  - (4) " " " covered? Yes _____ No _____
  - (5) Overall vehicle length (Meters) _____
  - (6) Maximum capacity (Kilos) _____

FINANCIAL AND ECONOMIC INFORMATION

1) Consolidated Balance Sheet for last three operational years. Are accounts kept by calendar year or fiscal year?

2) Annual Budget for each company for 1976, 1977, 1978 and 1979. Are the accounting methods uniform for all companies.

3) Detailed budget for maintenance, for each company and each individual maintenance facility.
   including:
   (a) overhead costs - administration, maintaining plant and equipment, water, electricity.
   (b) operational costs - salaries of maintenance workers, costs of supplies materials used in repair.

4) Allocation to each facility for tools.

5) Allocation for each facility for spare parts and percentage of these imported from abroad.

6) Procedure for determining maintenance budgets
   (a) internal system for initiating, reviewing and approving the budget
   (b) Contingencies allowed for
   (c) manner in which maintenance needs are estimated (routine servicing, scheduled overhauls, unforseen breakdown)

7) Adequacy of budgetary allowance for maintenance needs. (What is the hierarchy of needs - better salaries, training, shop equipment, spare parts, physical facilities).

8) Frequency of inability to spend funds allocated to maintenance because of funding or cash flow problem.

9) Schedule for vehicle acquisition and cost of these vehicles (for past 5 years and plans for next 2 years)

10) Size of vehicle fleet - manufacture, age, condition and estimated useful life

Manufacture	Year	Condition
		____Good
		_____Fair
		_____Poor

11) Average cost of maintaining vehicle on a yearly basis (1976-1979)

12) Average time/vehicle in maintenance facility per year, and intervals of scheduled service.

13) Time out of service due to shortage of parts; number of vehicles cannibalized for parts (year of vehicle and condition (1976 - 1979).

14) Average revenue/bus/year over major routes (intercity) or on system wide basis (intracity) (1976 - 1979).

15) Speed of average bus over major routes (intercity or on system for intracity operation. (1976 - 1979).

16) Average ridership and kilometer run on buses per year (1976 - 1979). Number of hours operated; number of average trips bus/yr.

17) Average yearly operational cost (1976 - 1979)

18) Number of new vehicles acquired per year and number scrapped (type and age) 1976 - 1979.

TECHNICAL AND FEASIBILITY STUDIES
VEHICLE MAINTENANCE
ORGANIZATION, POLICIES AND PRACTICES

Information Needs

The information needed, at this stage of the study, for the elements of Organization, Policies and Practices, and Financial, will be indicated by the following comments. This is not an all-inclusive listing; any additional information available and considered even possibly useful will be appreciated at this or any time.

Organization

For this study, the organization must be studied from two viewpoints. The first will be the relationships of all major units to each other, including but not limited to vehicle maintenance. This is essential to provide an over-all perspective. The second viewpoint will be a more detailed review of the sub-units making up the vehicle maintenance organization.

For the major organizational units, the following information is needed:

1. Organizational Charts : in block and line format to illustrate relationships between organizational units. Direct authority would be designated by a solid line. Staff, or advisory, assistance would be indicated by a dashed line. Note that it would not be necessary to arrange these charts by the "levels" related to salaries.

   In addition to the name of the unit, each block on the chart should be identified with a number so that the following information can be supplied accordingly for each organizational unit on:

2. <u>Listed Information</u>:

(a) Description of the functions and responsibilities of the unit;

(b) Total number of personnel in each unit;

(c) Titles, or positions, in each unit, with the number of people holding each; indicate whether incumbents are, or are not, members of the General Trade Union of Land Transport Workers (or are eligible for membership).

(d) Total amount, paid in salaries on an annual basis, to all personnel in the unit. Please note that "first level" positions such as Chairmen, etc., may be excluded from this provision.

(e) The minimum and maximum monthly salary levels within the unit. Again, this does not apply to "first level" positions.

(f) The annual personnel "turnover" rate for the unit. This is a ratio obtained by dividing the number of persons who have terminated within the past year by the average number of employees during the same year.

If the information for items (b) through (f) can be provided for the years 1977 and 1978 in addition to the current date in 1979, this would be of maximum value for the study. However, if obtaining the past years' data will appreciably affect the preparation time, we would appreciate obtaining the 1979 date at the earliest possible time.

For the maintenance unit, the following information is needed:

1. <u>Organizational Charts</u> : This would be similar to the above format but would present the detailed sub-units of the [illegible] Vehicle Maintenance units. All separate locations should be illustrated as individual units. Each block on the chart should also be identified with a number, so that

the following information can be supplied accordingly for each unit:

2. Listed Information:

(a) Description of the specific functions and responsibilities of each unit. This would include the particular types and quantities of vehicles for which the unit is responsible; the type of staff, or advisory, service being provided; the amount of monies for which responsible, etc.

(b) Geographic location, or address.

(c) Titles, or positions, in each unit, or skill classification, with the number of people holding each; the basic salary levels for each position; the average additional payments in the form of bonuses, incentives, etc., for each position; and the average length of service with the company for each position.

(d) Training requirements for each position : Mandatory training before employment; length of subsequent service required; mandatory training after employment; optional available training after employment; any salary increases bonuses, or other incentives to encourage continued training. Qualification testing procedures for new employees; for advancement.

3. Measures of Efficiency

(a) What measures of efficiency are used, for each unit, by the next higher level of management or supervision? How often are these reviewed? Are objectives established? Are they made a basis for any bonuses or other incentives?

(b) What measures of efficiency are used by direct supervisors of skilled maintenance workers? (Questions similar to above would be applicable).

4. "Work Order System"

(a) How are the daily work needs documented? How are the results documented?

(b) Samples of all "work order system" documents, including blank forms and completed forms.

APPENDIX II

SAMPLE DETAILED QUESTIONNAIRES

APPENDIX II

DETAIL QUESTIONNAIRES

IN-DEPTH VEHICLE MAINTENANCE INFORMATION SURVEY

1. Show average daily number of buses in each of the following categories, by type of bus. Monthly for last two years.

   In service

   Periodic maintenance

   Under repair

   General overhaul

   Awaiting repair

   Standby

1a. Describe reasons why buses are awaiting repair.

2. Show the number of vehicle breakdowns in each of the following categories, by type of bus. Monthly for last two years.

   Engine

   Alternator/Generator

   Starter Motor

   Other electrical

   Gear box

   Clutch

   Steering

   Drive shaft

   Rear axle/differential

   Leaf springs

   Brakes

   Tires

   Other

2a. Provide average length of vehicle downtime for each of the above categories.

3. Parts Availability

   Provide average length of time required to receive ordered parts by the following categories.

   Major units (engine, transmission, differential)

   Small units (generator/alternator, starter, fuel pump)

   Other items

   Tires

   Batteries

   Provide average length of out of service time caused by lack of parts in the same categories.

160

4. Vehicle Productivity

Provide monthly totals of the following by vehicle type, for last two years.
Scheduled bus hours

Actual operating bus hours

Scheduled kilometers

Actual kilometers

5. Provide annual percentage of parts turnover by major component and by type of bus.

6. Annual costs for:

Administration

Maintenance of plant and equipment

Water and electricity

Building repair or new construction

Management salaries

Workers salaries

Spare parts

Fuel, oil, grease, tools

6a. Annual costs by major activity

Operations

Maintenance

Repair of vehicles

7. Ages of vehicles by types

8. Value of spare parts acquired and percentage imported

9. How is budget for the coming year estimated?

What guidelines are used to predict labor and parts requirements?

10. Monthly ridership for the last two years

11. Any information relating operational and maintenance costs to age of vehicle

12. Average monthly manhours for technical workers per vehicle by bus type for last two years

13. Average number of managers, foremen, supervisors and workers in each shop, in each shift, For each quarter of last two years

14. Average number of workers in each skill category in each shop. For each quarter of last two years.

15. For each technical worker define:

    a. Skill classification

    b. Any training programs attended (Apprenticeship, formal training, on-the-job training, vocational school)

    c. Date last training was completed

    d. How long employed at this facility

    e. Total years of employment

16. At what time of day or on what shift are the following maintenance activities performed:

    a. Inspection of vehicle

    b. Periodic maintenance services

    c. Periodic component replacement

    d. Corrective repairs

17. Provide number, duration, and time of day of power outages at this facility during last two years.

18. Provide present illumination level in foot candles or lumens in each working area or shop

19. Provide drawing to scale of the facility showing existing use of all areas. Also show availability of compressed air, water and drainage system.

20. What floor cleaning resources are presently available in each area.

MAINTENANCE EQUIPMENT

Maintenance equipment is divided into two categories "General Purpose Equipment" and "Special Purpose Equipment"

GENERAL PURPOSE

21. Describe the maintenance equipment available in the shops

    a) Machine tools (lathes, mills, grinders, cutters, drills)

    - Type
    - Make
    - Quantity
    - Age
    - Capacity

b) Sheet Metal tools (shears, brakes, presses)

- o Type
- o Make
- o Quantity
- o Age
- o Capacity

c) Cutting & Welding (Arc welders, gas welders, spot welders)

- o Type
- o Make
- o Quantity
- o Capacity
- o Age

d) Lifts

- o Chain hoists; capacity and number
- o Hydraulic lifts; capacity and number
- o Pneumatic lifts; capacity and number

e) Other

22. Describe the Special Purpose maintenance equipment available in the shops:

a) Engine Maintenance and Overhaul

- o Engine lifts; capacity and quantity
- o Cylinder Boring Mill; capacity and quantity
- o Valve Grinder; capacity and quantity
- o Crankshaft grinder; capacity and quantity
- o Fuel Pump and Injector Benches; quantity
- o Jigs and fixtures

b) Transmission Maintenance and Overhaul

- o Gear cutters
- o Jigs and fixtures

c) Differential

- o Gear cutters
- o Jigs and fixtures

d) Suspension and Steering

- o Bushing presses
- o Bearing presses

163

e) Brakes

- o Cylinder rebuild benches
- o Drum Lathes

f) Electrical

- o Rotor turning
- o Collector/Commutator turning
- o Rewinding benches

23. Identify and describe general service equipment used for maintenance and overhaul purposes:

a) Wash racks ------Quantity

b) Lubrication racks ---- Quantity

c) Compressed air systems ----- Pressure

d) Hydraulic systems ---- Pressure, pumping rate

e) Cleaning systems ----- Type, quantity

24. Identify types and quantities of testing and trouble-shooting equipment in use by Facility

- o Engine analyzers
- o Dynamometers
- o Brake Testing Machines
- o Front-end Alignment Tester
- o Other

25. Provide general plans or diagrams for this facility showing:

a) Equipment layout in each shop

b) Process flow through total facility and in each shop.

26. Identify whether shop is set up on basis of:

- o Production line
- o Station
- o Line and station

27. Describe special tools that are stocked for each operating component. Define:

- o Type component
- o Type tool
- o Quantity
- o Replacement rate of tool
- o Location of tools

28. What is annual budget for:

- o Maitenance of shop equipment
- o Special tools.
- o General hand tools
- o Shop reference manuals
- o Shop training manuals

29. What is the percentage of time that maintenance equipment is available to perform its function. Indicate this information for each type of equipment described in items 21, 22 and 23. Indicate, by type, the average down time whenever maintenance equipment is out of service

30. In what manner is quality control exercised over maintenance activity.

Organization:

1. What are your three major responsibilities

1a. What is your least important responsibility

2. How many subordinates do you have?

2a. How many are managers and supervisors?

3. What are your three major activities and what percentage of your times does each take?

3a. Do you attempt to reduce the proportion of time any of them use up?

4. Do you have a job description outlining the duties and responsibilities of your position?

5. How does your unit contribute to achieving the objectives of the company?

6. Do subordinate managers have clearly defined descriptions of their duties and responsibilities, i.e. what they can do independantly without going to their immediate supervisor.

Planning, Review, Delegation

1. What are the objectives of the company as you see them.

Short Term

Strategic

1a. For what portion of the short term and strategic objectives is your unit responsible?

1b. Have goals and objectives been attained in the past?

2. What is in store for the future of this company?

3. Are the second, third and fourth levels of management made aware of the objectives of the company?

3a. Are they given tasks in the areas of responsibility for the purpose of fulfilling company objectives?

4. Is one of the duties of your subordinate managers to establish goals and develop plans to achieve those goals within a specified period of time? (To fulfill the portion of company objectives they are responsible for).

5. After subordinate managers are assigned tasks, what system is used to review the plans they develop to complete these tasks?

5a. What about reviews of their progress toward completing the tasks once the plans they develop are approved? Is there a time limit?

167

6. Do you have a replacement in mind if you get promoted?

7. Of your subordinates, which 3 would you rate best and why?

Planning, Review, Delegation

1. How much flexibility do you have in decisions?
   i.e. what can you do without going to top management?

   - Discipline?

   - Change a procedure?

   - Dismissal?

Control

1. What are the 3 most typical problems that occur from week to week?

1a. Have policies been established to cope with them?

1b. Can you suggest a solution for any of these problems?
   Can you propose this solution to your superiors?

Motivation

1. What sort of performance incentives exist for 2nd, 3rd and 4th level managers.

2. Are 2nd, 3rd and 4th level managers evaluated on a regular basis?

3. Is there a reasonable expectation that good performance will be rewarded with promotion?

Communication

1. Are periodic meetings held with subordinate managers?

   a. How often?

   b. Who attends?

   c. What is discussed?

2. How are 2nd, 3rd and 4th level managers made aware of company objectives and departmental goals to fulfill these objectives?

3. How does a subordinate manager communicate problems upward to higher levels of management?

Management Training

1. What sort of management training is available to 2, 3, 4, 5th level managers?

2. Would you suport a specialized management training program for middle management?

170

APPENDIX III

SUMMARY RESULTS OF QUESTIONAIRE SURVEYS

APPENDIX III

C.T.A.

RESPONSES TO MAINTENANCE SYSTEMS QUESTIONNAIRE

1) Describe generally the definition used by your organization for:

- Repair facility
- Maintenance facility
- Overhaul facility

C.T.A

1a) Describe generally the definition used by your organization for:

- Repair facility
- Maintenance facility
- Overhaul facility

Repair:

Repair of vehicles with defects - repair is done by two groups of workers, one group for simple defects - the other one for repairing the intermediate parts. There is another special group for the sudden breakdown of vehicle (this is done in all branches).

Maintenance :

It is according to a plan of making a periodic maintenance for the vehicle every 14 days. (This is done in all branches).

Overhaul:

Overhauling of vehicle and major parts is done in the central workshops, a complete overhauling for each vehicle every 30 months and every 12 months for the renewing of vehicles.

2) For each of the above, what criteria are used for initiating repair, maintenance or overhaul:

o driver complaint o testing program o mileage
o time in service o others

o Repair:

- Driver complaint
- Daily inspection

o Maintenance:

- Time in service

o Overhauling:

- Testing program
- Time in service

3) Describe preventive maintenance inspections that are performed on a daily basis:

a) before operation b) during operation c) after operation.

a) before operation:

- Inspection of guages
- Checking brakes
- Checking level of oil and water
- Checking of leakage of fuel.

172

b) during operation:

- Check belts - tires
- Be sure that there is no leakage of water

c) after operation:

- Check all mechanical and electrical parts
- Check oil level
- Check tightening of bolts of spring

4) By whom are the inspections performed?

Inspections are performed by workers who are trained to do so.

5) What is done to correct any defect?

If these defects happen during bus operation, special group of workers correct these defects - and other group of workers correct these defects if this is noted during inspection,

6) Describe periodical maintenance services that are performed on the following basis:

a) weekly b) monthly c) by kilometers

Periodic maintenance is done every 14 days i.e. 4000 km running distance.

7) Describe the causes of vehicle downtime in the following area:

a) Engine b) Transmission c) Differential d) Brake system
e) Steering system f) Cooling system g) Fuel System
h) Electricity

a) <u>Engine:</u>

o Temperature over-rise
o Fuel, oil or water leakage
o Defects on engine feeders

b) <u>Transmission:</u>

o Mistakes of the driver
o Sudden breakdown or clutch breakdown

c) <u>Differential:</u>

o Sudden breakdown inside the system

d) <u>Brake system:</u>

o Breakdown of compressor or any valves
o Sudden braking action

e) <u>Steering system:</u>

o Damage of belts
o Sudden damage of the steering pump

f) Cooling system:

- o Damage of fan belts
- o Damage of water pump
- o Damage of radiator

g) Fuel system:

- o Impurities in fuel resulting in quick damage of filters and obstruction of the system
- o Fuel leakage
- o Damage of engine feeders

h) Electrical:

- o Damage of starter or the dynamo belts

8) Indicate the average length of downtime for each item indicated above:

a) Engine:

simple breakdown	1 - 1.5 hrs
intermediate breakdown	2.5 - 3.0 hrs
engine replacement	6.0 hrs

b) Gear box:

simple breakdown	1.0 hour
intermediate	2.0 - 2.5 hrs

c) Differential: 1.0 - 1.50 hrs

d) Brake system:

simple breakdown	1.0 - 1.5 hrs
intermediate	2.5 - 3.0 hrs

e) Steering system: 0.5 - 1.0 hrs

9) Describe those mechanical failures that are attributable to vehicle accidents:

- o Failure of brake system
- o Steering system failure
- o Sudden blow-out of front wheel

10) Describe what vehicle breakdowns that are attributable to the driver:

No answer

11) Describe your driver's training program:

Drivers are trained for three months in the C.T.A. Training Center

- o How to treat people
- o How to keep the vehicle from the breakdowns
- o Necessary rules to follow them before, during and after operation

12) Describe incentive program for operators with the best driving records:

- o Income incentive
- o 6 LE (max) for the driver who makes more number of trips

13) What vehicles are put on easy routes or are they rotated over various routes:

Every branch has its own vehicles which are operated on its routes

14) What is the average life by type of vehicle:

Average life of vehicle is generally about 7 years

15) Are service items always available?

Yes, oil filters, fuel filters, air cleaner cartridges are always available

16) Are spare parts and/or assemblies available from direct exchange for use in periodic maintenance:

Yes, fuel pumps, fuel injectors, water pumps, electric generators, voltage regulators are always available

17) No answer

18) No answer

19) No answer

20) No answer

21) No answer

22) Identify whether shop is set up on basis of

- o Production line
- o Station
- o Line and station

C.T.A shops are as follows:

<u>Nasr Central shops</u>:

- o Engine rebuild line
- o Station for other units and vehicles

<u>Ameria Shop:</u>

- o Production line
- o Station for rework units especially engine and gearbox

175

23) Provide a list of maintenance and repair manuals, overhaul manuals and maintenance/overhaul specifications available at each facility. Define for each:

- o Type
- o Edition date
- o Quantity
- o Location of manuals in facility

- maintenance/repair catalogs provided with vehicles by the concerned manufacturer

  instructions concerning any alteration as regards repairs/ maintenance operation issued by technical affairs planning department
- two copies of manufacturers' catalogs
- two copies of repair/maintenance manuals are kept in each branch and workshop

24) Provide a list of parts catalogs, periodic factory bulletins, and other reference and instructional material in the facility and shops

Provide the following information about each:

- o Type
- o Edition date
- o List of changes and effective dates
- o Location of material in facility and shops

We have:

- vehicle spare parts catalog according to type of vehicle
- technical instructions issued by the technical affairs on various time

25) Provide one copy of each form used to control record maintenance and overhaul activity for each facility.

Provide brief description of the flow of paperwork indicating point of origin.

Who exercises quality control and ultimate destination of form.

Some copies are attached.

26) Describe what general hand tools are available,in what sizes, quantities, where stored and how controled:

No special tools are stocked, only the following are available:

- o One set of special tools for each operating component of the branch
- o One set of special tools for particular components in the workshop.

27) Describe how special tools are controlled:

No specific rules for controlling the special tools.

28) Describe what general hand tools are available, in what size, quantities - Where stored and how controlled:

176

General hand tools available are: spanners, pliers, screwdrivers, hammers, etc.

29) What is the purpose of the annual budget?

- o Maintenance of shop equipment?
- o Special tools
- o General hand tools
- o Shop reference manuals
- o Shop training manuals

No Answer

30) What is the percentage of time that maintenance equipment is available to perform its function. Indicate this information for each type of equipment described in items 17, 18, 19. Indicate, by type, the average downtime whenever maintenance equipment is out of service.

No time can be estimated but the percentage of time that maintenance equipment is available to perform its function depends on how they are maintained.

31) In what manner is quality control exercised over maintenance activity. For example:

- o What percentage of repaired parts are inspected
- o What percentage of rebuilt assemblies are tested
- o Are incentives awarded to workers that produce good units.
- o Are penalties exacted on those who produce bad units

- 100% of the repaired parts are inspected
- incentives are awarded to workers (according to the activity and productivity)
- penalties are exacted on those who produce bad units.

PHYSICAL FACILITY INFORMATION

32) Description of type of work done:

- o Operating buses with the performance of necessary repair/maintenance
- o Type of work done by workers is to execute required overhaul and maintenance and repair

Name of Branch	Type of work done
NASR	Operating & Maintenance
FATH	"
AMERIA	"
GISR EL SUEZ	"
EL MAZALAT	"
EL TERRA	"
EL MOUNIB	"
GIZA	"
IMBABA	"
ATHAR EL NABI	"
EL BASATEEN	"

WORKSHOPS

NASR CENTRAL WORKSHOP	Complete overhaul
AMERIA WORKSHOP	Unit Overhaul
EL QUOBA	Vehicle Overhaul
BOULAC WORKSHOP	Vehicle Overhaul

33) Floor area of building

NASR BRANCH	27765 m^2
FATH BRANCH	21498 "
AMERIA BRANCH	11439 "
GISR EL SUEZ	22183 "
EL MAZALAT	17506 "
EL TERA	9177 "
EL MOUNIB	19667 "
GIZA BRANCH	5340 "
IMBABA BRANCH	18955 "
ATHAR EL NABI	15029 "
EL BASATEEN	20745 "
NASR CENTRAL WORKSHOP	14820 "
AMERIA	5633 "
EL DOUBA	
BOULAC	

178

34) No. of work pits

No answer

35) Number of buses now serviced at facility

	No. of running buses	No. of total buses
NASR BRANCH	133	198
FATH BRANCH	147	177
AMERIA BRANCH	100	163
GISR EL SUEZ BRANCH	110	163
EL MAZALAT BRANCH	166	197
EL TERRA BRANCH	175	216
EL MOUNIB BRANCH	155	193
GIZA BRANCH	60	75
IMBABA BRANCH	130	171
ATHAR EL NABI BRANCH	106	135
EL BASATIN BRANCH	160	200
NASR CENTRAL WORKSHOP		
AMERIA CENTRAL WORKSHOP		
EL QOUBA CENTRAL WORKSHOP		
BOULAK CENTRAL WORKSHOP		

36) Optimum number of buses that could be serviced at this facility:

NASR BRANCH	215 buses
FATH BRANCH	200 "
AMERIA BRANCH	200 "
GISR EL SUEZ BRANCH	207
EL MAZALAT BRANCH	199 "
EL TERRA BRANCH	130 "
EL MOUNIB BRANCH	175 "
GIZA BRANCH	65
IMBABA BRANCH	221 "
ATHAR EL NABI BRANCH	163
EL BASATIN BRANCH	210

38). Area available for building expansion within site

(Nothing)

39) Describe any plans for improvement needed in this facility?

(Nothing)

No answer for the rest.

180

EAST DELTA	WEST DELTA	MIDDLE DELTA	UPPER EGYPT
o **Repair** it is the repairing of the sudden breakdown. o **Maintenance** a periodic daily maintenance for checking the oil level, cooling liquid, draining the moisture from air tank, electricity and battery water level. a periodic complete checking of all parts and groups o **Overhaul** it is the complete overhaul of engine and renewing the bus chassis and checking electricity cycles.	o **Repair** it is the excution of information delivered by the driver about his bus. o **Maintenance** it is according to the distance travelled by the vehicle (lubrication, chaging parts adjustment and fixing the different parts. o **Overhaul** overhauling for engine (after 250,000 km) for body (in case of accident and in case of annual renovation.		o **Repair** 2 kinds of repair: 1) with periodic maintenance 2) partial repair in the workshops in the branches like repairing of gearbox, differential, clutch -- (if there is emergency breakdown) o **Maintenance** there is 1) daily maintenance 2) routine maintenance (weekly monthly or every 2 months) o **Overhaul** major overhaul for engine, gearbox, differential and clutch overhauling of springs -chassis springs and suspension body overhaul maintenance and repairs are performed by groups of skilled workers.

2) For each of the above, what criteria are used for initiating repair maintenance or overhaul o driver complaint o testing program o mileage o time in service o other.

EAST DELTA	WEST DELTA	UPPER EGYPT
driver complaint according to the daily inspection mileage time in service (it is related to the run kilometers) others : accidents, sudden breakdown ---	**Repair** driver complaint field test **Maintenance** every 14 days **Overhaul** engine overhaul (after 250,000 km) for the body and the others (in case of accident)	**Repair** driver complaint daily inspection before & after operation distance travelled time in service **Maintenance** distance travelled time in service (it differs according to type of vehicle, services and road condition) **Overhaul** periodic testing program emergency brakdown of engines or major parts renovations of body & chassis are performed according to an annual programs.

EAST DELTA	WEST DELTA	MIDDLE DELTA	UPPER DELTA
Before operation check oil level check cooling liquid check air pressure of brakes check the oil indicator check the head lamp **During operation** check air pressure of brakes check oil indicator check engine temperature check the head lamps **After operation** check oil level check the cooling liquid check air pressure check engine temperature check the head lamps	**Before operation** check oil, fuel and water level check tire pressure check light inside and outside check belts check brakes washing and cleaning the vehicle **During operation** making the periodic maintenance changing oil and making the required lubrication in time **After operation** perform the required repairs and check the driver complaint		**Before operation** checking of oil and water level checking of the belts tension checking of tire pressure operating engines, to be sure that no abnormal sound is heard checking all lights of the vehicle check the brakes check all indicators in the panel check all oil and fuel connections **During operation** review all indicators watch the warning system check the mechanical system on the final station **After operation** check oil level, compressor, pump, air system and connection check the free length of clutch and brake pedal check the chassis and steering check foot and hand brakes check suspension system of vehicle

4) By whom are the inspections performed?

this is done by the responsible foreman under the supervision of the responsible engineer (before operation) during operation; it is performed by the driver and he is reporting for any sudden faults in the bus	by superintendent and his assistants under the supervision of the responsible engineer		this is done by the vehicle inspector who is checking the fitness of all parts of the vehicle - he also receives the driver's complaints and checks it before sending it to the responsible engineer

the foreman determines the faults and asks the mechanics to do the required repair (if using the main parts) - if using new spare parts it is the responsibility of the engineer to make this decision and tell the foreman, who is responsible for completing the repair.

as soon as any defect is noticed the vehicle is reserved and the operation department is informed and the defects are corrected.

the vehicle [illegible] to the concerned department in the workshop according to the kind of defects [illegible] by the responsible [illegible]. The supervisor [illegible] chief of the workshop checks the repairs the inspector makes the required tests before giving the vehicle to the driver

6) Describe preventive maintenance inspection that is performed: weekly - monthly - by kilometers:

considering kind, efficiency of bus cooling system (air-liquid) and condition of route, the kilometer run is determined - and transferred into days of maintenance;according to this a monthly system is performed for maintenance - thus the system is not weekly but by kilometers according to a monthly program

Weekly

this is done twice/week

lubrication, cleaning, changing oil, checking belts & oil pressure

Monthly

adjusting of rocker arms

changing of radiator water, fuel and oil filter packing

inspecting the dynamo, starter the injector parts (2 months)- oil pump and changing of fuel & oil traps (4 months)

changing crown oil, gearbox oil every 3 months

By kilometer

changing of engine oil every 4500 kilometers

SEE MAINTENANCE MANUAL ATTACHED

7) Describe the causes of vehicle downtime in the following areas: engine - transmission - differential - break system - stearing system - cooling system - fuel system - electrical system.

here is just to mention % downtime for: engine 38%-power transmission 16% differential 5% - brake system 12% stoering 3% - cooling system 2% fuel system 14% - electrical system 10%

a) engine: non-functioning performance
engine knocking
low oil pressure

b) transmission: gearbox noise
oil leakage
difficulties when chaging gear
gear control lever trouble

c) differential:
noise in crown
oil leakage

d) brake system:
loose pedal
out of true wheels
rise in temperature
vehicle swerving

183

e) steering system:
- steering wheel
- backlash
- front wheels flutter
- damage of steering oil pump
- clutch slip or non functioning

f) cooling system:
- rise in engine temperature
- noise from water pumper fan
- belt damages
- water loss

g) fuel system:
- obstruction of the circulation
- over-consumption of fuel

h) electrical system:
- engine breakdown
- non-efficiency of starter
- short circuit
- salted battery
- damage in voltage regulator

8) Indicate the average length of down time for each item:

It is difficult to indicate length of downtime for this reason:
- spare parts are not available always (main reason)
- when the no. of breakdown is more than the efficiency of the workshop
- shortages of tools
- shortage of the skilled workers

if the spare parts are always available this length of down time can be given

engine - 10 days

transmission : ½ - 1 day

brake system : 1 - 4 hours

steering system : 2 hours - ½ day

cooling system: 1 day

fuel system : 1 hour - ½ day

electrical system : 1 - 3 hours

9) Describe those mechanical failures that are attributable to vehicle accident:

brake faults

the front wheel tires faults

starter faults

blowing out of tires

sudden brake failure

blowing out of one of the front tires

fracture of one of the front wheel rims

defects of brak system like sudden damage of brake cylinder or fracture of front drum

a short circuit that causes fire in the vehicle

EAST DELTA	WEST DELTA	MIDDLE DELTA	UPPER EGYPT
these breakdowns occur because of the inadequate training of the driver or his lack of attention to his instruments and proper application of brakes	engine failure as a result of continuous driving with the high temperature of engine transmission breakdown due to improper operation		major engine troubles due to driving on with abnormal noise or with low oil pressure shown by the indicator fracture of gearbox because of the incorrect transmission and improper meshing quick wear of roller bearing, cylinder lining -- due to the continuous foot pressure on clutch pedal on rough roadway, and this may also damage the brake cylinder rubber cups
11) Describe your driver's training program. this program is 1 month (150 hours) to raise the skill of drivers who have driving licenses. 1st theoretical program:60 hours traffic & driving rules administration & organization fire protection, ambulance and safety 2nd applied program : 90 hours 20 hours - training on the workshop	NO ANSWER		a periodic training program for the drivers (especially the beginners) is performed in the training center where they are trained on the new vehicles. Also, how to make small repairs on their vehicles - during this period also they are instructed on the rules of driving and how to avoid accidents.
12) Describe incentive program for operators with the best driving records. We have no such program at present - but we give bonus as follows: a) income bonus:3% of the daily income (for the good treatment of passengers-respecting stations and for keeping time) b) activity, bonus:5% of the extra daily income fixed by the company for each route c) bonus for maintenance: for keeping his bus in good working condition for a month without accidents d) a bonus between 5-10 or 15 LE for keeping the bus engine working for a certain number of kms without overhauling.	NO ANSWER		15% - reward for no accidents 5% - for income increase 10% - group operation 15 LE - monthly, if fulfilling number of scheduled trips in a vehicle 4 years old 2.5 LE- similar for vehicles 4-8 years old 3.5 LE- more than 8 years old 20 LE - incentive for maintaining the engine

EAST DELTA	WEST DELTA	MIDDLE DELTA	UPPER EGYPT
the new vehicles are usually operated on paved routes - the old buses are operated on other routes	Mercedes (Germany-Iran-Turkey) type and also Pigaso are put on desert road and agricultural highway - the other types (Ward-Nasr-Barrieros and Tata) operate on other different routes		Ward buses and Tata are operated on the agricultural roads Nasr type are operated on asphalt paved roads Mercedes are operated on express and desert roads

14) What is the average life by type of vehicle?

EAST DELTA	WEST DELTA	MIDDLE DELTA	UPPER EGYPT
the average life is considered to be 8 years - it reaches up to 18 years because of the shortage of buses - the life of a bus depends on these reasons: bus industry operating conditions (load-kilometers run and nature of route) availability of spare parts	Mercedes (Turkey) less than 1 yr " (Germany) 4 years " (Iran) 3 - 4 years Tata 6 - 8 years Pegaso 6 - 8 years Ward 1 - 2 years Nasr (Kuwait) upto 11 years Nasr (Egypt) 9 years Nasr 10 - 17 years Barrieros 10 - 14 years Hino 6 years Fab 13 years		the assumed average life of a vehicle is 5 years - some vehicles are operated more than 8 years - for example, Nasr type is operated for 18 years at present

15) Are service items always available? a) oil filters b) fuel filters c) air cleaner cartridges?

EAST DELTA	WEST DELTA	MIDDLE DELTA	UPPER EGYPT
all service items are available in all the company stores	oil and fuel filters are available in the stores of Alexandria, Damanhour and Cairo. The air cleaners are available in the central and branch workshops. The other branches will be supplied by moving compressed air cylinders		they are all available in all the facilities of the company

16) Are spare parts and/or assemblies available from direct exchange for use in periodic maintenance: a) fuel pumps b) fuel injectors c) water pumps d) starter motor e) generator/alternator f) voltage regulator.

EAST DELTA	WEST DELTA	MIDDLE DELTA	UPPER EGYPT
spare parts are available in all the company branches for maintenance	fuel pumps, injectors and water pumps are stored in the central stores. They are issued as per branches' request-Generators and voltage regulators are available in work site		central stores are always supplied with spare parts of major units as well as equipment. The some of branches are supplied also with various parts according to the number of vehicles in each facility

Best Available Document

17) Describe the maintenance equipment available in the shops:

EAST DELTA	WEST DELTA	MIDDLE DELTA	UPPER EGYPT
lathes milling machines grinding machine cutters drills shears brakes presses electrical welding gas welding spot welding chain hoists hydraulic lifts pneumatic lifts lifting kack	metal lathe drum lathe center lathe metal boring lathe metal milling machine cylinder turning lathe cylinder grinder crankshaft grinder valve grinder injector needle grinder fuel pump adjusting device injector tester electrical drill electrical bench drill radial drill bobbing and dynamo tester battery charger frequency metal saw frequency wood saw brake lining riveting machine hydraulic press air pump tester connecting rod tester connecting rod servicing machine wheel balancing device fuel filter vehicle washing machine sheet metal shear water lifting pump solar lifting pump sheet metal straightening machine valve grinder cylinder head grinder planning machine electric drill fork truck 3 tons hydraulic mobile wench hoisting tackle lifting jack compressed air tank arc welder welding transformer internal tube cementing device		NO ANSWER

EAST DELTA	WEST DELTA	MIDDLE DELTA	UPPER EGYPT
engine lifts cylinder boring drill cylinder grinding drill cylinder grinding crankshaft chain hoists hydraulic lifts lifting jack fuel pumps and injector benches jigs and fixtures gear cutters jigs and fixtures bushing presses bearing presses cylinder rebuild benches crum lathes rotor turning collector/commutator turning rewinding benches	SEE LIST ABOVE		NO ANSWER

19) Identify and describe general service equipment for maintenance and overhaul purposes.

a) wash racks b) compressed air system c) lubrication racks d) hydraulic system e) cleaning system	SEE LIST ABOVE		NO ANSWER

20) Identify types and quantities of testing and trouble-shooting equipment in use by facility.

engine test analyzer dynamometer brake testing machine front-end alignment tester tester of volts & ampere machine	engine analyzer) dynamometer) brake testing machine) front end alignment) fuel pump adjusting device injector tester	they are not available	We have an engine analyzer for each region but uptil now it is not operated front-end alignment tester has not been operated 3 wheel balancing units still in customs fuel pump adjusting device injector adjusting device cylinder internal pressure control device dynamo and starter tester pressure guauge for steering system crankshaft hardness tester connecting rod alignment tester crankshaft straightening tester

188

[illegible]	WEST DELTA	MIDDLE DELTA	UPPER [illegible]
[illegible]	NO ANSWER		NO ANSWER
[illegible] on basis of - production line -			our shops are set up on the basis of - station - maintenance center
[illegible] set up [illegible]	the central workshops are set on basis of production line fulfilling the requirements of the branches in addition to a station service		

23) Provide a list of maintenance and repair manuals, overhaul manual and maintenance/overhaul specifications available.

[illegible]nance and spare parts
[illegible] are kept in all
[illegible] and workshops
[illegible] (Iran-Tata)

NO ANSWER

24) [illegible] list of parts catalogs, periodic factory bulletins and other [illegible] instructional materials in the facility and shops

[illegible] spare parts
[illegible] in all branches
[illegible]

NO ANSWER

spare parts catalogs:

Iranian Mercedes
O:360 1975

German Mercedes
O 302 Body 1975

Ward (intercity transit bus)
Cat 3208 Engine 1977

Carrieros (Auto-bus)
SAMTA 75/DA-020166 : 196[illegible]

Mercedes Tata:
engine model O[illegible] (187[illegible]
chassis model [illegible])

Nasr:
engine model F6L[illegible]14) 1961
chassis model SATURN)

they are all kept in the outside purchasing dept.

Best Available Document

EAST DELTA	WEST DELTA	MIDDLE DELTA	UPPER EGYPT
NO ANSWER	NO ANSWER		NO ANSWER
26) Describe how special tools are controlled: a) availability b) quality. Special tools are controlled (availability & quality) by the engineer who is responsible for the workshop or the branch through a periodic inspection of these tools	NO ANSWER		Necessary arrangement for their safety and maintenance are put into consideration. They are kept in special boxes
27) Describe what general hand tools are available - in what size, quantities, where stored and how controlled. General hand tools are: open end spanners (all sizes) adjustable spanners (all sizes) pincers pliers saws hammers all of these tools are available in all branches and workshops			general hand tools are: spanner sets adjustable spanners files -pliers - sludge hammers - hammers they are all kept in stores. The workers take what they need and keep them till they finish their work - everyday these tools are checked
28) What is the annual budget for: maintenance of shop equipment - special tools - general hand tools - shop reference manuals - shop training manual NO ANSWER	NO ANSWER		
29) What is the percentage of time that maintenance equipment is available to perform its function. NO ANSWER	NO ANSWER		
30) In what manner is quality control exercised over maintenance activity: a) what % of repaired parts are inspected b) what % of rebuilt assemblies are tested c) are incentives awarded to workers who produce good units d) are penalties exacted on those who produce bad unit. 100% of repaired parts are inspected 100% of rebuilt assemblies are tested those who produce good work are giving bonus according to the rule which was applied on 1/1/1977 those who produce bad units are penalyzed.	NO ANSWER		

EAST DELTA	WEST DELTA	MIDDLE DELTA	UPPER EGYPT
Ismailia garage : reparing Damietta " : repairing Benha " : repairing collecting scraped Mit Ghamr " : repairing Zagazig " : repairing Cairo " : repairing Port Said " : repairing Fagour " : repairing Suez " : repairing Mansoura " : repairing Tanta " : collecting scraped	Alex-Damanhour and Cairo: operating vehicles along particular lines performing vehicle maintenance, repairs and overhauling the central workshops at the H.Q. in Smouha in Alex performs also renovates the engine and manufacture locally some parts		NO ANSWER

32) Floor area of building:

Ismailia	: 1180 m^2	Alex Zone	: 800 m^2
Damietta	: 800 "	Marsa Matruh	: 200 "
Benha	: 1820+1260 m^2	Damanhour	: 560 "
Mit Ghamr	: 3800 "	Mahmoudia	: 80 "
Zagazig	: 4030 "	Shubrakhit	: 150 "
Cairo	: 3240 "	Rosetta	: 270 "
Port Said	: 4000 "	Kafr el Dawar	: 98 "
Fagour	: 1160 "	Abu Matameer	: 175 "
		Cairo branch	: 675 "

33) Number of work pits

Ismailia	: 2	Giza branch	: 5 pits
"new"	: 6	Fayoum	: 5 "
Damietta	: -	Helwan	: 5 "
"new"	: 4	El Saaf	: 1 "
Benha	: 6+3	El Gardaka	: 2 "
Mit Gamr	: 8	Beni Suef	: 5 "
Zagazig	: [illegible]	Magahga	: 1 "
Cairo	: 4	El Minia	: 5 "
Port Said	: 6	Asyut	: 2 "
Fagous	: 3	Sohag branch	: 5 "
Suez	: 6	Tahta	: 1 "
Mansoura	: 6	Quena	: 5 "
Central workshop	: 3	Abou Tesht	: 1 "
		Esna	: 2 "

EAST DELTA		WEST DELTA		MIDDLE DELTA		UPPER EGYPT	
Ismailia	: 70	Alexandria	: 189 buses			Giza	: 82 buses
Damietta	: 73	Damnhour	: 132 "			Helwan	: 32 "
Benha	: 85	Cairo	: 39 "			Fayoum	: 98 "
Mit Ghamr	: 85	Total	360			Red Sea	: 48 "
Zagazig	:178					Beni Suef	: 89 "
Cairo	: 77					Beni Mazar	: 50 "
Port Said	: 58					Minya	: 90 "
Faqous	: 65					Mallawi	: 31 "
Suez	: 58					Asiut	: 97 "
Asema	: 36					New Valley	: 27 "
Mansoura	:1[illegible]					Sohag	: 81 "
						Nagh Hamadi	: 27 "
						Quena	: 52 "
						Esna	: 22 "
						Aswan	: 59 "

35) Optimum number of buses that could be serviced at this facility:

Ismailia "under construction"	= 150 buses
Ismailia	= 75 "
Damietta "under construction"	= 150 "
Damietta	= 73 "
Benha	= 120 "
Mit Ghamr	= 120 "
Zagazig	= 200 "
Cairo	= 100 "
Port Said	= 100 "
Faqous	= 65 "
Suez	= 100 "
Asema	-
Mansoura	= 200 "

NO ANSWER

192

[illegible]	WEST DELTA	MIDDLE DELTA	UPPER [illegible]
[illegible] Kanal Garage: [illegible] m^2	Alex : 5 fed.+station		Giza branch : 9233.33 m^2
Ismailia (proposed) : 24,975 "	Cairo : 5152.69 m^2		Fayoum " : 12600 "
Ismailia : 2,660 "	Damanhour : 13542 "		Helwan " : 280000 "
Damietta : 19,539 "	(old) + station		El Saaf " : 4200 "
(under construction)	Damanhour : 6 fed.		El Gardaka " : 5400 "
Damietta (Existing) : 2,000 "	Marsa Matruh : 1000 m^2		Beni Suef " : 22000 "
Tanta : 6,000 "	Shubrakhit :		Nagahga Suef " : 1780 "
Mit Ghamr : 11,050 "	Mahmoudya : 1150 "		Minia " : 17000 "
Zagazig : 2,350 "	Kafr El Dewar : 300 "		Asiut " : 4853.5 "
Cairo : 5,225 "	Roseta : 1040 "		Sohag " : 10000 "
Port Said : 9,320 "	Abu El Hatameer : 1093.967 m^2		Tahta " : 1700 "
Fayous : 1,800 "			Quena " : 15000 "
Suez : 10,000 "			Abu Tesht " : 1170 "
Tanta : 4,160 "			Esna " : 8450 "
Mansoura : 14,064 "			

37) Area available for building expansion within site:

Damietta : 1000 m^2
under construction

there is only a possibility to construct new floors in the existing buildings

$1000 m^2$ at Fayoum
new floor at Helwan
$2000 m^2$ in Gardaka
new floor in Beni Suef
new floor at Minia

38) Describe any plans for improvement and/or expansion a)immediate b)longer term (3-5 years)

immediate plan : Damietta
(3-5 yrs) plan : Mit Ghamr

a) immediate plans:
Damanhour & Alexandria

b) longer term (3-5 years)
garages in Kom Hamada
El Khatatba
Kafr El Zayat

constructing a new garage at Giza

39) Describe physical condition of buildings and site a)structurally b)ventilation c)lighting d)water supply e)sewer service f)site drains

Ismailia	a)good-	b)	c)	d)	e)	f)poor
Damietta	a)	b)	c)	d)	e)	f) fair
Tanta	a)	b)	c)	d)	e)	f) poor
Mit Ghamr	"	"	"	"	"	"
Zagazig	"	"	"	"	"	"
Cairo	"	"	"	"	"	"
Port Said	"	"	"	"	"	"
Fayous	"	"	"	"	"	"
Suez	"	"	"	"	"	"
Mansoura	"	"	"	"	"	"

Alexandria:
a)b)c)d)e)good - f)tank-type

Damanhour:
a)b)c)good - d)e)f)under improvement

Cairo:
a)b)c)fair - d)e)under improvement -f)pipe drain

for all branches:

structure - ventilation - lighting - water supply and sewer services are in fair condition

EAST DELTA	WEST DELTA	MIDDLE DELTA	UPPER [illegible]
NO ANSWER	1. additional buildings for stores 2. new garages for Cairo instead of the one in El Batun this is besides what we mentioned in No. 38 and 39		Fayoum branch : 1000m^2 El Gardaka : 2000m^2 Esna : 3000m^2

41) In what year was facility built?

Ismailia under construction	: 1979
Ismailia	: 1961
Damietta under construction	: 1974
Damietta	: 1960
Benha	: 1967
Mit Gamr	: 1970
Zagazig	: 1942
Cairo	: over 20 yrs
Port Said	: 1966
Fayoum	: over 20 yrs
Suez	: " " "
Aswan	: " " "
Mansoura	: 1976
Central workshop in Nasr City	: 1971
Ameria workshop	: over 30 yrs
Rosetta	1979
Kafr el Dawar	1978
Mahmoudia	1976
Shubrakhit	1979
Marsa Matrun	1976
Giza branch	: rented from East Delta in 1963
Fayoum	: 1968
Helwan	: 1978
El Saaf	: 1978
El Gardaka	: 1975
Beni Suef	: 1973
El Minia	: 1973
Tahta unit	: 1976
Quena	: 1970
Abou Tesht	: 1978
Esna	: 1978

TRUCK COMPANIES

1a) Describe generally the definition used by your organization for (repair facility, maintenance and overhaul).

1b) What type of facility is reported at this location.

Goods Transport	Transport Works	Heavy Transport	Direct Transport	Rural Transport	AutomotiveRepair
Repair Repair of daily defects and unexpected troubles.	**Repair** For sudden faults in the vehicle that prevent vehicle from working with the same efficiency.	**Repair** Repair air,electrical, fuel, cooling system...etc.	**Repair** It is the repairing of the vehicle defects requiring not more than 72 man-hours.	**Repair** Replacing damaged/ defected parts with new parts or making the required repair.	**Repair** Heavy repair for all mechanical and electrical components.
Maintenance Preventive maintenance each 15 days or 3000 km. including oil change, cleaning, also different categories of preventive maintenance 3000,6000...etc.	**Maintenance** It is the changing of oil, lubrication, adjustment of the different clearances in the vehicle, reviewing the fixation of the connection cleaning or changing filter.	**Maintenance** Washing-changing different cartridges of fuel, oil, filter..etc. every certain number of kilometers, also checking nuts, wheels...etc.	**Maintenance** For the various parts every specified distance,fuel consumption or time in service according to technical instructions of manufacturers	**Maintenance** Performing periodic tests and/or inspections every 3000/ 6000 km...and after 12000 km some partd should be replaced. **Overaul** Complete repair of parts in emergency cases or major damage 1) intermediate overhaul differential,gear box,clutch,changing piston,sleeves..etc. 2) Complete overhaul: engine:crankshaft cylinder turning.. Brakes:changing of sleaves,piston of the compressor... gas system:cleaning adjustment..... All the above are performed in the company workshops except crankshaft & cylinder grinding and turning.	
Overhaul General overhaul for mechanical parts in the vehicle, also for the body and underframe. It also includes heavy repair for damaged vehicles Repair & maintenance in all branches. Overhaul facility is allowed only in Ameria and Alexandria.	**Overhaul** It is the complete repair for the vehicle parts or groups. Repair, maintenance and overhauling	**Overhaul** Renewing the unit, engine, pistons, liners, springs, bearing of the crankshaft etc. --- No answer	**Overhaul** Complete renovation of vehicle system and/or components Repair,maintenance & overhaul in all branches - in Qena & Safaga repair & maintenance are achieved		

195

2) For each of the above, what criteria are used for initiating repair, maintenance or overhaul:

Goods Transport	Transport Works	Heavy Transport	Direct Transport	Rural Transport	Automotive Repair
Repair - driver complaint Maintenance -mileage -time in service Overhaul -mileage -time in service -testing program	Repair -driver complaint approved by inspection -accident Maintenance -according to mileage Overhaul -mileage	Repair -driver complaint -other Maintenance -testing program Overhaul -mileage -time in service	Repair -driver complaint Maintenance -mileage -fuel consumption Overhaul -time in service -mileage technical condition	Repair -driver complaint -testing program Maintenance -mileage -time in service Overhaul -distance travelled by vehicle -sudden damage or failure	Repair It does not concern our activity

3) Describe preventive maintenance inspection that is performed on daily bases - before - during after operation

It is understood that you are asking for daily inspection performed on the vehicle before going out to service. In my opinion, it is to be quite different from preventive maintenance) before operation -batteries & electrical lights-level of oil-cooling water-brakes-tires-clutch during operation -performance of all gauges after operation -check on leakage of water, oil,fuel,air and if enough fuel in trak & check oil levels & hand brakes.	before operation -check oil level, water in radiator-no water in the air tank -check tires during operation No answer before operation No answer	o before and during operation by the driver o after operation by technicians	before operation -check water,oil tires,quantity of fuel -inspection of water, oil,fuel leakage or air escape during operation No answer after operation The driver fills a workshop order including his remake on his vehicle during operation and according to particular rules all requirements are done.	before operation -check oil,water and fuel levels-tire pressure-belt tension, tightening sequence, brake system, battery water -reviewing vehicle in general during operation -watching indicators, efficiency of dynamo brakes,clutch -sound of engine after operation -reviewing all parts of the vehicle by the vehicle inspector.	It does not concern our activity

Goods Transport	Transport Works	Heavy Transport	Direct Transport	Rural Transport
By engineer or chief of technical division or vehicle inspector.	Inspection before operation is performed by the driver.	Inspections are performed by driver during and before operation-- by the technical staff after operations.	Some inspections are performed by supervisor, others are achieved by the driver.	Mainly performed by the driver-after and before operation by the vehicle inspector.
5) What is done to correct any defects.				
A repair card is prepared- All defects are registered. After repair the vehicle is re-inspected.	Noticing any failure or defect the driver asks for correction of same-the vehicle inspector checks the failure and sends the vehicle to be corrected in the concerned workshop.	The technicians check the defected parts and make the required change or adjustments.	the breakdown is reported by the driver to the engineer.This is recorded in the "drivers' complaint records" in the workshop where repairs are distributed among the mechanics.	The group writes reports according to the complaint of the driver describing the vehicle failure.This is sent by the driver to thetechnical follow up secretary who fill a repair card and repair order,sends them to the responsible supervisor of workshop who gives orders to initiate the required repair. After finishing repair,the repair order on which the performed repairs are recorded is given back
6) Describe periodical maintenance services that are performed a)weekly b)monthly c)by kilometer				
Change of oil and class of maintenance is done each 2 weeks or 3000 kms which also includes greasing,cleaning & tightening of parts - change of filter element.	Periodic maintenance services are performed on basis of mileage according to recommendation in the instruction manuals provided with each vehicle.		The following should be checked-engine oil,fuel tanks,fuel circulation-cooling system filters-air filters-starter-air circulation,exhaust circulation-air compressor - gear box -differential & tires.	Periodic maintenance services are performed on basis of mileage. Changing of oil is considered on basis of fuel consumption (1500-2000 liters).

197

cooling system - fuel and electrical system.

Goods Transport	Transport Works	Heavy Transport	Direct Transport	Rural Transport
a) Engine oil level, oil pressure, valve clearance, filters, pistons. b) Transmission gears, syncron apparatus between highest speed and lowest. c) Differential pinion and crown set-pinion bearings. d) Brake system rubber parts in brake valves and brake. e) Steering system pump of hydraulic system for steering hydraulic system f) Cooling system cooling fan blades-radiator-rubber cooling water-connections + water pump bearing + water leakage. g) Fuel System injector-nozzles-fuel pump-fuel piping. h) Electrical system batteries-starter-generator and voltage regulators.	a) Engine -fuel system -wear of bearing shells and packing rings. b) Transmission -wear of gearing -wear of synchronizer -wear of clutch -rolling bearing. c) Differential -wear of crown gears -wear of wheel gears -wear of rolling bearings. d) Brake system -wear of brake lining -air escape. e) Steering system -rolling bearings -wear of swivel connection of steering -steering oil pump f) Cooling system -observation of radiator -wear of water seals. g) Fuel system -observation of fuel circulation -air leakage in the circulation -damage of nozzles h) Electrical system -burning out of lamps -damage of the starter -battery dynamo damage.	a) Engine -high heat, unadjusted fuel injection pump & nozzles-dirty oil-fuel filters-defected water or oil pump-cracks in cylinder heads. b) Transmission bad driving without enough oil-excess load on the differential gear. c) Differential leakage of oil, spoiled oil, ball bearings. d) Brake system leakage of air-deffects in air regulators, valves, pipes, air compressor brake liners & drums. e) Steering system unadjusted front wheel-leakage in steering hydraulic pump-uncalibrated hydraulic steering linkages & bars. f) Cooling system spoiled radiator, unsufficient cooling area-defects in water pump-spoiled fan belt.	a) Engine non-functioning intake - valve rocker arms-piston sleeves-oil leakage injector-upnormal oil consumption-engine misperformance. b) Transmission lightness of bolting-clutch roller bearing knocking of gearbox-oil leakage-clutch servo- c) Differential pinion oil seal pinion gear d) Break system air escape-repair of regulator-repair of compressor-drum turning brake discs. e) Steering system air bubbles in the system-oil leakage-pump defect-servo steering defect-oil seal of steering box-roller bearing of steering box-wheel toe. f) Cooling system water leakage -hose replacement-radiator soldering-radiator cleaning.	a) Engine fuel pump and/or injector failure decrease in piston action and leakage due to damage of gaskets inefficiency of oil pump or its valve that case low pressure of oil - obstructed air inlets and/or exhaust outlets. b) Transmission weak spring action of clutch-wear of cylinder lining and/or cracks in clutch and inefficiency of servo too-wear in gearing cone and breaking of gear teeth, damage of oil seal, roller bearing and improper transmission c) Differential -insufficient quantity of lubricating oil -damage of oil seal & roller bearing -wear of crown gears & pinion. d) Brake system insufficient air circulation clearance in brake pull-rod and/or can arms-wear of brake lining.

7) Continued

Goods Transport	Transport Works	Heavy Transport	Direct Transport	Rural Transport
		h) Electrical system deffects in alternator, parts of alternator, rectifiers, batteries, starter.	g) Fuel system air bubbles-fuel leakage, tanks cleaning pipe welding-hose replacement pump & injector adjust. h) Electrical system lights-batteries cables-starter-dynamo-flasher-indicators.	e) Steering System insufficient steering oil pump due to damage of gears-oil leakage-obstruction of steering pump oil filter-clearances-damage of roller bearing of front wheel axle. Wear of gears-oil leakage clearance in one of steering swivel joints-damage of roller bearing of front wheel axle. f) Coding system -obstructed circulation -water leakage -damage of roller bearing and wear of blades -improper tension of belts -inefficient cooling fan. g) Fuel system air bubbles-damage of fuel filters-bad connection leakage or inefficient injectors and nozzles h) Electrical system fusion of some lamps or lantern breaking-non adjustment of cut-out inefficiency of battery

Goods Transport	Transport Works	Heavy Transport	Direct Transport	Rural Transport
approx. Engine : 40% Transmission : 25% Accidents : 25% Others : 10%	Length of downtime depends on type of vehicle failure and availability of spare parts.	This is not a clear answer to the question. Indicated below the average kms for each item to be maintained: engine :200000-350000 km transmission :100000-250000 " differential :200000-300000 " brake system :500000-100000 " steering " :1500000-250000 " cooling " 50000-100000 " fuel " 50000-100000 " electrical 50000-100000 "	Engine : 10% Transmission: 10% Differential: 5% Brake system: 15% Steering : 15% Cooling : 5% Fuel : 20% Electrical : 20%	repair / overhaul Engine 4-6 hrs / 6 hrs-1 week Transmission " / up to 12 hrs Differential " / up to 10 hrs Brake system up to 4 hrs / up to 8 hrs Steering " " / " Cooling " " / " Fuel " up to 6 hrs Electrical "

9) Describe those mechanical failures that are attributable to vehicle accidents:

engine cracks,transmission,steering radiator,cooling fan, batteries.Front axle, cardan(universal) shafts.	-brake system -steering system	it depends on kind of accident	radiator damage, fan,dynamo drum, steering wheel, wheel angles, wheel toe,filters, front axle,regulator,clutch master.	-defective of brake system -defective steering system -blowing out of front tires.

10) Describe what vehicle breakdowns are attributable to the driver:

tires-improper driving,transmission and clutch.Oil pressure and level-brakes-load distribution of some commodities may cause accidents.	damages of transmissio ,engine and tires which are results from the improper driving.	propellor,gearbox suspension springs in the truck tractor or in the semi trailor-breakdown in the engine due to speed and excess load-clutch disc plates and thrust ball bearings-tires-lamps.	engine overload, rapid wear of clutch disc,damage of gearing in the gear box differential,rapid wear of tires,damage to the dynamo.	-for the following points there is no mention of vehicle breakdown-here there is a mention of mistakes that are made by the driver. -no sufficient inspection for the vehicle before operating like checking of fuel level-also the bad operation of the vehicle. -incorrect transmission-and here is mention of some breakdowns attributable to the driver: o bad operation of starter which causes its damage o multi operation of brake system which causes weak breaking effect.

11) Describe your driver's training program.

Goods Transport	Transport Work	Heavy Transport	Direct Transport	Rural Transport
it is supposed that all fresh drivers are to be trained in the M.O.T. training centre. Also refresher program for old drivers but (sorry) nowadays nothing is done. The existing procedure is to allow the new driver to work for some period under the supervision of a more experienced one.	new drivers are trained in the training center but a training program is not available for the other drivers in the company.	there is a training center in Abbasia that follows the program of Ministry of Transportation. In that center a training program is applied for the drivers.	training courses are arranged for drivers to have technical instructions in driving new vehicles.	We send our drivers for training in the training center which belongs to the Ministry of Transportation.

12) Describe incentive program for operators with the best driving records.

after engine overhaul, LE 5 is given to the driving during the running-in period LE 10 as first bonus (100000 km) for new engine, 75000 overhauled engine, LE 10 as second bonus (175000 km) for new engine, 100000 km overhauled engine. LE 15.5 as third bonus for every 50000 kms after that-also some bonus for batteries and tires.	-incentives are given to the driver who keeps his tire for a long time, for the engine which works more than the normal rate- -also for the driver who is working much.	this is according to the life of engine, batteries, tires, no accidents - also according to the success and activity of the driver due to kilometrage with loading every month.	for the driver who operates his truck for 4000 km/month, he is given LE 5. for the driver who operates his truck (loaded) for 5000 kms per month, he is given LE 10.	

13) What vehicles are put on easy routes or are they rotated over various routes:

Good Transport	Transport Work	Heavy Transport	Direct Transport	Rural Transport
each branch has his own fleet and his obligation in his area. These vehicles from different branches which arrive in Alex harbor are loaded and directed towards their branches	all vehicles are put on different routes.	old vehicles are put on easy routes.	all vehicles are put on different routes.	all vehicles are operated on various routes.

14) What is the average life by type of vehicle?

the assumed life is 8 years or 638400 kms, 266 km/day, average 300 days = 79800 80000 km/yr ie. about 640000 km=8 yrs	average life of vehicle of any type is 8 years	this is decided by the Ministry of Transportation after 8 years but by this time the vehicles cost us more money to be maintained and be provided with spare parts.	average life of vehicle = 8 years-but according to kilometers run by vehicle (production life) the life of vehicles is less than 8 years.	average life of vehicles for economical operation is 8 years or 500000 kms on road.

15) Are service items always available? a)oil filter b)fuel filters c)air cleaner cartridges.

yes	they are all available	all service items are available	yes, they are always available	yes

16) Are spare parts and/or assemblies available from direct exchange for use in periodic maintenance:
a)fuel pumps b)fuel injectors c)water pumps d)starter motor e)generator/alternator f) voltage regulator.

it is understood from this question that you are aiming to know either that we depend on change of assemblies,or we repair them ourselves. Spare parts are available. It is the duty of the central workshops & the technical division of the branches.All assemblies are overhauled,the co. premises except for, Fiat fuel pump Sevice SMS	they are all available in all the company branches.	starter motor,alternators,voltage regulators are available for use in periodic maintenance-w.r.t. fuel pumps,fuel injectors,water pumps spare parts are available in stores for overhauling.We change them if necessary & if they are all available.	yes, all these items are available in this site.	yes

17) Describe the maintenance equipment available in the shops:

Goods Transport	Transport Works	Heavy Transport	Direct Transport	Rural Transport	Automotive Repair
a) machine tools lathes milling grinding cutting drilling bench drill b) sheet metal tools fixed hand sheer bending hydraulic press c) cutting & welding -welding transformer apparatus -meter generator d) lifts: _____ e) others: _____	a) machine tools: lathe drill b) sheet metal tools: nothing available c) cutting & welding: arc welder d) lifts: forklift	lathe valve grinding machine drills hydraulic press spot welds arc welding fork lift manual lift	a) machine tools lathe grinder drill drum lathes b) sheet metal tools nothing available c) cutting & welding arc welder gas welder d) lifts chain hoists hydraulic lift	a) machine tools lathe drum lathe valve grinder valve seat grinder electric grinder bench drill drill b) sheet metal tools pipe bending machine press c) cutting & welding arc welder gas welder d) lifts hydraulic crane lift truck electric crane hydraulic jack	lathes: ordinary central lathes mills: vertical mills grinders: wheel grinding mic grinding mic drills: val drills bench drills shears: presses: hydraulic presses

203

16) Describe the special purpose maintenance equipment available in the shops:

Goods Transport	Transport Works	Heavy Transport	Direct Transport	Rural Transport	Automotive Repair
a) engine maintenance & overhaul engine lifts fuel pump & injector benches (some are out of operatic..)	a) engine maintenance & overhaul -fuel pump adjusting device -injector advising device -pump adjusting device	a) engine maintenance & overhaul -forklift -valve grinder -bench test -injector test	a) engine maintenance & overhaul -engine lifts -fuel pump & injector benches	a) engine maintenance & overhaul -engine lift -valve grinder -fuel pump & injector bench	-cylinder bearing -crankshaft grinder -cylinder honing -test machine for fuel injection pump -turning drum -hydraulic lifts -charging batteries -transformers for welding. -compressors
b) transmission maint. & overhaul gear cutters jigs & fixtures	b) transmission maint. & overhaul nothing available	b) transmission maint. & overhaul nothing available	b) transmission maint. & overhaul -jigs & fixtures are available	b) transmission maint. & overhaul nothing available	
c) differential gear cutters for differential	c) differential nothing available	c) differential nothing available	c) differential -jigs and fixtures are available	c) differential nothing available	
d) suspension & steering bushing presses	d) suspension & steering bushing press	d) suspension & steering nothing available	d) suspension & steering bushing press are available	d) suspension & steering nothing available	
e) brakes cylinder rebuilt benches drum lathes	e) brakes drum lathe	e) brakes drum lathe	e) brakes -3 devices for punching & riveting brake & clutch -4 drum lathes	e) brakes drum lathe	
f) electrical -rotor turning -collector/commutator -rewinding benches	f) electrical nothing available	f) electrical nothing available	f) electrical -rotor turning is achieved by means of ordinary lathes -rewinding benches is not available	f) electrical nothing available	

204

19) Identify and describe general service equipment used for maintenance and overhaul purposes:

a) wash racks b) lubrication racks c) compressed air system d) hydraulic system e) cleaning system.

a) wash racks - None
b) lubrication racks
c) compressed system:
Qty 14 10kg/cm^2
1 8kg/cm^2
1 7kg/cm^2
d) hydraulic systems
e) cleaning system

a) None
b) None
c) None
d) None
e) air compressor 3, capacity 2.5 HP each.

a) None
b) None
c) compressed system: two, one stage compressor
d) hydraulic system: None
e) cleaning system: None

a) wash racks, washing is done on shoulders
b) lubricarion racks this is done completely on lubrication pits
c) compressed system: there is a station for compressed air + 1 compressor for tires + 2 for riveting machines
d) hydraulic system: None
e) cleaning system: one Fiat type

a) None
b) None
c) None
d) None
e) None

---

20) Identify types and quantities of testing and trouble shooting equipment in use by facility.
o engine analyzers o dynamometers o brake testing machines o front and alignment tester o others.

o Engine analyzers: only pressure tester
o dynamometer : None
o brake testing machine: None
o front & alignment tester: one for the wheel

o fuel pump tester
o injector testor

engine analyzers: None
dynamometers: None
brake testing machine: None
front-end alignment tester: None

o engine analyzers: one in every branch
o dynamometers : None
o brake testing machines: None
o front-end alignment tester: we have one - but it is not used

-pressure gauge for compressed air
-dynamo & starter tester
-wheel angles adjusting device
-pump & injector adjusting device

-testing machine
-engine analyzers
-dynamometers
-brake testing
-front end alignment tester
-balancing wheel tester

21) Provide a general plan or diagram for each facility showing: a) equipment layout b) process flow through total facility:

Goods Transport	Transport Works	Heavy Transport	Direct Transport	Rural Transport	Automotive Repair
22) Identify whether shop is set up on basis of o production line o station o line & station:					
central workshops are production lines and repair of vehicles arriving from some branches.	shop is set up on basis of station	shop in set up on basis of production line & station	all workshops in the company are based on basis of performance, repair & maintenance services except the branch of Nasr City	the shop is set up on basis of station	

23) Provide a list of maintenance and repair manuals, overhaul manuals and maintenance/overhaul specifications available at each facility.

None

24) Provide a list of parts catalogs, periodic factory bulletins, and other reference and instructional materials in the facility and shops.

None

25) Provide one copy of each form used to control and record maintenance and overhaul activity. Provide brief description of the flow of paperwork indicating point of irigin; who exercises quality control and ultimatedestination of form.

26) Describe special tools that are stocked for each operating component o type component o type tool o quantity o replacement					
there are enough special tools for both types - Saviem & [illegible] : average life about 8 years	all special tools are available in the "tool stores" and issued according to need, but should be back in stores. A committee is formed annualy to check the tools and scrap whatever found out of use	Attached	Attached	-pullers -measuring sets as lorque wrenches pressure gauge --- -quantity of these tools is limited compared to the other simple tools -replacement rate of tool differs according to kind of tool, duration of use-all these special tools tools are available in stores.	we have different kinds of special tools handed to the labor

27) Describe how special tools are controlled: o availability o quality

Goods Transport	Transport Works	Heavy Transport	Direct Transport	Rural Transport	Automotive Repair
-control is performed by technical division in each branch. -check is performed by technical dept.	all special tools are available in a "tool stores"	special tools are controlled by engineers & foremen. Some of special tools are available of good quality, other are not available	every superintendant of a workshop is considered to be responsible for taking care of tools and equipment in his shop.	special tools are always in charge of supervisors and superintendants. Skilled workers are permitted to use these tools only. Some of the tools are stationary inside the workshop others are found on benches-the quality of these tools varies from 55% - 75%	

28) Describe what general hand tools are available in what sizes, quantities, where stored and controlled how.

sets: spanners 6mm-48mm sockets 6mm-56mm stens 8,10,12,14 (adjustable spanners) hammers ½,1,1½ kgs saws 12" clippers 6.8" stocks are in the stores till they are distributed among the filter.	sets: -open and spanner (all sizes) -adjustable spanner (all sizes) -box spanner -torque wrench -pullers the quantities vary from 2- to -4 sets for each type	No answer	-open end spanner -adjustable spanner -box spanner -allen spanner -pliers (normal, insulated,etc.) also there is a large quantity of equipment in stores-if a worker needs any, he can get it from the store and he becomes responsible for it. A special record of such equipment is kept in the general department stores.	sets: -open end, or adjustable spanners-they are kept in tools cases or boxes with workshop supervisors who give them out to workers for use during workdays. Tools are controlled by the work leader and checked at annual inventory

207

29) What is the annual budget for: o maintenance of shop equipment o special tools o general hand tools o shop reference manuals o shop training manuals:

Goods Transport	Transport Works	Heavy Transport	Direct Transport	Rural Transport	Automotive Repair
no answer	no answer	no answer	-maintenance of shop maintenance=1795 LE -general tools=6012 LE -shop reference = 3000 LE manual -shop training = 500 LE manuals	no answer	annual budget for special and general hand tools, shop reference manual and shop training manual is 50,000 LE.

30) What is the percentage of time in which maintenance equipment is available to perform its function:

no answer	it depends on the equipment efficiency and number of breakdowns to be achieved	we have not yet imported the maintenance equipment	these equipments are generally available in all branches	for machine tools, sheet metal tools, cutting & welding= 5% and about 10% for lifts. This percent is compared with the total time of the work.

31) In what manner is quality control exercised over maintenance activity, for example:
o what percentage of repaired parts are inspected. o What percentage of rebuilt assemblies are tested. o Are incentives awarded to workers that produce good - or - bad units.

No answer	the quality control exercised over maintenance activity considered as measure - the number of breakdowns that happen between the two maintenance services there is an incentive program for those workers producing good work of maintenance or overhaul. Also penalties are	quality control: -percentage of repaired parts inspected -incentives awarded to workers who produce good units -penalties exacted on those who produce bad units	percentage of quality of repaired parts varies from 60-70% incentives are awarded to workers producing good units according to their productivity. Also penalties are exacted on those workers who produce bad results	o not only all the repaired parts are inspected-the important parts only. About 75% of the repaired parts are inspected by the concerned supervisors o incentives are awarded to workers who produce good units o penalites are exacted on those who produce bad units according to penalty rules

PHYSICAL FACILITY INFORMATION

32) Description of type of work done:

Goods Transport	Transport Works	Heavy Transport	Direct Transport	Rural Transport	Automotive Repair
fleet operation for goods transport	repairing and maintenance	o Cairo branch maintenance & overhaul o Alex branch maintenance only	repair, routine maintenance-for Nasr city branch there is engine & transmission. Nasr branch is served by Quena & Safaga.For Helwan & Alex branch there are overhaul sections for the service of each branch	repair, maintenance and overhaul for 145 vehicles	heavy repair and body builder for buses and trucks

33) Floor area of building:

no answer	3500 m^2	Cairo branch: 5934 m^2 Alex branch: 1330 m^2	no answer	11407 m^2	16000 m^2

34) Number of work pits:

10 workpits	2 workpits	no answer	Nasr City : 2 Alex : 3 Helwan : 1 Quena : 1 Safaga : 1	4 workpits	12 workpits

35) Number of trucks now serviced at the facility:

318 vehicles	Cairo 77	Cairo 121 trucks Alex 79 " 200	Nasr City : 30 v. Alex : 78 Helwan : 50 Quena : 60 Safaga : 40 258	Cairo : 45 Alex :145 Mahalla : 84 Kafr el Zayat: 93 367	12 buses for service

36) Optimum number of trucks that could be serviced at this facility:

Goods Transport	Transport Works	Heavy Transport	Direct Transport	Rural Transport	Automotive Repair
400/450 vehicles	Cairo 120	Cairo 121 trucks Alex 79 trucks 200	Nasr City : 180 Alex : 100 Helwan : 50 Quena : 60 Safaga : 40	Same as # 35	optimum number is 9 buses

37) Total area of facility site:

about 60,000 m^2	Cairo 33,000	Cairo branch: 35,380 m^2 Alex branch: 19,660 m^2	Nasr City: 18,825 m^2 Alex : 21,022 m^2 Helwan : 7,000 m^2 Quena - Safaga : 7,560 m^2	Cairo 13,192 Alex 25,407 Mahalla 59,277 Kafr el Zayat 24,979	80% of the total area

38) Area available for building expansion within site:

area available = 18,000 m^2	no area available for building expansion within site	Cairo : 2,200 m^2 Alex : 800 m^2	now expansion within site, but expansion means a new branch	no area available for building expansion within site	area available for building expansion 20% of the total area

39) Describe any plans for improvement and/or expansion - a) immediate b) longer-term (3-5 years)

it is under study	the answer is about the plans of the technical affairs	for Cairo a new store (300m^2) will be established, also a sheltered area of 1700m^2-the 4th flr of the existing building will be built for Alex. A new service station will be built on 800m^2-also the drain of latrines & rain will be improved. In the long term we are going to build a complete workshop on an area of 500 m^2	a new branch (El Zahraa) is under construction-this is for immediate expansion. For longer term plans (3-5 yrs) new branches will be built in Quena, Safaga and Suez	stores and stocks yard will be constructed on 3 feddans-3 feddans to complete Alex branch. The 6 feddans are located on Alex-Cairo desert road

410

40) Describe physical condition of buildings and site: a) structurally b) ventilation c) lighting d) water supply e) sewer service f) site drainage.

Goods Transport	Transport Works	Heavy Transport	Direct Transport	Rural Transport	Automotive Repair
	structurally :good ventilation :good light :good water supply :fair sewer service :fair site damage :fair		o natural and artificial ventilation and light are available in each branch-also there is 2 water circulations:one for fire and the other for drinking. There is also a complete circuit connection for sewer service	-structurally: fair-some new buildings are in good condition -ventilation: good -lighting: good (by day) poor at night -water supply: needs repair -sewer service: needs layout alterations due to sewer troubles -site damage: needs improvements to reach its efficiency	structurally : good ventilation : (natural ventilatio lighting : good water supply : good sewer service: good site drainage: good

41) What main area of physical improvement is needed in this facility:

no area needed	300m^2 for a store 1700m^2 for a truss 4th floor for the administration bldg (Cairo branch) for Alex branch: 800m^2 for a service station 500m^2 for a workshop	no need for a new area	main area needed is 20,000m^2 to 25000m^2	total area needed for this facility is abour 20% of the total area

211

42) What year was facility built?

Goods Transport	Transport Works	Heavy Transport	Direct Transport	Rural Transport	Automotive Repair
-nationalization occured on 30-6-1964	the facility was built on June 17, 1963	-Cairo branch 1972 - 1975 -Alex branch 1972 1978 1979	Nasr City : 1969 Helwan : 1970 Alex : 1971 Safaga : 1972 Quena (rented) : 1970	we received this facility with its old building in 1968 - some new buildings and other improvements have been made after this date	1945

2/2

OPERATING SYSTEM QUESTIONNAIRE

MIDDLE DELTA BUS CO.
1343 Kornish El Nile
Cairo, Egypt

I. Logistics

	A. Purchase/Acquisition/Manufacture where purchases are made for	% Manuf. in House	% Purchased or acquired International	% Purchased or acquired Local	% Leased
Please supply a copy of each form used by your organization in the acquisition of parts.	1. Vehicle (Buses, Trucks, Cars)	zero	80	20	zero
	2. Major Units (engines, Transmissions, etc.)	zero	85	15	zero
	3. Small Units (Injectors, Starters, etc).	zero	85	15	zero
	4. Chassis Parts (Springs, Fans, etc)	zero	25	75	zero
	5. Body Parts (Panels, sheet metal, glass, etc)	20	20	60	zero
	6. Tires	zero	70	30	zero
	7. Batteries	70	20	10	zero
	8. Fuel & Petroleum Products	zero	zero	100	zero
	9. Cleaning Supplies	zero	zero	100	zero

	B. Storage Where are items stored	% at Central Stores	% at Engine Rebuild Shop	% at Operating Garage
Please supply a copy of each form used by your organization in parts storage - inventory forms, parts locations, etc.	1. Vehicles	zero	zero	100
	2. Major Units	80	20	zero
	3. Small Units	40	20	40
	4. Chassis Parts	65	zero	35
	5. Body Parts	65	zero	35
	6. Tires	60	zero	40
	7. Batteries	80	zero	20
	8. Fuel & Petroleum Products	zero	5	95
	9. Cleaning Supplies	zero	10	90

	C. Issue/Disbursement How are items issued a.To sub-storeroom b.to Final user	% by written requisitions	% by work order	% by verbal order	% no record
Please supply copies of Issue/Disbursement forms - requisition, receipts, work orders, perpetual inventory forms, etc.	1. Vehicles				
	a.	100	zero	zero	zero
	b.	10	90	zero	zero
	2. Major Units				
	a.	100	zero	zero	zero
	b.	zero	100	zero	zero
	3. Small Units				
	a.	100	zero	zero	zero
	b.	80	20	zero	zero
	4. Chassis Parts				
	a.	100	zero	zero	zero
	b.	40	60	zero	zero
	5. Body Parts				
	a.	100	zero	zero	zero
	b.	40	60	zero	zero
	6. Tires				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	7. Batteries				
	a.	10[illegible]	zero	zero	zero
	b.	90	10	zero	zero
	8. Fuel & Petrol Products				
	a.	100	zero	zero	zero
	b.	90	10	zero	zero
	9. Cleaning Supplies				
	a.	100	zero	zero	zero
	b.	90	10	zero	zero

Remarks:
The time taken from ordering spare parts to receive it is as shown for each item.
If the required spare parts, the quantity is 100%
If the total buses fleet of our company is 100%.
The percentage for the out-of-service beses due to each item is as shown

D. Parts Availability	10 days or less	11-30 days	30-90 days	Over 90 days
On order-not received				
(1) Major Units	zero	5%	10%	85% of the reg.qty.
(2) Small Units	zero	5%	10%	85% of the reg.qty.
(3) Other Parts	zero	30%	40%	30% of the reg.qty.
(4) Tires	zero	30%	70%	zero
(5) Batteries	70%	zero	10%	20% of the reg.qty.
Vehicles out of service due to lack of:				
(1) Major Units	zero	2%	5%	3% of the fleet
(2) Small Units	3%	1%	zero	zero
(3) Other Parts	2%	1%	3%	zero
(4) Tires	zero	zero	zero	zero
(5) Batteries	zero	zero	zero	zero

II Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated;

A. Structural Details:

Name & Manufacturer's Model: Mercedes-Benz Buses, German Type 0302/13 row

(1) Engine 6 cylinder, in line-water colled-diesel engine type OM355 four smoke
(2) Body type 0302/13 row
(3) Transmission synchro mesh. G 3/70 4/4.24
(4) Rear Axle/Differential two-speed reduction/hypoid type axle
(5) Steering power steering LS5
(6) Seats I/52 Standard upholstered passenger seats

B. Mechanical Details:

(1) Type Engine (Diesel, Gasoline) Diesel-four stroke 6 cyl. type OM355V
(2) Fuel Consumption 40 litre/100kms
(3) Oil Consumption (100 km/Litre) 0.8 litre/100kms
(4) Annual km's operated per unit 73600 km/year unite
(5) " hours " " " 2100 km/year unite
(6) Number of units operated 20 buses
(7) Maintenance Cycle (interval between periodic inspections Daily inspection, servicing after 3000 kms, 9000 kms, 18000 kms

215

II Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated;

A. Structural Details:

Name & Manufacturer's Model: Mercedes TATA India LP312

(1) Engine 6 cyl., 4 stroke, diesel-water cooled type OM312
(2) Body LP 312/48
(3) Transmission Syndromesh gearbox manual
(4) Rear Axle/Differential single reduction pully floating
(5) Steering DB Recirculating ball type (mechanical)
(6) Seats standard type

B. Mechanical Details:

(1) Type Engine (Diesel, Gasoline) Diesel, 4 stroke OM 312
(2) Fuel Consumption 25 litre/100km
(3) Oil Consumption (100 km/Litre) 0.5 litre/100km
(4) Annual km's operated per unit 64,400 km/unit
(5) " hours " " " 1,610 hr/yr.unit
(6) Number of units operated 68 buses
(7) Maintenance Cycle (interval between periodic inspections daily inspection, servicing after 3000 km, 9000 km, 18000 km.

MIDDLE DELTA BUS COMPANY

II Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated;

A. Structural Details:

Name & Manufacturer's Model: Barreiros, SAETA 75 Spanish Madrid

(1) Engine 6 cyl. 4 stroke, diesel water cooled type D-135
(2) Body SAETA 75
(3) Transmission Synchromesh gear box manual
(4) Rear Axle/Differential single reduction gear box 442 S5
(5) Steering mechanical ~~worm and nut~~
(6) Seats standard type

B. Mechanical Details:

(1) Type Engine (Diesel, Gasoline) Diesel D-135
(2) Fuel Consumption 28 litre/100 km
(3) Oil Consumption (100 km/Litre) 0.87 litre/100 km
(4) Annual km's operated per unit 64,400 km/unit
(5) " hours " " " 1,610 hr/unit/yr
(6) Number of units operated 113 buses
(7) Maintenance Cycle (interval between periodic inspections Daily inspection, servicing after 3000 km, 9000 km, 18000 km

217

II Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated;

A. Structural Details:

Name & Manufacturer's Model: Ward, USA

(1) Engine 8 cylinder -V-, water cooled, 4 stroke caterpillar 3208
(2) Body
(3) Transmission syncromesh manual, SPICER NO CM 5052A
(4) Rear Axle/Differential single reduction, Rockwell L-155 series
(5) Steering hydrolic power, Ross
(6) Seats standard type

B. Mechanical Details:

(1) Type Engine (Diesel, Gasoline) Diesel - 4 stroke-V8 cyl-3208 Caterpiller
(2) Fuel Consumption 48 litre/100 km
(3) Oil Consumption (100 km/Litre) 48 litre/100 km
(4) Annual km's operated per unit 78,200 km/unit
(5) " hours " " " 2,510 hr/unit
(6) Number of units operated 166
(7) Maintenance Cycle (interval between periodic inspections daily inspections, servicing after 3000 km, 9000 km, 18000 km

MIDDLE DELTA BUS COMPANY

II Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated;

A. Structural Details:

Name & Manufacturer's Model: Mercedes Iran - national type 0302/11R 0302/12R

(1) Engine 6 cyl, 4 stroke, diesel, water cooled type OM360
(2) Body 0301/11 rows 0302/12 rows
(3) Transmission syncromesh manual gearbox
(4) Rear Axle/Differential double reduction rigid axle
(5) Steering mechanical steering type for 11 row and power steering for 12 row type
(6) Seats standard type

B. Mechanical Details:

(1) Type Engine (Diesel, Gasoline) Mercedes Benz OM 360 diesel
(2) Fuel Consumption 32 litre/100 km
(3) Oil Consumption (100 km/Litre) 0.75 litre/100 km
(4) Annual km's operated per unit 73,600 km/unit
(5) " hours " " " 2,100 hr/unit
(6) Number of units operated 74 buses
(7) Maintenance Cycle (interval between periodic inspections daily inspection, servicing after 3000 km, 9000 km, 18000 km

219

MIDDLE DELTA BUS COMPANY

II Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated;

A. Structural Details:

Name & Manufacturer's Model: NASR Egyptian manufacturing

(1) Engine 6 cyl.,4 stroke, diesel, air cooled, V engine F6L 614 type
(2) Body NASR KWITTE
(3) Transmission synchromesh manual gearbox
(4) Rear Axle/Differential single reduction, fully floating axle
(5) Steering full forward control system Z.F.
(6) Seats standard type

B. Mechanical Details:

(1) Type Engine (Diesel, Gasoline) diesel, 4 stroke, air cooled type F6L614
(2) Fuel Consumption 26 litre/100 km
(3) Oil Consumption (100 km/Litre) 0.87 litre/100 km
(4) Annual km's operated per unit 64,400 km/unit
(5) " hours " " " 1,610 hr/unit
(6) Number of units operated 74 buses
(7) Maintenance Cycle (interval between periodic inspections daily inspection, servicing after 3000 km, 9000 km, 18000 km

C. Operational Details:

- Buses
  - (1) Length of Body (Meters) 12 meters
  - (2) Width of Body (Meters) 2.5 meters
  - (3) No. of passenger seats 52
  - (4) Maximum Passenger Capacity _____
  - (5) Conductor/Collector required? Yes x No _____

- Trucks
  - (1) Length of cargo compartment (meters) _____
  - (2) Width " " " " _____
  - (3) Is cargo compartment enclosed? Yes _____ No _____
  - (4) " " " covered? Yes _____ No _____
  - (5) Overall vehicle length (Meters) _____
  - (6) Maximum capacity (Kilos) _____

OPERATING SYSTEM QUESTIONNAIRE

I. Logistics

EAST DELTA BUS COMPANY

	A. Purchase/Acquisition/Manufacture where purchases are made for	% Manuf. in House	% Purchased or acquired International	% Purchased or acquired Local	% Leased
Please supply a copy of each form used by your organization in the acquisition of parts.	1. Vehicle (Buses, Trucks, Cars)	zero	90	10	zero
	2. Major Units (engines, Transmissions, etc.)	zero	90	10	zerp
	3. Small Units (Injectors, Starters, etc).	zero	100	zero	zero
	4. Chassis Parts (Springs, Fans, etc)	zero	15	85	zero
	5. Body Parts (Panels, sheet metal, glass, etc)	zero	zero	100	zero
	6. Tires	zero	35	65	zero
	7. Batteries	zero	zero	100	zero
	8. Fuel & Petroleum Products	zero	zero	100	zero
	9. Cleaning Supplies	zero	zero	100	zero

	B. Storage Where are items stored.	% at Central Stores	% at Engine Rebuild Shop	% at Operating Garage
Please supply a copy of each form used by your organization in parts storage - inventory forms, parts locations, etc.	1. Vehicles	zero	zero	100
	2. Major Units	80	zero	20
	3. Small Units	30	zero	70
	4. Chassis Parts	30	70	zero
	5. Body Parts	30	70	zero
	6. Tires	20	zero	80
	7. Batteries	20	zero	80
	8. Fuel & Petroleum Products	zero	zero	100
	9. Cleaning Supplies	20	10	70

D. Parts Availability On order-not received	10 days or less	11-30 days	30-90 days	Over 90 days
(1) Major Units	100	zero	zero	zero
(2) Small Units	100	zero	zero	zero
(3) Other Parts	100	zero	zero	zero
(4) Tires	100	zero	zero	zero
(5) Batteries	100	zero	zero	zero
Vehicles out of service due to lack of:				
(1) Major Units	85	5	10	zero
(2) Small Units	85	10	5	zero
(3) Other Parts	100	zero	zero	zero
(4) Tires	100	zero	zero	zero
(5) Batteries	100	zero	zero	zero

II Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated;

A. Structural Details:

Name & Manufacturer's Model: Pegaso - Spain

(1) Engine Diesel Pegaso
(2) Body Pegaso - Spain
(3) Transmission Pegaso - Spain
(4) Rear Axle/Differential Pegaso - Spain
(5) Steering Pegaso - Spain
(6) Seats Pegaso - Spain

B. Mechanical Details:

(1) Type Engine (Diesel, Gasoline) diesel - water cooling
(2) Fuel Consumption 32 litre/100 km
(3) Oil Consumption (100 km/Litre) 0.6 kg/100 km (engine) - 0.08 kg/100km (gear shift lever & crown)
(4) Annual km's operated per unit 100,000 km approx
(5) " hours " " " 2,000 hours approx
(6) Number of units operated 39 buses
(7) Maintenance Cycle (interval between periodic inspections every 4000 km.

123

II Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated;

A. Structural Details:

Name & Manufacturer's Model: NASR Magirus Deutz West Germany

(1) Engine Diesel F6L514
(2) Body Nasr company for automotive industry
(3) Transmission Magirus Deutz
(4) Rear Axle/Differential Magirus Deutz
(5) Steering Magirus Deutz
(6) Seats Nasr Company

B. Mechanical Details:

(1) Type Engine (Diesel, Gasoline) Diesel (air cooling)
(2) Fuel Consumption 30 litre/100 km
(3) Oil Consumption (100 km/Litre) 0.87 kg/100 km (engine)-0.104 ky/100 km (gear shift lever & crown)
(4) Annual km's operated per unit 60,000 km approx
(5) " hours " " " 1,500 hours approx
(6) Number of units operated 172
(7) Maintenance Cycle (interval between periodic inspections every 3000 km

EAST DELTA BUS COMPANY

II Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated;

A. Structural Details:

Name & Manufacturer's Model: Mercedes Iran

(1) Engine diesel OM 360
(2) Body Mercedes Iran
(3) Transmission Mercedes Iran
(4) Rear Axle/Differential Mercedes Iran
(5) Steering Mercedes Iran
(6) Seats Mercedes

B. Mechanical Details:

(1) Type Engine (Diesel, Gasoline) Diesel water cooling
(2) Fuel Consumption 30 litre/100 km
(3) Oil Consumption (100 km/Litre) 0.65 kg/100 lit (engine)-0.13 kg/100km (gear shift lever & crown)
(4) Annual km's operated per unit 140,000 km approx
(5) " hours " " " 2,400 hours approx
(6) Number of units operated 100
(7) Maintenance Cycle (interval between periodic inspections every 4000 km

EAST DELTA BUS COMPANY

Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated;

A. Structural Details:

Name & Manufacturer's Model: Mercedes TATA OM 312

(1) Engine Mercedes TATA OM 312
(2) Body Mercedes TATA
(3) Transmission Mercedes TATA
(4) Rear Axle/Differential Mercedes TATA
(5) Steering Mercedes TATA
(6) Seats Mercedes TATA

B. Mechanical Details:

(1) Type Engine (Diesel, Gasoline) Diesel water cooling
(2) Fuel Consumption 28 lit/100 km
(3) Oil Consumption (100 km/Litre) 0.73 kg/100 km - 0.07 kg/100 km (gear shift lever & crown)
(4) Annual km's operated per unit 80,000 km approx.
(5) " hours " " " 1,300 hours approx.
(6) Number of units operated 82 buses
(7) Maintenance Cycle (interval between periodic inspections every 4000 km

EAST DELTA BUS COMPANY

II Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated:

A. Structural Details:

Name & Manufacturer's Model: Ward - America

(1) Engine Diesel 3208
(2) Body Ward
(3) Transmission Spicer
(4) Rear Axle/Differential Rockwell
(5) Steering Eaton
(6) Seats Ward

B. Mechanical Details:

(1) Type Engine (Diesel, Gasoline) Diesel water cooling
(2) Fuel Consumption 40 litre/100 km
(3) Oil Consumption (100 km/Litre) 0.46 kg/100 km (engine) - 0.23 kg/100 km (gear shift lever & crown)
(4) Annual km's operated per unit 120,000 km
(5) " hours " " " 2,200 hours
(6) Number of units operated 384 buses
(7) Maintenance Cycle (interval between periodic inspections every 4000 km

227

C. Operational Details:

- Buses

	Mercedes German	Mercedes Iran	Mercedes TATA Ind.	Ward US	Pegaso Spain	Barreiros Spain	Nasr
(1) Length of Body (Meters)	12	10.95	8.535	10.643	12	9.12	10.4
(2) Width of Body (Meters)	2.5	2.5	2.438	2.438	2.5	2.5	2.5
(3) No. of passenger seats	32	47	34	40	52	39	42
(4) Maximum Passenger Capacity	100	90	80	52	100	80	100
(5) Conductor/Collector required?	Yes	Yes	Yes	Yes	Yes	Yes	Yes

- Trucks

(1) Length of cargo compartment (meters) _____

(2) Width " " " " _____

(3) Is cargo compartment enclosed? Yes _____ No _____

(4) " " " covered? Yes _____ No _____

(5) Overall vehicle length (Meters) _____

(6) Maximum capacity (Kilos) _____

EAST DELTA BUS COMPANY

	C. Issue/Disbursement How are items issued a.To sub-storeroom b.to Final user	% by written requisitions	% by work order	% by verbal order	% no record
Please supply copies of Issue/Disbursement forms - requisition, receipts, work orders perpetual inventory forms, etc.	1. Vehicles				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	2. Major Units				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	3. Small Units				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	4. Chassis Parts				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	5. Body Parts				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	6. Tires				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	7. Batteries				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	8. Fuel & Petrol Products				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	9. Cleaning Supplies				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero

OPERATING SYSTEM QUESTIONNAIRE

CTA

I. Logistics

A. Purchase/Acquisition/Manufacture where purchases are made for		% Manuf. in House	% Purchased or acquired International	% Purchased or acquired Local	% Leased
Please supply a copy of each form used by your organization in the acquisition of parts.	1. Vehicle (Buses, Trucks, Cars)	zero	100	zero	zero
	2. Major Units (engines, Transmissions, etc.)	zero	100	zero	zero
	3. Small Units (Injectors, Starters, etc).	zero	90	10	zero
	4. Chassis Parts (Springs, Fans, etc)	zero	zero	100	zero
	5. Body Parts (Panels, sheet metal, glass, etc)	zero	zero	100	zero
	6. Tires	zero	zero	100	zero
	7. Batteries	zero	zero	100	zero
	8. Fuel & Petroleum Products	zero	zero	100	zero
	9. Cleaning Supplies	zero	zero	100	zero

B. Storage Where are items stored		% at Central Stores	% at Engine Rebuild Shop	% at Operating Garage
Please supply a copy of each form used by your organization in parts storage - inventory forms, parts locations, etc.	1. Vehicles	zero	zero	100
	2. Major Units	100	zero	zero
	3. Small Units	100	zero	zero
	4. Chassis Parts	100	zero	zero
	5. Body Parts	100	zero	zero
	6. Tires	100	zero	zero
	7. Batteries	100	zero	zero
	8. Fuel & Petroleum Products	100	zero	zero
	9. Cleaning Supplies	100	zero	zero

CTA

	C. Issue/Disbursement How are items issued a.To sub-storeroom b.to Final user	% by written requisitions	% by work order	% by verbal order	% no record
Please supply copies of Issue/Disbursement forms - requisition, receipts, work orders, perpetual inventory forms, etc.	1. Vehicles				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	2. Major Units				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	3. Small Units				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	4. Chassis Parts				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	5. Body Parts				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	6. Tires				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	7. Batteries				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	8. Fuel & Petrol Products				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	9. Cleaning Supplies				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero

D. Parts Availability On order-not received	10 days or less	11-30 days	30-90 days	Over 90 days
(1) Major Units	100%	zero	zero	zero
(2) Small Units	100%	zero	zero	zero
(3) Other Parts	100%	zero	zero	zero
(4) Tires	100%	zero	zero	zero
(5) Batteries	100%	zero	zero	zero
Vehicles out of service due to lack of:				
(1) Major Units				
(2) Small Units	NO INFORMATION GIVEN			
(3) Other Parts				
(4) Tires				
(5) Batteries				

II Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated;

A. Structural Details:

Name & Manufacturer's Model: Pegaso Model # 5032

(1) Engine Pegaso Type 9 106 15
(2) Body Van Hool
(3) Transmission ISA
(4) Rear Axle/Differential Pegaso
(5) Steering Virex Fulmina
(6) Seats 36

B. Mechanical Details:

(1) Type Engine (Diesel, Gasoline) Diesel
(2) Fuel Consumption 40 lit/100 km
(3) Oil Consumption (100 km/Litre) 0.1 lit/100 Km
(4) Annual km's operated per unit 100,000 km approx
(5) " hours " " " 5,840 hr. approx.
(6) Number of units operated 303 bus/day
(7) Maintenance Cycle (interval between periodic inspections 15 days

232

C. Operational Details:

- Buses
  - (1) Length of Body (Meters) 12 m
  - (2) Width of Body (Meters) 2.5 m
  - (3) No. of passenger seats 36 seats
  - (4) Maximum Passenger Capacity 140 passengers (approx.)
  - (5) Conductor/Collector required? Yes X No

- Trucks
  - (1) Length of cargo compartment (meters) _____
  - (2) Width " " " " _____
  - (3) Is cargo compartment enclosed? Yes _____ No _____
  - (4) " " " covered? Yes _____ No _____
  - (5) Overall vehicle length (Meters) _____
  - (6) Maximum capacity (Kilos) _____

II Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated;

A. Structural Details:

Name & Manufacturer's Model: Mercedes - Iran National

(1) Engine Mercedes Benz OM 360
(2) Body Iran
(3) Transmission Mercedes Benz.
(4) Rear Axle/Differential H05/4
(5) Steering Mercedes Benz
(6) Seats 33 seats

B. Mechanical Details:

(1) Type Engine (Diesel, Gasoline) Diesel
(2) Fuel Consumption /
(3) Oil Consumption (100 km/Litre) /
(4) Annual km's operated per unit /approx. 100,000 km
(5) " hours " " " 4,800 hrs.
(6) Number of units operated 555 buses/day
(7) Maintenance Cycle (interval between periodic inspections 15 days

C. Operational Details:

- Buses

(1) Length of Body (Meters) 10.98 m
(2) Width of Body (Meters) 2.48 m
(3) No. of passenger seats 33 passengers seats
(4) Maximum Passenger Capacity 105 passengers
(5) Conductor/Collector required? Yes x No

234

II Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated;

A. Structural Details:

Name & Manufacturer's Model: NASR Type M 230 E 113 NASCO

(1) Engine KHD F8L 413
(2) Body NASCO
(3) Transmission 2F
(4) Rear Axle/Differential KHD
(5) Steering 2F
(6) Seats 46

B. Mechanical Details:

(1) Type Engine (Diesel, Gasoline) Diesel
(2) Fuel Consumption 35 lit/100 km
(3) Oil Consumption (100 km/Litre) 0.4 lit/100 km
(4) Annual km's operated per unit approx. 1000 km
(5) " hours " " " 4800 hrs
(6) Number of units operated 587 bus/day
(7) Maintenance Cycle (interval between periodic inspections 15 days

C. Operational Details:

- Buses

(1) Length of Body (Meters) 11.7 m
(2) Width of Body (Meters) 2.5 m
(3) No. of passenger seats 46
(4) Maximum Passenger Capacity 120 passengers approx.
(5) Conductor/Collector required? Yes x No

135

OPERATING SYSTEM QUESTIONNAIRE

GENERAL NILE COMPANY FOR WEST DELTA BUS

I. Logistics

A. Purchase/Acquisition/Manufacture where purchases are made for	% Manuf. in House	% Purchased or acquired International	% Purchased or acquired Local	% Leased
Please supply a copy of each form used by your organization in the acquisition of parts.				
1. Vehicle (Buses, Trucks, Cars)	zero	86.4	13.6	zero
2. Major Units (engines, Transmissions, etc.)	zero	100	zero	zero
3. Small Units (Injectors, Starters, etc).	zero	100	zero	zero
4. Chassis Parts (Springs, Fans, etc)	zero	60	40	zero
5. Body Parts (Panels, sheet metal, glass, etc)	zero	70	30	zero
6. Tires	zero	35	65	zero
7. Batteries	zero	10	90	zero
8. Fuel & Petroleum Products	zero	zero	100	zero
9. Cleaning Supplies	zero	zero	100	zero

B. Storage Where are items stored	% at Central Stores	% at Engine Rebuild Shop	% at Operating Garage
Please supply a copy of each form used by your organization in parts storage - inventory forms, parts locations, etc.			
1. Vehicles	100	zero	zero
2. Major Units	80	10	10
3. Small Units	80	10	10
4. Chassis Parts	50	zero	50
5. Body Parts	70	zero	30
6. Tires	100	zero	zero
7. Batteries	90	5	5
8. Fuel & Petroleum Products	60	10	30
9. Cleaning Supplies	75	zero	25

236

	C. Issue/Disbursement How are items issued a.To sub-storeroom b.to Final user	% by written requisitions	% by work order	% by verbal order	% no record
Please supply copies of Issue/Disbursement forms - requisition, receipts, work orders, perpetual inventory forms, etc.	1. Vehicles				
	a.	90	zero	10	zero
	b.	100	zero	zero	zero
	2. Major Units				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	3. Small Units				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	4. Chassis Parts				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	5. Body Parts				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	6. Tires				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	7. Batteries				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	8. Fuel & Petrol Products				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero
	9. Cleaning Supplies				
	a.	100	zero	zero	zero
	b.	100	zero	zero	zero

OPERATING SYSTEM QUESTIONNAIRE GOODS TRANSPORT

I. Logistics

A. Purchase/Acquisition/Manufacture where purchases are made for		% Manuf. in House	% Purchased or acquired International	% Purchased or acquired Local	% Leased
Please supply a copy of each form used by your organization in the acquisition of parts.	1.Vehicle(Buses,Trucks,Cars)	-	100%	-	-
	2.Major Units (engines,Transmissions, etc.)	-	100%	-	
	3.Small Units(Injectors, Starters, etc).	-	100%	-	
	4.Chassis Parts(Springs,Fans,etc)		30%	70%	
	5.Body Parts(Panels,sheet metal, glass,etc)		90%	10%	
	6.Tires		80%	20%	
	7.Batteries		100%	-	
	8.Fuel & Petroleum Products			100%	
	9.Cleaning Supplies		100%	-	

B. Storage Where are items stored		% at Central Stores	% at Engine Rebuild Shop	% at Operating Garage
Please supply a copy of each form used by your organization in parts storage - inventory forms, parts locations, etc.	1.Vehicles	-	-	100%
	2.Major Units	10%	70%	20%
	3.Small Units	10%	45%	45%
	4.Chassis Parts	40%	30%	30%
	5.Body Parts	40%	30%	30%
	6.Tires	10%	-	90%
	7.Batteries	10%	-	90%
	8.Fuel & Petroleum Products	-	-	100%
	9.Cleaning Supplies	30%	-	70%

238

C. Operational Details:

- Buses
  - (1) Length of Body (Meters) _____
  - (2) Width of Body (Meters) _____
  - (3) No. of passenger seats _____
  - (4) Maximum Passenger Capacity _____
  - (5) Conductor/Collector required? Yes _____ No _____

- Trucks

	Saviem 260	Saviem SM8	Fiat
(1) Length of cargo compartment (meters)	11.00 m	6.00 m	6.00 m
(2) Width " " " "		1.5m	
(3) Is cargo compartment enclosed? Yes			Nox
(4) " " " covered? Yes			Nox
(5) Overall vehicle length (Meters)	5.00	9.00	7.945
(6) Maximum capacity (Kilos)	35	21.5	36

239

	C. Issue/Disbursement How are items issued a.To sub-storeroom b.to Final user	% by written requisitions	% by work order	% by verbal order	% no record
Please supply copies of Issue/Disbursement forms - requisition, receipts, work orders, perpetual inventory forms, etc.	1. Vehicles				
	a.	100%	-	-	-
	b.	100%	-	-	-
	2. Major Units				
	a.	100%	-	-	-
	b.	100%	-	-	-
	3. Small Units				
	a.	100%	-	-	-
	b.	100%	-	-	-
	4. Chassis Parts				
	a.	50%	50%	-	-
	b.	50%	50%	-	-
	5. Body Parts				
	a.	50%	50%	-	-
	b.	50%	50%	-	-
	6. Tires				
	a.	50%	50%	-	-
	b.	50%	50%	-	-
	7. Batteries				
	a.	50%	50%	-	-
	b.	50%	50%	-	-
	8. Fuel & Petrol Products				
	a.	100%	-	-	-
	b.	100%	-	-	-
	9. Cleaning Supplies				
	a.	50%	-	-	-
	b.	50%	-	-	-

240

GOODS TRANSPORT

D. Parts Availability	10 days or less	11-30 days	30-90 days	Over 90 days
On order-not received				
(1) Major Units	-	-	-	x
(2) Small Units	-	x	-	-
(3) Other Parts	x	-	-	-
(4) Tires	x	-	-	-
(5) Batteries	-	x	-	-
Vehicles out of service due to lack of:				
(1) Major Units	-	-	x	-
(2) Small Units	x	-	-	-
(3) Other Parts	x	-	-	-
(4) Tires	x	-	-	-
(5) Batteries	x	-	-	-

II Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated;

A. Structural Details:

Name & Manufacturer's Model: Saviem SM260 - Saviem SMB - Fiat

(1) Engine MAN 2356 - Saviem - Fiat
(2) Body Saviem - Saviem - Fiat
(3) Transmission Continuous meshing - continuous meshing
(4) Rear Axle/Differential -
(5) Steering Hydraulic- Mechanical - Hydraulic
(6) Seats -

B. Mechanical Details:

(1) Type Engine (Diesel, Gasoline) Diesel
(2) Fuel Consumption 2.3 - 5 - 2.2 lit/100 km
(3) Oil Consumption (100 km/Litre) 6-10 gm/km
(4) Annual km's operated per unit 80000 km
(5) " hours " " " 1140 hours
(6) Number of units operated 318 including 100 Barrieros
133 Saviem 260
144 Fiat
41 Saviem SM8
(7) Maintenance Cycle (interval between periodic inspections every 3000
6000
24000
48000
96000 km

241

OPERATING SYSTEM QUESTIONNAIRE

GENERAL NILE CO.FOR RURAL TRANSPORT

Logistics

	A. Purchase/Acquisition/Manufacture where purchases are made for	% Manuf. in House	% Purchased or acquired International	% Purchased or acquired Local	% Leased
Please supply a copy of each form used by your organization in the acquisition of parts.	1.Vehicle(Buses,Trucks,Cars)		100%		
	2.Major Units (engines,Transmissions, etc.)		100%		
	3.Small Units(Injectors, Starters, etc).		100%		
	4.Chassis Parts(Springs,Fans,etc)			100%	
	5.Body Parts(Panels,sheet metal, glass,etc)		20%	80%	
	6.Tires		70%	30%	
	7.Batteries			100%	
	8.Fuel & Petroleum Products			100%	
	9.Cleaning Supplies			100%	

	B. Storage Where are items stored	% at Central Stores	% at Engine Rebuild Shop	% at Operating Garage
Please supply a copy of each form used by your organization in parts storage - inventory forms, parts locations, etc.	1.Vehicles			100%
	2.Major Units			100%
	3.Small Units			100%
	4.Chassis Parts	25%		75%
	5.Body Parts	25%		75%
	6.Tires	80%		20%
	7.Batteries	80%		20%
	8.Fuel & Petroleum Products			100%
	9.Cleaning Supplies	25%		75%

	C. Issue/Disbursement How are items issued a.To sub-storeroom b.to Final user	% by written requisitions	% by work order	% by verbal order	% no record
Please supply copies of Issue/Disbursement forms - requisition, receipts, work orders, perpetual inventory forms, etc.	1. Vehicles				
	a.				
	b.		100%		
	2. Major Units				
	a.	100%			
	b.				
	3. Small Units				
	a.	100%			
	b.				
	4. Chassis Parts				
	a.	100%			
	b.				
	5. Body Parts				
	a.	100%			
	b.				
	6. Tires				
	a.	100%			
	b.				
	7. Batteries				
	a.	100%			
	b.				
	8. Fuel & Petrol Products				
	a.	100%			
	b.				
	9. Cleaning Supplies				
	a.	100%			
	b.				

243

D. Parts Availability	10 days or less	11-30 days	30-90 days	Over 90 days
On order-not received				
(1) Major Units	Less			
(2) Small Units	"			
(3) Other Parts	"			
(4) Tires	"			
(5) Batteries	"			
Vehicles out of service due to lack of:				
(1) Major Units		(N O T	H I N G)	
(2) Small Units				
(3) Other Parts				
(4) Tires				
(5) Batteries				

II. Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated;

A. Structural Details:

Name & Manufacturer's Model: _____

(1) Engine _____
(2) Body _____
(3) Transmission _____
(4) Rear Axle/Differential _____
(5) Steering _____
(6) Seats _____

B. Mechanical Details:

(1) Type Engine (Diesel, Gasoline) _____
(2) Fuel Consumption _____
(3) Oil Consumption (100 km/Litre) _____
(4) Annual km's operated per unit _____
(5) " hours " " " _____
(6) Number of units operated _____
(7) Maintenance Cycle (interval between periodic inspections _____

244

XI Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated;

A. Structural Details:

Name & Manufacturer's Model: FIAT/truck and trailer

(1) Engine Diesel, direct injection model 8210.02
(2) Body Truck and trailer total cap. 26 tons
(3) Transmission Gearbox manual/clutch 14 inc. twin plate
(4) Rear Axle/Differential 2 differentials/optional drive ratio 9.4011
(5) Steering Power assisted 7.4211
(6) Seats 2 seats

B. Mechanical Details:

(1) Type Engine (Diesel, Gasoline) Diesel
(2) Fuel Consumption 50 litre/100 km
(3) Oil Consumption (100 km/Litre) 8 qm/km
(4) Annual km's operated per unit 70,000
(5) " hours " " " 1,200 (approx)
(6) Number of units operated 147
(7) Maintenance Cycle (interval between periodic inspections 15 days

Trucks FIAT

(1) Length of cargo compartment (meters) 5.42 truck/7.50 trailer
(2) Width " " " " 2.42 " /2.42 "
(3) Is cargo compartment enclosed? ~~Yes~~ No
(4) " " " covered? ~~Yes~~ No
(5) Overall vehicle length (Meters) 8.05 m
(6) Maximum capacity (Kilos) 12 tons (truck) /14 tons (trailer) net

245

II Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated;

A. Structural Details:

Name & Manufacturer's Model: Model 853-13 (RABA)

(1) Engine Model D2156 MTN6/256 HP
(2) Body Semi trailer tractor
(3) Transmission gearbox/Eton Fuller RT 950 a/A-Clutch GF 420 Fictel
(4) Rear Axle/Differential RABA double reduction
(5) Steering ZF power assisted
(6) Seats 2 seats

B. Mechanical Details:

(1) Type Engine (Diesel, Gasoline) Diesel
(2) Fuel Consumption 50 litre/100 km
(3) Oil Consumption (100 km/Litre) 8.3 gm/km
(4) Annual km's operated per unit about 70,000
(5) " hours " " " 1200 (approx)
(6) Number of units operated 21
(7) Maintenance Cycle (interval between periodic inspections 15 days

Trucks RABA

(1) Length of cargo compartment (meters) 12.306 m
(2) Width " " " " 2.50 m
(3) Is cargo compartment enc[illegible]ed? ~~Yes~~ No
(4) " " " covered? ~~Yes~~ No
(5) Overall vehicle length (Meters) 14.90 m
(6) Maximum capacity (Kilos) 24 tons net

246

II Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated;

A. Structural Details:

Name & Manufacturer's Model: Saviem SM 260/Semi trailer tractor

(1)	Engine	MAN 2356 HM SD
(2)	Body	Semi trailer tractor cap. 24 tons
(3)	Transmission	Ferode single plate/gearbox model 343
(4)	Rear Axle/Differential	Model 4878
(5)	Steering	2F Type 8065
(6)	Seats	2 seats

B. Mechanical Details:

(1)	Type Engine (Diesel, Gasoline)	Diesel
(2)	Fuel Consumption	50 litres/100 km
(3)	Oil Consumption (100 km/Litre)	8.3 gm/km
(4)	Annual km's operated per unit	70,000
(5)	" hours " " "	1200 (approx)
(6)	Number of units operated	129
(7)	Maintenance Cycle (interval between periodic inspections	15 days

Trucks SAVIEM

(1)	Length of cargo compartment (meters)	12.22 m
(2)	Width " " " "	2.43 m
(3)	Is cargo compartment enclosed? ~~Yes~~	No
(4)	" " " covered? ~~Yes~~	No
(5)	Overall vehicle length (Meters)	15 m
(6)	Maximum capacity (Kilos)	24 tons net

OPERATING SYSTEM QUESTIONNAIRE

TRANSPORTATION WORK

I. Logistics

A. Purchase/Acquisition/Manufacture where purchases are made for		% Manuf. in House	% Purchased or acquired International	% Purchased or acquired Local	% Leased
Please supply a copy of each form used by your organization in the acquisition of parts.	1. Vehicle (Buses, Trucks, Cars)	-	90%	-	-
	2. Major Units (engines, Transmissions, etc.)	-	100%		
	3. Small Units (Injectors, Starters, etc).	-	100%		
	4. Chassis Parts (Springs, Fans, etc)	-	20%		
	5. Body Parts (Panels, sheet metal, glass, etc)	-		100%	
	6. Tires	-	100%		
	7. Batteries	25%		75%	
	8. Fuel & Petroleum Products	-		100%	
	9. Cleaning Supplies	-		100%	

B. Storage Where are items stored		% at Central Stores	% at Engine Rebuild Shop	% at Operating Garage
Please supply a copy of each form used by your organization in parts storage - inventory forms, parts locations, etc.	1. Vehicles	-	-	-
	2. Major Units	90%	10%	-
	3. Small Units	100%	-	-
	4. Chassis Parts	100%	-	-
	5. Body Parts	100%	-	-
	6. Tires	100%	-	-
	7. Batteries	100%	-	-
	8. Fuel & Petroleum Products	Fuel Stat.	-	-
	9. Cleaning Supplies	100%	-	-

	C. Issue/Disbursement How are items issued a.To sub-storeroom b.to Final user	% by written requisitions	% by work order	% by verbal order	% no record
Please supply copies of Issue/Disbursement forms - requisition, receipts, work orders, perpetual inventory forms, etc.	1. Vehicles				
	a.	100%			
	b.	100%			
	2. Major Units				
	a.	100%			
	b.	100%			
	3. Small Units				
	a.	100%			
	b.	100%			
	4. Chassis Parts				
	a.	100%			
	b.	100%			
	5. Body Parts				
	a.	100%			
	b.	100%			
	6. Tires				
	a.	100%			
	b.	100%			
	7. Batteries				
	a.	100%			
	b.	100%			
	8. Fuel & Petrol Products				
	a.	100%			
	b.	100%			
	9. Cleaning Supplies				
	a.	100%			
	b.	100%			

TRANSPORT WORKS

D. Parts Availability On order-not received	10 days or less	11-30 days	30-90 days	Over 90 days
(1) Major Units	-			
(2) Small Units	-			
(3) Other Parts	-	50	40	10
(4) Tires	-			
(5) Batteries	-			
Vehicles out of service due to lack of:	Capin	Capin		
(1) Major Units	1	2		
(2) Small Units				
(3) Other Parts				
(4) Tires				
(5) Batteries				

II Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated;

A. Structural Details:

Name & Manufacturer's Model: _____

(1) Engine _____
(2) Body _____
(3) Transmission _____
(4) Rear Axle/Differential _____
(5) Steering _____
(6) Seats _____

B. Mechanical Details:

(1) Type Engine (Diesel, Gasoline) _____
(2) Fuel Consumption _____
(3) Oil Consumption (100 km/Litre) _____
(4) Annual km's operated per unit _____
(5) " hours " " " _____
(6) Number of units operated _____
(7) Maintenance Cycle (interval between periodic inspections _____

250

OPERATING SYSTEM QUESTIONNAIRE DIRECT TRANSPORT

I. Logistics

A. Purchase/Acquisition/Manufacture where purchases are made for		% Manuf. in House	% Purchased or acquired International	% Purchased or acquired Local	% Leased
Please supply a copy of each form used by your organization in the acquisition of parts.	1.Vehicle(Buses,Trucks,Cars)		100%		
	2.Major Units (engines,Transmissions, etc.)		100%		
	3.Small Units(Injectors, Starters, etc).		100%		
	1.Chassis Parts(Springs,Fans,etc)		50%	50%	
	5.Body Parts(Panels,sheet metal, glass,etc)			100%	
	6.Tires		90%	10%	
	7.Batteries			100%	
	8.Fuel & Petroleum Products			100%	
	9.Cleaning Supplies			100%	

B. Storage Where are items stored		% at Central Stores	% at Engine Rebuild Shop	% at Operating Garage
Please supply a copy of each form used by your organization in parts storage - inventory forms, parts locations, etc.	1.Vehicles			100%
	2.Major Units	100%		
	3.Small Units	100%		
	4.Chassis Parts	in the different branches of the company		
	5.Body Parts			
	6.Tires			
	7.Batteries			
	8.Fuel & Petroleum Products			
	9.Cleaning Supplies			

251

DIRECT TRANSPORT

	C. Issue/Disbursement How are items issued a.To sub-storeroom b.to Final user	% by written requisitions	% by work order	% by verbal order	% no record
Please supply copies of Issue/Disbursement forms - requisition, receipts, work orders, perpetual inventory forms, etc.	1. Vehicles				
	a.	100%			
	b.		100%		
	2. Major Units				
	a.	100%			
	b.	100%			
	3. Small Units				
	a.	100%			
	b.		100%		
	4. Chassis Parts				
	a.	100%			
	b.	100%			
	5. Body Parts				
	a.	100%			
	b.	100%			
	6. Tires				
	a.	100%			
	b.	100%			
	7. Batteries				
	a.	100%			
	b.	100%			
	8. Fuel & Petrol Products				
	a.		100%		
	b.		100%		
	9. Cleaning Supplies				
	a.	100%			
	b.		100%		

DIRECT TRANSPORT

D. Parts Availability	10 days or less	11-30 days	30-90 days	Over 90 days
On order-not received				
(1) Major Units	x			
(2) Small Units	x			
(3) Other Parts	x			
(4) Tires	x			
(5) Batteries	x			
Vehicles out of service due to lack of:		according to the rule they pay		
(1) Major Units	x	charges if delayed		
(2) Small Units	x			
(3) Other Parts	x			
(4) Tires	x			
(5) Batteries	x			

II Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated;

A. Structural Details:

Name & Manufacturer's Model: Fiat Unit 27-64 - Berilie TR280 - Berilie TLR 280

(1) Engine M62S - MDS06.35.40 - MDS06.35.40
(2) Body
(3) Transmission Fiat - BRT3 - BM83
(4) Rear Axle/Differential Fiat - P1332 - P1332
(5) Steering Bendix calozoni - Z.F - Berilie
(6) Seats xxx

B. Mechanical Details:

(1)	Type Engine (Diesel, Gasoline)	Diesel	Diesel	Diesel
(2)	Fuel Consumption	50	40	45
(3)	Oil Consumption (100 km/Litre)	0.1	0.1	0.1
(4)	Annual km's operated per unit	75000	90000	90000
(5)	" hours " " "	1100	1200	1200
(6)	Number of units operated	130	28	14
(7)	Maintenance Cycle (interval between periodic inspections	3000	4000	4000 km

253

- Trucks

(1) Length of cargo compartment (meters)	12.00 m	(all kind)
(2) Width " " " "	2.45 m	(" ")
(3) Is cargo compartment enclosed? Yes		~~No~~
(4) " " " covered? Yes		~~No~~
(5) Overall vehicle length (Meters)	16.00 m - 14.50 m - 15.3 m	
(6) Maximum capacity (Kilos)	28000 - 24000 - 24000	

OPERATING SYSTEM QUESTIONNAIRE

HEAVY TRANSPORT

.. Logistics

A. Purchase/Acquisition/Manufacture where purchases are made for	% Manuf. in House	% Purchased or acquired International	% Purchased or acquired Local	% Leased
Please supply a copy of each form used by your organization in the acquisition of parts.				
1. Vehicle (Buses, Trucks, Cars)		100%		
2. Major Units (engines, Transmissions, etc.)		100%		
3. Small Units (Injectors, Starters, etc).		100%		
4. Chassis Parts (Springs, Fans, etc)			70%	
5. Body Parts (Panels, sheet metal, glass, etc)		100%	100%	
6. Tires			100%	
7. Batteries			100%	
8. Fuel & Petroleum Products			100%	
9. Cleaning Supplies				

B. Storage Where are items stored	% at Central Stores	% at Engine Rebuild Shop	% at Operating Garage
Please supply a copy of each form used by your organization in parts storage - inventory forms, parts locations, etc.			
1. Vehicles			100%
2. Major Units			
3. Small Units		100%	
4. Chassis Parts		100%	
5. Body Parts		100%	
6. Tires		100%	
7. Batteries		100%	
8. Fuel & Petroleum Products		100%	
9. Cleaning Supplies			

HEAVY TRANSPORT

	C. Issue/Disbursement How are items issued a.To sub-storeroom b.to Final user	% by written requisitions	% by work order	% by verbal order	% no record
Please supply copies of Issue/Disbursement forms - requisition, receipts, work orders, perpetual inventory forms, etc.	1. Vehicles				
	a.	100%			
	b.	100%			
	2. Major Units				
	a.		100%		
	b.		100%		
	3. Small Units				
	a.		100%		
	b.		100%		
	4. Chassis Parts				
	a.		100%		
	b.		100%		
	5. Body Parts				
	a.		100%		
	b.		100%		
	6. Tires				
	a.		100%		
	b.		100%		
	7. Batteries				
	a.		100%		
	b.		100%		
	8. Fuel & Petrol Products				
	a.		100%		
	b.		100%		
	9. Cleaning Supplies				
	a.		100%		
	b.		100%		

256

D. Parts Availability	10 days or less	11-30 days	30-90 days	Over 90 days
On order-not received				
(1) Major Units				
(2) Small Units				
(3) Other Parts			Yes	
(4) Tires				Yes
(5) Batteries				
Vehicles out of service due to lack of:				
(1) Major Units				
(2) Small Units				
(3) Other Parts			Yes	
(4) Tires				
(5) Batteries				

II Buses and Trucks

Please supply copies of all forms related to vehicle maintenance and servicing

(Please fill out one form for each type of bus or truck operated;

A. Structural Details:

Name & Manufacturer's Model: Saviem - Berlit - Fiat - Unic

(1) Engine Berlit - Fiat - Unic
(2) Body
(3) Transmission
(4) Rear Axle/Differential
(5) Steering Hydraulic
(6) Seats -

B. Mechanical Details:

(1) Type Engine (Diesel, Gasoline) Diesel
(2) Fuel Consumption 50 lit/100 km
(3) Oil Consumption (100 km/Litre)
(4) Annual km's operated per unit 75000 kms
(5) " hours " " "
(6) Number of units operated 200
(7) Maintenance Cycle (interval between periodic inspections

257

- Trucks
  - (1) Length of cargo compartment (meters) _____
  - (2) Width " " " " _____
  - (3) Is cargo compartment enclosed? Yes _____ No _____
  - (4) " " " covered? Yes _____ No _____
  - (5) Overall vehicle length (Meters) 12 m
  - (6) Maximum capacity (Kilos) 24 ton - 29 ton - 27 ton

APPENDIX IV

BUS MAINTENANCE AND LOGISTIC SUPPORT PRACTICES

APPENDIX IV

BUS MAINTENANCE AND LOGISTIC SUPPORT PRACTICES

A basic assumption must be made at the outset of this note concerning the definition of the phrase "vehicle maintenance". In the context of this note, "vehicle maintenance" includes all those activities that are required to keep the vehicle physically capable of being operated in revenue service. Thus, vehicle maintenance would include, in addition to regular preventive maintenance, all aspects of vehicle servicing and repair.

Of primary importance in the maintenance of fleet vehicles is the daily servicing and inspection procedure. While basic servicing is unavoidable, (vehicles won't run without fuel) the inspection procedure is often overlooked, skimped upon, or made difficult due to lack of proper facilities, supplies, or tools. Sometimes servicing is limited to only one or two elements, (fuel and oil topping, for instance) without thought being given to some of the other elements that should be checked (battery water, tire pressure, etc.). These activities will be commented on in the proper section below.

Next in importance is the periodic preventive maintenance inspection. Normally, such inspections take place at given increments of distance (5 or 10 thousand kilometers, for example) with certain inspections (20, 50, or 100 thousand, for example) going into more elaborate procedures on some of the vehicle components, or changing specific units. Again, in certain circumstances, there is a tendency to skip over or slight some of these activities or to fall behind in the maintenance program. These tendencies will be addressed in the appropriate section below.

The repair aspects of maintenance are also usually divided into two main components. First is "running repair", or those repairs made on an ad hoc basis to keep a vehicle in service. These repairs are usually done on the vehicle itself, as opposed to unit repair -- "back shop" work that is done on units that have been removed from the vehicle. Unit repair is further distinguished from running repair by being done -- hopefully -- on the basis of a schedule, rather than as the result of a breakdown.

Preventive Maintenance is a phrase which means different things to different people. Thus it is probably best to start out with a definition so that a common understanding can be achieved. Preventive maintenance means, in most fleet transport circles,

that a vehicle is inspected on a regular basis; that certain procedures are undertaken at specified intervals; and that various parts are replaced at specified intervals without regard to outward appearance of utility. The purpose of preventive maintenance is three fold:

- o to keep vehicle downtime to a minimum
- o to extend the operating life of the element being maintained
- o to increase the percentage of total activities that are done on a scheduled basis, so as to minimize backlogs and/or unused person hours.

Often associated with preventive maintenance is the concept of unit exchange. The concept derives from the fact that the complete vehicle is expensive; therefore, vehicle downtime must be held to a minimum in the interest of proper utilization of capital funds. Spare units -- complete engines, transmissions, fuel pumps, air compressors, starters, etc.-- are maintained in inventory so as to enable a "quick change" and rapid return of the vehicle to service.

Every phase of mechanical activity is dependent on logistical support. It is the intent of this memo to detail the types of logistical support required for proper maintenance, so as to set a standard against which actual operations can be measured.

A. Vehicle Servicing: Vehicle servicing should be a daily activity performed on each vehicle that has operated during the day. Regardless of distance travelled, each should be thoroughly serviced and inspected for safety defects. Servicing and inspection should consist of, at minimum, the following:

(1) Fueling (tank to be topped off)

(2) Oil level check (oil added to attain proper level when required, but not overfilled)

(3) Cooling system checked, (water and rust inhibitor added as indicated)

(4) Tire pressure checked with gauge (pressure adjusted as required). Tires examined for side wall damage, tread wear.

(5) Battery water checked (topped off as necessary)

(6) Brakes checked for proper clearance, (adjusted as necessary)

(7) Vehicle underside and engine compartment checked for leaks, worn belts, etc.

(8) Door operation checked

(9) All lights - inside and out - checked for proper operation. Includes check of brake lights and turn signals. Horn, windshield wiper and other safety equipment checked.

(10) Vehicle washed on exterior, and swept inside. (Some systems wash only every other day, on an odd-even vehicle number basis).

All of this should be on a printed check-list, initialed by the foreman for each vehicle serviced and inspected. This check list inspection should be supplemented by the driver's pre-, during-, and after-operation check. Each driver should fill out a daily defect card, stating any problems he has incurred, which should be collected each night by the service foreman. The foreman would then decide, after the daily inspection and a review of the defect card, whether the vehicle should be marked ready for service, or sent to running repair for correction.

Logistical support required for proper daily service and inspection is as follows:

(1) Fuel -- proper grade, dispensed from pump with resettable meter dial, in addition to cumulative dial.

(2) Oil* -- proper grade, dispensed through pump with resettable meter dial. (In smaller garages, pump may be replaced by use of individual liter cans -- but provision must be made for accounting for use).

(3) Water -- available from hose with nozzle cut-off for filling radiators.

(4) Battery water -- purified (clean) water kept in and dispensed from specially designed battery fillers.

(5) Compressed air, to maintain proper tire pressure. Inspector to be supplied with a gauge for checking pressure.

(6) Properly lighted, clean pit for under vehicles inspection and brake check and adjustment

(7) Exterior vehicle washer(s) drive through w/brush around capability to wash fronts and backs. Interior air-sweep system(s) at bus garages. (In smaller garages - 40 buses or less - an industrial vacuum might be used in place of air-sweep).

(8) Supply of detergent, brushes, mops, rags, etc., as indicated.

---

* It is the present custom in Egypt to measure oil in kilos rather than liters. Since pumps can only reasonably be calibrated in liters, it is strongly recommended that the more useful liter measurement be generally adopted.

All of these supplies and facilities should be located within the service area, which would normally be an in-line, drive-through facility, normally designed for one-stop servicing. Care in the overall design of the facility is important so as to minimize wasted time and motion.

Proper supervision of the service line at all times is required to maintain a given level of production, to insure that proper records are kept (amount of fuel and oil dispensed to each bus), and to prevent overfilling and overlooking. In smaller operations, supervision of the service line might have to be combined with running repair.

Records of the amount of fuel and oil dispensed, while kept by the servicing crew, are the responsibility of the storekeeper, who should check daily the starting and ending readings on the dispensers to compare with amounts of fuel and oil dispensed to individual vehicles.

B. Running Repair. It is axiomatic that the need for running repair increases as the proper execution of preventive maintenance declines. While impossible to eliminate the running repair function entirely, the hallmark of good maintenance is a running repair section of minimal size -- that is, small in comparison to the preventive maintenance section. The size of the "deadline" (vehicles awaiting repair) should also be kept to an irreducable minimum.

The bases for running repair activity are the various reports from drivers on defects, and problems found during the daily inspections. When a problem is detected by a driver during operation, it should be noted on the defect card kept in the vehicle. Should the defect be serious, or such that the continued operation of the vehicle might be dangerous or increase the severity of the defect, the vehicle should be removed from service. Making "road calls" -- answering requests for assistance from drivers of vehicles with mechanical difficulties -- is another function of the running repair section.

When it is determined that that a vehicle has a defect serious enough to cause its removal from service, it should be set in a separate area known as the "deadline" until it can be repaired. The prudent maintenance superintendent keeps careful records on his deadline, noting just how long each vehicle has been out of service, and for what reasons -- lack of parts, insufficient manpower, or whatever.

Logistical support for running repair includes the maintenance of a parts inventory sufficient to effectuate required repairs; making sure that needed special tools are readily available; and providing necessary vehicles and equipment to answer road calls promptly and properly.

It is general practice throughout the industry to require each mechanic to supply and maintain his own tools. Individual mechanics are often assisted by management through periodic payment of a specific amount for the maintenance and upgrading of his tool kit. These tools, however, are the "common" tools -- hammers, pliers, wrenches, screwdrivers, etc. The storekeeper at each garage usually maintains a "tool crib"wherein special tools -- pullers, air wrenches, machine tools, rivet guns, etc -- are kept, ready for use when required. It is mainly for the running repair mechanic that the tool crib is maintained, since most of the other mechanics are specialists, and are normally in possession of the special tools that they are called on to use on a regular basis. Supervisors should constantly and consistently insist that each mechanic maintain his required tools in serviceable condition.

C. Preventive Maintenance/Inspection. This section is the heart of a well run mechanical organization. Here, maintenance is done on a regularly scheduled basis, with mechanics and servicers going through a set routine in accordance with a written sequence of activities that varies with the type of vehicle and the particular kilometer increment. (See below). The inspection sequence must be based on the manufacturer's recommendations -- unless it is, all warranties are voided. For example, the manufacturer of a particular vehicle might establish the following guidelines:*

Oil Change	3,000 KM
Chassis Lube	6,000 KM
Oil Filter	6,000 KM
Air Filter	6,000 KM
Fuel Filter	12,000 KM
Transmission Oil	24,000 KM
Differential Oil	24,000 KM
Fuel Pump Adjustment	24,000 KM
Cooling System Flush	48,000 KM
Brake Relining	48,000 KM
Wheel Bearing Repacking	48,000 KM

This list is far from complete -- it is used for example only

In addition to this partial list of manufacturer's recommendations, the superintendent of maintenance may have determined through experience that the following schedule of unit replacements will best serve his purposes:

Alternator	48,000 KM
Starter	48,000 KM
Air Compressor	24,000 KM
Fuel Pump/injectors	48,000 KM
Differential	96,000 KM
Radiator	96,000 KM

Thus a schedule of maintenance activities might be established as shown in Table 1.

Logistical support for these activities is generally as follows:

(1) Lubricants (grease and oils) dispensed and metered in pits or adjacent to hoists

(2) Proper filters for the vehicle being serviced and inspected

(3) Proper cleaning agents and equipment

(4) Spare units as specified in the particular maintenance cycle.

(5) Other parts as determined by the inspector.

As shown in the sample maintenance schedule, units are scheduled to be changed at specified intervals -- before they malfunction. For example, air compressors are changed on the sample schedule at 24,000 KM, the alternator at 48,000 KM, etc. The only exceptions to this rule should be units directly in the drive train -- Engine, transmission, converter, clutch. These are usually replaced on a demonstrated need basis -- but before failure. For example, the engine should be replaced when oil consumption exceeds 1 liter per 150 KM, the clutch when travel exceeds a certain minimum, etc. But these activities should also be done on a unit exchange basis so as to minimize vehicle downtime.

D. Unit Shops (workshops). These shops are charged with repairing the various units removed by running repair and inspection crews; and with rebuilding and repairing drive train elements. These shops, as opposed to running repair and inspection, do not have to be located in proximity to the operating garage. Rather, due to the need for volume to make best use of skill specialization, special tools, proper supervision, and specialized training, it is generally preferable to have one such unit shop supporting a number of garages.

Larger unit shops can afford a considerable degree of specialization. For example, it might be feasible to employ a semi-skilled mechanic as a dis-assembler who takes the unit apart and cleans it; one highly trained mechanic who inspects the dis-assembled unit and decides which parts must be retained and which replaced; and a skilled assembler who puts the unit back into working order with the new and retained parts as decided on by the inspector. This type of division of labor also provides a logical promotion path and pay scale gradients -- dis-assembler, to assembler to inspector.

Usual unit shop divisions are as follows:

Engine rebuild/blowers
Transmission/torque converter-clutch-differential
Electrical-starters, alternators, generators, regulators, thermocouples, etc.
Air-compressors, door engines, brake components, etc.
Fuel-pumps, injectors, etc.
Cooling - radiators, fans, etc.

While all these shops can and should be located in the same general area (there is no need for separate small rooms -- in fact, supervision is made easier by having one large open space), it is best to have a separate room with filtered air supply where work on such items as torque converters, injectors, and fuel pumps can be done. Small particles of dust and dirt introduced into these units during rebuild can severely effect longevity. This special room, however, does not reduce the need for cleanliness throughout the entire area; work of any kind suffers when it must be performed in a dirty environment.

Logistical support for unit shops would be in the form of parts and kits required to replace items found to be defective, the provision of special tools designed to ease and speed up the work process, and the supply of whatever else might be needed to perform the work -- an air supply to power tools and hoists; solvents for cleaning; and proper instruments for testing.

This last is an important element in itself. No shop, no mechanic can do a proper job without proper measuring and testing devices. Of major importance in any large shop is a device to detect hair-line cracks and metal fatigue in critical parts and assemblies -- particularly engine blocks and heads, gears, transmission cases, etc. Further, each unit shop should have its own gauges and testers -- micrometers, torque wrenches, and dynamometers in engine rebuild; ammeter/voltmeter/growler in electrical; pressure/volume gauges in fuel and air; pressure testers in radiators; pressure gauges and other specialized testers in torque converters, etc.

E. Speciality Shops. In addition to unit rebuild, certain

other shops are normally associated with this level of maintenance. Such facilities include the body shop - rebuilding, repairing and painting vehicle bodies; carpenter shop - rebuilding and replacing wooden items associated with vehicles and operating structures; upholstery shop - repairing damage to seats. Systems operating electrically operated vehicles or systems with private right -of-way would have other specialty shops - maintenance of right-of-way, line crew shop, etc.

Logistical support for these shops is virtually the same as for the unit shops - i.e. required parts, supplies/and tools -- although these trade shops would tend to maintain their own specialized tool-cribs because of the unique nature of the tools required.

F. Stores. The storeroom, while largely the servant of the mechanical department, is normally considered to be a part of the fiscal function of the operating agency -- i.e under the same management as the accounting department. The reasons for this, in addition to the fact that it has more reasons for its existence than to serve maintenance, are several. First, there is the need for close financial scrutiny of all three logistical functions --procurement, storage, and distribution. There must be a balance -- the most cost effective production balance -- between labor cost and material cost; and this can best be determined by a department not involved in direct day-to-day production problems - a department whose duty it is to watch the purse-strings for the entire system. Second, the process of procuring, storing, and distributing requires clerical skills -- not mechanical -- and these skills are best supervised by those who understand them. Third, the specialized accounting devices (computers, posting machines, and the like) used in the fiscal section can also he used for stores accounting, ensuring the maintenance of proper inventory levels, checking and comparing costs of procurement, and making required use projections. Fourth (particularly in Egypt with its dependance on foreign parts and assemblies), purchasing must be done on a high level, and far in advance -- a function best left to knowledgeable specialists in finance and purchasing -- not mechanical engineers.

However, organization is a creature of personnel availability -- and is dictated by it. There may well be overriding reasons for a particular organization because of the presence of or lack of qualified personnel in a particular field. But the reasons stated above should at least be considered, regardless of personnel.

Just as there are various levels of maintenance, there are also various levels of storerooms. Each level has a specific mission to perform, and requires specific types of records and personnel. These levels are:

1. Garage Storeroom. Each operating garage requires its own storeroom, open and staffed during all those hours that maintenance

activity is being performed at that facility. At the smaller facilities, it may be necessary that a mechanic act as part-time storekeeper during certain times of day -- but whether this be the case or not, there should always be someone who is charged with the security of the stores, and with properly maintaining the records.

Personnel necessary at this level are of three types -- often combined into one or two individuals at the smaller installations. These are· Storekeeper; charged with the proper operation of the storeroom, overseeing stores personnel, maintaining records, Receiving clerk; charged with checking new goods into the storeroom and ensuring their storage in the proper locations. Issue Clerk; charged with supplying the mechanical department with the proper parts and assemblies on receipt of competent orders, and making proper entries on work order, requisition form, perpetual inventory, or whatever. All personnel would be engaged in periodic physical inventories.

The forms used at this level include:

(1) The perpetual inventory form, One of these forms is maintained for each different type of part or assembly kept in the storeroom. In the heading of this form is the part name and number, manufacturer, type vehicle on which it is used, location in storeroom, maximum inventory level, and reorder point. The body of the card is columnar, with repeating rows of four basic column headings -- date, number of parts received, number of parts issued, and balance. The last entry in the balance column should reflect the current inventory of that particular part. This level should be affirmed or corrected at least twice a year through the conduct of a physical inventory -- which should be supervised by someone not connected with the local storeroom.

(2) The locator card. Each different part or assembly type should have two locator cards, each containing four essential pieces of information -- Part name, part number, type of vehicle, storeroom location. One set is filed by part number (which also usually denotes manufacturer and type of vehicle), and one alphabetically by part name -- often subdivided by vehicle type. Thus, when a mechanic asks for a part or assembly by either name or part number, even the most inexperienced issue clerk can readily determine its location in the storeroom.

(3) Requisition form. As parts are issued, the inventory level will eventually reach the "re-order point"noted on the perpetual inventory card. When this occurs, the issue clerk flags the occurrence for the storekeeper (usually by placing the perpetual inventory form on his desk) and the storekeeper prepares a requisition to bring the level of parts back to the "maximum" level shown on the card. This requisition form,

consisting basically of spaces for the entry of part number, name, and quantity desired, is then forwarded to central stores for resupply of the needed part or unit.

(4) Work Order. This is properly a mechanical department form, but needs to be mentioned here as it is an integral part of the stores issuing process. Each mechanic, when starting to work on a vehicle, should have a serially numbered work order form issued to him by his foreman. This order tells the mechanic what is wrong with the vehicle, and/or what his specific tasks related to the vehicle are. After that, each action taken by the mechanic in regard to that vehicle is entered on the form, and, of importance to the storeroom, each part or unit used on the bus is entered. These parts and unit requirements are transferred to the

(5) Issue Slip. This is the storekeeper's record of parts and units issued. The issue slip contains such information as the number and name of each part requested, the vehicle number on which the part will be installed, the time and date of issue, the work order number, and a place for the signature of the mechanic signifying that he has received his order.

The storekeeper is also charged with the procurement, storage, and disbursement of items other than mechanical parts, some of which require a specialized form of issue slip and inventory form. These include fuel, oil, grease, cleaning materials, tools, stationery, and miscellaneous items.

2. Central Storeroom. This storeroom has two main functions -- first, to resupply the various storerooms at the garage level; and second, to provide logistical support to the unit and specialty shops. Thus, the storeroom should be in close proximity to the workshops. Usually, this is the highest level of store-room necessary -- but in some extremely large systems (4000+ vehicles) where more than one unit shop complex might be required (or, in the case of Cairo Transport Authority, where a number of different vehicular modes are operated) another hierarchy of stores might be indicated.

In performing its two major functions, the central storeroom operates much in the same manner as its smaller counterpart at the garage level. It procures parts, stores them, and distributes them. In this case, however, certain more specialized skills might be required, as follows:

(1) Purchasing Agent. This position is charged with procuring parts and supplies, having full knowledge of the anticipated needs of the various shops and garages, the location and lead time required by each supplier, and an excellent knowledge of the competitive price structures of the potential suppliers for each item to be purchased. Putting all this specialized information to use, the purchasing agent must maintain a proper level of parts and supplies, neither overstocking (particularly in the case of vehicles likely to soon become obsolete) nor understocking (more serious, because lack of parts can keep expensive vehicles out of service), and obtain the best possible prices, given the necessary lead times.

(2) Disposal Agent. Each shop and garage, as a matter of course, produces a large amount of scrap metal and used oil. Scrap metal -- obsolete and junked vehicles, worn out engines, transmissions and other useless parts and metal shavings -- has positive value only if sold off and removed from shop and garage premises. Laying around, taking up space needed (planned) for operations and maintenance, it has negative value. The same can be said for drain oil. If it can be sold off to re-refiners, it has positive value. If it is allowed to accumulate in pits and on shop and garage floors, it has negative value in terms of creating an undesirable place to work, making pits unusable, causing accidents, and destroying tires. Therefore, the disposal agent is a most important element in the logistics chain. His knowledge of potential buyers and prices for these materials can turn negative value into positive -- but without this skill, profit can easily turn into loss.

(3) Miscellaneous skills. The larger central store-rooms are likely to need such skills as fork lift drivers, key-punch and computer operators, posting machine operators, typists, and the like. The purchasing agent may need a staff of expediters, and shipping clerks will be needed to prepare shipments to the various garages. Truck drivers will be required to make deliveries and pick-ups at the garages and other locations.

One of the least understood tasks of a central storeroom in a bus or truck operating system is its role as intermediary between the garage and the central unit shops, and its role as a "slack adjustor". As stated before, the major purpose of preventive maintenance is to permit very close scheduling of manpower -- neither to have too much nor too little for the employees to do at a given time. Thus, with regular inspections based on kilometers of travel per vehicle, the garage maintenance superintendent knows fairly precisely how many man hours of labor he requires each day to accomplish his mission. The only unknown lies in the area of running repair; and if the maintenance

program is a good one, this will be held to a minimum. He also will know exactly how many units of various types he must remove and exchange in a given period. This is part of his budget, just as much as are his expenditures for man hours, fuel, or whatever.

At the same time, the central workshop manager, knowing the maintenance schedule of the subsidiary garages, will know quite accurately what his repair and rebuild rate for various types of units should be, and he budgets accordingly. However, no one can possibly foresee all contingencies -- and this is where the various levels of storerooms come into the picture. They maintain a few spare units of each type likely to be needed. When a unit to be repaired arrives from the garage storeroom at the central stores, a similar unit in good condition is dispatched to the local storeroom. (Local stores should not normally carry more than one spare unit of a given type, unless daily demand exceeds that). Central stores sends the unit to be rebuilt along to the proper shop, and accepts any rebuilt units that flow out of the shops. In this way, a constant rate of production can be sustained, with any over production going into stores, to be eventually depleted in times of higher than normal demand, or in a subsequent period when the workshop manager has adjusted his work force to more nearly approximate demand.

C. Stores Accounting: This is a specialized branch of accounting that is an important part of the overall process -- yet is little practiced and less understood. The purpose of stores accounting is to provide a basis for cost accounting, to provide necessary management information, to provide the purchasing agent with the information he needs to be able to plan effectively, and to provide a centralised store of information that can be drawn upon by all interested parties.

For Example : A properly maintained stores accounting system can, when coupled with proper cost accounting in the shops and garages, compare the cost of maintaining any single vehicle or class of vehicles with any other vehicle or class. A properly maintained stores accounting system can immediately send warning signals to management that stock is too much or too little for any class of vehicle -- in other word, a check on the performance of the purchasing agent. A properly maintained stores accounting system can enable the disposal agent to know the quantity and value of surplus parts that are on hand, and where he might best dispose of them at the best price. A properly maintained stores accounting system will allow other companies operating the same types of equipment to know if needed parts are available -- and this can be beneficial to all concerned.

Just what does a properly maintained stores accounting system consist of? Basically, it's some of the forms that were written of earlier in this memo -- the issue slip, the inventory form, and the requisition. In addition, certain summary forms based on these are required, and some type of data processing equipment--computer if possible, humans if necessary.

Ideally, the system works like this. Goods are purchased from the outside on the basis of a purchase order. When the goods arrive two accounting transactions take place -- a debit is set up for the goods now in stock in the central storeroom, and a credit is established as a claim against cash (accounts payable). Later, when the goods are paid for, accounts payable are debited and cash credited. When the stock is transmitted from central stores to a garage storeroom, a credit is entered in the amount of the monetary amount of the items transferred in the central stores account, and a balancing debit is established in the local garage stores account.

Goods may also pass out of central stores in other ways. The most common of these, of course, is to the unit repair shop to be used in the repair of a specific unit. When this happens, a credit is made to the central stores account, and a debit is made to the appropriate unit shop. It should be noted that no cost is yet assigned to the item -- it is expensed only at end use. When the unit is fully rebuilt,the price of all the parts that went into it, which came out of the central stores stock, plus the price assigned t the labor is credited to the unit shop, and debited back to central stores. Thus, central stores now has a unit in stock that has a specific price in terms of labor and materials. It is also possible that central stores might pro-rate part of its operational cost to each item that flows through in order to completely pass all costs down to the end use.

At times, items may pass out of central stores directly to an end use -- say, stationery used in the central office. In such a case, the central stores stationery account would be credited, and an expense charged against the user -- going to the proper expense category in the general ledger. Another case might occur when goods are declared to be surplus and are sold or otherwise disposed of. The purchase price of these goods is credited to the central stores, and an expense is established (offset to the extent of any moneys received) in the disposal account.

When goods are acquired by the local garage from central stores, they are, as stated before, debited to the proper local stores account. Since almost all use after this would be end use, accounting is somewhat simpler. On a part or unit issued to a particular vehicle, a credit is made to the appropriate local stores account, and an expense (debit) is incurred by the individual vehicle. Thus, costs can be kept on a vehicle by vehicle basis.

It should be noted that in all the above transactions, costs are not incurred until end use occurs. At that time, the cost is charged to the particular vehicle and/or activity receiving the goods. As in the previous example, the cost is charged not only to the individual vehicle, but to running repair as a line item in the profit and loss statement, if that was the department where end use occurred. In the case of an issue of detergent to the

272

service line for the purpose of washing vehicles, the charge is to the vehicle fleet (thing) (later to be prorated evenly among all the vehicles), and to servicing - activity.

There is an exception to all of this -- many systems maintain a class of goods known as CD, for Charge Direct. These are usually fast moving items of low unit costs -- say, for example, motor mount grommets. When these items are purchased, they are Charged Direct to the fleet and/or activity in which they will be used, and no further paperwork is accomplished. In order to maintain a sufficient stock of such items on hand without inventory cards, the common practice is to bundle or bag a minimum (re-order) number of the items together, so that when the issue clerk is forced to go into the bundle or bag to fill a request, he so notifies the storekeeper, who prepares a requisition re-ordering up to the maximum amount.

TABLE 1

SAMPLE MAINTENANCE SCHEDULE

Maintenance Schedule ID at - thousand KM.	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45	48
Items Covered:																
Oil Change	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Chassis Lubrication		x		x		x		x		x		x		x		x
Oil Filter Change		x		x		x		x		x		x		x		x
Air Filter Change		x		x		x		x		x		x		x		x
Fuel Filter Change				x				x				x				x
Transmission Oil Change		x								x						
Different. Oil Change		x								x						
Fuel Pump Adjustment		x								x						
Air Compressor Exchange		x								x						
Cooling System Flush						x										
Brake Relining														x		
Wheel Bearing Change														x		
Alternator Exchange						x										
Starter Exchange						x										
Fuel Pump/Injector Exc.														x		
Differential Exc.																48
Radiator Exc.																96
Maintenance Schedule ID	A	B	A	C	A	D	A	C	A	B	A	C	A	E	A	F1 F2

APPENDIX V

FINANCIAL AND ECONOMIC INFORMATION

APPENDIX V
FINANCIAL AND ECONOMIC INFORMATION

1.0
OVERVIEW

1.0
OVERVIEW

1.1 BACKGROUND

The vehicle maintenance study is limited to the public sector bus and truck companies. These organizations, while all involving transportation, can be divided into three classifications, along organizational and operational lines:

1) Public sector truck companies
2) Public sector bus companies
3) Transportation authorities

The trucking fleet operated by the government is a small portion of this sector in Egypt. The mission is to haul public cargo, principally to and from the ports and interior.

A very small percentage of the total load is made up of private sector goods, sought only to avoid unloaded returns from delivery of public sector cargo. There are currently five public truck companies - Goods Transport, Rural Transport, Direct Transport, Transportation Works and Heavy Transport. All companies serve Cairo and Alexandria, and have a specific geographic zone to cover. These operational zones are exclusive.

Each company is authorized to have a certain capacity, and receives government support to maintain this capacity in the replacement of obsolete units. Should demand for trucking service significantly exceed the total capacity, the Egyptian government creates a new firm. This last occurred in 1971.

Each company is autonomous in its operations and is expected to remain profitable. Each firm has a service area, although

there is considerable overlap in these areas from company to company. The companies utilize private trucking cooperatives on a regular basis to carry some of their freight.

The public sector bus companies were produced by the nationalization of transport companies in 1961. In 1964, the organizational structure was altered to form four separate companies in the configuration that continues up to the present. The companies serve specific geographical areas - East Delta, Middle Delta, West Delta and Upper Egypt. Each bus company provides both intercity and intracity service with the zone of operations. The companies are autonomous, run by a board of directors appointed by the government (four directors) and the employees (four directors). Each firm is expected to earn a profit on its operations.

The transportation authorities provide public transport for the two major metropolitan areas, Cairo and Alexandria. These authorities serve the public in the urban areas and are regarded as service organizations in contrast to commercial organizations. They operate buses, trains, trolleys and in Cairo, river transport for passengers. Both systems produce large operating losses which are made up by subsidies from the Egyptian government.

In July 1978, a new transportation company was created from the assets of the Cairo Transport Authority. The 400 new Ward buses were transferred to the Greater Cairo Bus Company. The organization is still in its initial phase of operations,but the intention is to make the company a commercial organization. The CTA assigns routes to the company, and maintains the assets used in the formation of the company as investment.

1.2 COORDINATION WITHIN THE TRANSPORTATION SECTOR

The public transportation companies are placed within the realm of responsibility of the Ministry of Transport.

Upon nationalization, the bus and truck companies were placed under the general control of the General Organization for Intercity Passenger Transport and the General Authority for Rural Goods Transport. The organizations regulated the operations of the companies and handled coordination between the firms and other entities. Centralization of certain major repairs as well as vehicle acquisition and spare parts purchase was assigned to the General Nile Company for Automotive Repair.

Since 1975, the Egyptian government has taken steps designed to heighten accountability for public sector companies through increasing the responsibility of operational authorities. The General Organizations for both the bus and truck companies were abolished. The Technical Secretariat of the Under-secretary of Transport has maintained an overall supervisory authority over the companies, but this is exercised through approval of the budget and other formal procedures, not in operations. This increased freedom to maneuver was utilized to chip away at the position of the General Nile Co. for Automotive Repair. The companies are currently free to make basic decisions as to expansion of facilities, the purchase of spare parts, new vehicles and equipment. Common interest dictates a handling together for parts or vehicle purchases when the needs are generalized, however, this is not an obligation. At present, only tire purchases and an occasional spare parts order is channeled through the Automotive Repair Company. The Chairman of that organization has indicated that his company is somewhat at a loss as to how to adjust to the new situation. He is attempting to attract a considerable portion of the private automobile overhaul trade in the Cairo area to his shops.

In discussing the present regime the bus and truck company officials feel the change has been beneficial in giving operational authorities more control over the filling of their requests for equipment and parts, and that one layer of "red tape" has been removed by the reform. These positive consequences, however are counterbalanced by the desire of each organization to maximize its independence; to build its own "empire". This results in the unnecessary duplication of facilities, the purchase of expensive equipment that will be underutilized and simply wasted.

At this moment, the picture is somewhat unsettled. The bus and the truck companies appear to recognize that their problems and needs are similar, producing an amount of voluntary cooperation. Personal relationships within the upper echelons of the management seem to be helpful in this regard. Through various discussions it has become clear that there is a recognition that more coordination and rationalization of the structure of the public bus and truck companies is required. The exact nature of this need is still an area of great debate, with each separate entity being hesitant to compromise its independence of action.

The urban transport organization, the Cairo Transport Authority and the Alexandria Transport Authority appear to operate with a great deal of autonomy. They are dependencies of their respective governorates, and do not report to the Ministry of Transport. Operational losses are made up by the Ministry of Finance. The Greater Cairo Bus Company was created from the assets of the CTA, and the CTA retains a large share of the net worth of the Company, as well as assigning the routes to the GCB Company. Conversations with company officials indicate that the new organization reports to the Ministry of Transport and to the Cairo Governorate.

A sign of the lack of coordination in the public sector transport is the planning of investment by the various organizations. The CTA, Middle Delta and East Delta are currently investing or have invested large resources in facilities that are overdesigned - of a scale far beyond their present needs. The new workshop and rebuild facility of the CTA begun in 1972 near the Gisr el Suez Garage, has been partially completed at the cost of 3.5 million LE.

Completion will require another 7 million LE and equipment needs a further 3 million LE. Middle Delta's new Tanta central workshop and training center has consumed from 3-4 million LE and will need 5-6 more to finish. East Delta's new Cairo region central workshop/storeroom/garage will reach a construction cost of 3.5 million when completed sometime in 1980.

In a similar manner, the truck companies operate their part to destination traffic with little regard for each other. Interchange of cargo and transshipment nodes between firms are unknown. The logic of having 5 separate companies serving Alexandria and Cairo as well as the patchwork distribution of governorates has apparently never been questioned.

281

2.0

PUBLIC SECTOR ACCOUNTS

2.0

PUBLIC SECTOR ACCOUNTS

2.1 ACCOUNTING SYSTEMS

The entire public sector follows a standardized system of accounting as a legal requirement. In practice, however, it has been observed that there is a considerable degree of latitude in the formulation of accounts to the point where at times it is difficult to compare the accounts of the different companies.

In Egypt, the fiscal year coincides with the calendar year. Following the end of the operational year, each company prepares an annual statement on the result of its activities and its situation as of December 31. An annual report is presented by the companies to the Ministry of Transportation within the first six months of the new year. The accounts are reviewed by the Technical Secretariat of the Ministry. Approval is given by the General Assembly of the Transportation Sector which functions similar to an annual meeting of the shareholders. The Assembly is chaired by the Minister and attended by representatives of the Ministry, the Technical Secretariat, the bus and truck companies, the Ministry of Finance, the Ministry of Supply, the Central Accounting office and the Ministry of Defense. The accounts are inspected, revised and approved by the Assembly. Recent revisions in accounts have concerned the setting up of new categories of revenues and the revaluation of inventory items, resulting in the reduction of net profit.

The Cairo Transport Authority and the Alexandria Authority are not subject to the Assembly, being dependencies of their respective governorates. Accounts for the Authorities are

presented to the Ministry of Finance and the Governors[1].

Four documents make up the core of the annual reports - the balance sheet, the current production account, and the production account and profit and loss statement. The balance sheet is presented in its usual form, with assets on one side and liabilities on the other. Terminology varies from U.S. standards, but the concepts are similar. Profits are entered as a separate item on the liability side and shortages or losses on the asset so as to balance the account. A lengthy list of reserves and provisions is carried on the liability side.

The current production account reveals the income from operations and other sources and the related costs, divided into salary and wages, operations, operation needs and other expenses - depreciation, provisions and other minor costs. Miscellaneous costs and income are grouped into a category labeled transferring income (expenses), and usually add up to a significant amount. The profit figures in the production account may differ from the balance sheet due to the practice of carrying forward of previous year's debt or previous year's profit on the balance sheet.

The most important account for the purpose of this study is the Production and Profit and Loss Statement. Operating costs are distributed to two cost centers : production and production services. Production includes everything relating to the operation of the vehicle-wages of drivers and collectors, gasoline, oil, grease, spare parts, license fees and insurance. Production services refer to support services for the vehicles; maintenance, shops, garages, mechanics, service vehicle, etc.

---

[1] The Alexandria Authority did not provide sufficient information to allow an analysis of its operations.

Operation income from fares, scrap sales and other categories is balanced against operational expenditures to arrive at the operational profit. Finally overhead in the form of administrative, financial and non allocated miscellaneous costs are compared with the operational and miscellaneous income to secure the net profit and loss. The Cairo Transport Authority differs from other organization in that spare parts are included as a service (maintenance) cost and not as an operations item.

2.2 THE MAINTENANCE BUDGET

Investigations during this report period has failed to uncover a maintenance budget as such for the truck and bus companies. A preliminary maintenance budget has been prepared in cases where necessary detailed information was available.

The production and commercial accounts divide costs into three major cost centers. For maintenance activities, it is necessary to examine the production costs, which include spare parts, grease and oil costs as well as other operations related expenses, in addition to the production services account, containing support systems expenditures, principally those categories associated with maintenance and storeroom costs. To fabricate a makeshift maintenance budget, certain items were combined from the two sub accounts.

The Cairo Transport Authority separates its costs into operations, service (maintenance) and overhead. Maintenance categories include all maintenance items. The CTA was the only organization that routinely divided costs and revenues by facility. Each garage has its own statistics as do the 4 operating regions[1].

---

[1] The CTA recently created a new region called the Middle Region to make 5 operating regions.

Discussions with responsible officials of the organizations reveal the absence of a cost system. In the case of the bus and truck companies, the information is not even arranged in a manner that establishes cost centers. The CTA in this regards, perhaps due to its scale, is more satisfactory.

Initial requests for cost and revenue information made to the bus and truck companies provoked interesting responses. Most organizations claimed to be incapable of delivering such statistics. The Vehicle Maintenance Study team was told that this would be "very difficult" at best. It was clear that the accounts were not kept in a manner that allowed ready access to facility information. Costs and revenues are not analyzed on an operational unit basis, but only on a company wide level. There is basically no financial information kept on the individual garages, and the administrative system is highly centralized, with very little feedback from the field.

Not one bus or truck company returned statistics on individual garages or workshops during the initial phase of this Study, and it was only at the very end of the second phase that some data was offered for selected garages.

As far as can be determined, there is no record for unit costs of specific repairs, for routine servicing and consequently no detailed study of labor requirements or input needs. In addition this means that no statistics are kept showing the level of performance for each shop in term of productive efficiency. Each shop is apportioned a share of the budget without study of its requirements or its use of the allocation.

The cost situation contrasts with revenue side; it is evident that a more careful watch in kept on income and statistics are usually maintained on branch revenues. During visits garages we have been shown forms detailing income by each

vehicle per day and per month. Each vehicle is reported to have a history of repair, but the actual time, labor and parts required for the repair are not available, No tracing is made of rebuilt units which are transferred from one vehicle to another.

3.0

ANALYSIS OF ACCOUNTS

3.0
ANALYSIS OF ACCOUNT

3.1 BACKGROUND

An examination of the accounts of the bus and truck companies and authorities presents certain fundamental problems. It proved to be very difficult to secure adequate information, and the questionnaire on financial matters that was submitted to the organizations elicited very mixed results, and quite a few questions simply were ignored. In the end, much of the information needed was taken from the Ministry of Transport. In examining these accounts, one often gets the impression that they are merely bookeeping operations, which must balance on the income and expenditure sides.

3.2 GENERAL FINANCIAL SITUATION

The financial situation of the companies and authorities being studied has a great impact upon the level of the maintenance activities being carried out. Although not the sole determinant of the condition of a vehicle fleet, availability of sufficient funds is indispensible. In this respect, the general financial picture of the companies does not bode well for vehicle maintenance. Liabilities are very heavy in relation to assets, and the income is anemic. In the United States these companies would be in serious trouble. This is the conclusion in the absence of a detailed item by item audit of the companies which would undoubtedly turn up over-valued or questionable assets, inventories for obsolete vehicle types, and double accounting of items.

Conventional financial measurements such as return on net fixed assets and the ratio of current assets to current liabilities reveal a dismal picture. All bus companies

report current assets less than current liabilities in 1978, and the highest return on fixed assets is at 4.2%. Truck companies are in somewhat better shape, with the current assets at least exceeding the liabilities. The return on fixed assets however, is not impressive and, with an exception of a high 9.9%, the ratios are marginal.

The accounts of the Cairo Transport Authority demonstrate the negative financial situation of the Authority. The current assets to current liabilities ratio is the highest of the entire bus sector because of the CTA's classification system. In 1978, the Authority reported the loans as totaling 148 LE million. This immense figure, larger than the fixed assets, is principally comprised of loans from the Ministry of Finance. Apparently the subsidies paid by the government are regarded as "loans". This is a questionable practice, as the likelihood of repayment is extremely remote, not to say impossible. An organization with a net worth of 16.5 LE million and assets of 81 LE million is obviously in a financial quandry.

BUS

	M	E	W	Up.E.	CTA[1]	Greater Cairo
return on net fixed assets	4.2	.2	3.4	2.6	(1.48)	-
current assets to current liabilities	.8	.6	.8	.6	1.34	.11

[1] 1977 figures. The CTA claimed it could not provide depreciation total for 1978.

	TRUCK				
	Goods	Direct	Heavy	Rural	Trans-works
return on net fixed assets	2.1	9.9	3.2	(5.7)	-
current assets to current liabilities	1.5	1.5	1.2	1.3	1.1

3.3 COSTS

The budgetary information returned by the bus companies indicate a serious trend of rising costs in the past few years. The rate of increase varies from 26.1% to 46.1% for the bus companies, with the largest increases evident in operations and production services. Costs are affected by inflation in the economy and also by expansion of the level of service offered. All companies providing ridership and kilometer statistics show an increase in service. A paradox in the expansion of kilometers run on a significant scale did not result in a proportionate rise in ridership. It is unknown whether this is inadequate record keeping or if the companies are attempting to extend service to isolated less populated areas.

Revenues have also risen, but not at the same rate, except for Middle Delta Company. In general the 3 years have witnessed a tightening financial picture, with revenue/km remaining generally stagnant.

The accounts of the Cairo Transport Authority show that the operational loss has increased at a rate of 20.8% per year in the 1976-78 period. Costs for the last two years for bus operations have increased by 21.9%, while revenues registered a growth of 9.3%.

The truck companies accounts show more moderate cost increases, with service cost for vehicles being one of the most dynamic items. Revenue has more or less kept pace with costs, and profits are reflected in operations accounts except for the large losses for the Heavy Transportation Company. A curious feature of the truck company accounts is the recording of profit in production accounts in all but one of the 5 companies for the period 1977-1978, while in the balance sheet, all companies except one report losses. The explanation of losses carried forward from previous years is the one given, but there must have been a long accumulation of such losses prior to 1977 to have such a generalized effect over the entire trucking sector. Even more curious is the Rural Transport Company which shows both profit and losses for the 1977-1978 on its balance sheet.

Concerning maintenance expenditures, it has previously been mentioned that there appears to exist no budget for maintenance as a separate cost center. For the bus and truck companies through examination of the detailed accounts, a makeshift maintenance budget was extracted for the bus companies. The figures on a per bus basis for 1977-1978 appear reasonable, although the differences in labor cost and parts costs make it difficult to use U.S. experience as a guide. What is extremely interesting is the possible effect of the rising trend of cost has upon maintenance activities. Maintenance by its very nature, is a service to a vehicle fleet, and in itself, not an essential daily input into operations. Cost cutting in service area and frequency of runs is more difficult than, for example, reducing the frequency of maintenance, or the supply of spare parts. The long run consequences of such a course are extremely negative, but it is attractive to an inflation-harassed management.

For the public sector bus companies, the amounts dedicated to maintenance have increased in absolute terms from 1976-1978, but in relative terms, there is evidence of a decline in proportion to other budget items. This trend is extremely suggestive.

Maintenance Expenditures
and a % of operational costs

	MD	ED	WD	UP.E.
1978	39.5	41.2	40.9	47.1
1977	41.5	44.0	44.7	58.4
1976	43.9	45.3	-	50.4

The rate of increase of maintenance expenditures for 1977-1978 generally lagged behind other costs, and the key item of costs for spare parts and batteries registered a very small growth.

Rates of Increase in Costs
1977-1978

	MD	ED	WD	UP.E.
total operational cost	30.9	37.3	40.3	33.4
maintenance cost	24.4	28.8	37.6	7.5
spare parts & batteries	3.6	29.9	33.0[1]	18.0

The Cairo Transport Authority was able to provide a detailed maintenance budget for the organization, regions and for each facility.

The CTA accounts show that the organization has also faced a serious trend of price increases, although the rate is lower

[1] West Delta's accounts combine parts and batteries, tires, and miscellaneous maintenance equipment and supplies

than that of the bus companies. Maintenance activities consumed a marginally greater portion of total resources from 1977 to 1978.

Cairo Transport Authority

	1977	1978
maintenance as % facility operation costs	27.5	28.1

Rate of increase in costs, 1977-1978

Total operational cost	21.9%
maintenance expenses	24.6%
expenditures on spare parts and materials	39.1%

Total resources dedicated to maintenance is much less than for the bus companies, principally due to the tremendous burden of depreciation over a 4 year period. For 1977 and 1978, vehicle depreciation made up approximately 30% of total facility cost, while for the bus companies, depreciation is in the range of 15-17% of total cost. The value of spare parts used in 1978 represents a 39.1% increase over the 1977 total.

The CTA, despite its financial situation was able to not only stabilize but to maximally increase its expenditures on vehicle maintenance. This is perhaps because the CTA is not subject to the "discipline of the market place". In this regard the CTA is in an advantageous position - it is not expected to extract net income from a very difficult cost - revenue situation as are the bus companies.

The public sector truck companies did not provide sufficient details to create a separate maintenance budget. A rough

combining of production service cost, which includes items extraneous to maintenance activity, but is as close to an approximation as possible under the circumstances, shows that maintenance and other services have more than kept pace with the rest of the expenditures.

Maintenance and Production Service Cost

	Goods	Direct	Rural	Trans.	Heavy
rate of increase of operation cost 77-78	21.1	31.9	23.6	7.9	8.2
rate of increase maintenance 77-78	57.7	45.4	39.4	9.4	15.4
% of operations cost - 1977	45.8	61.1	50	73.3	49.3
% of operations cost - 1978	59.6	67.3	56.4	74.3	52.4

This proportion of resources dedicated to maintenance is generally quite significant, and in the case of Transport Works, is remarkable, and even questionable. The statistics indicate that maintenance activities have been given a significant proportion of total resources, and this proportion has been increasing at a steady rate from 1977 to 1978.

This may be due to the policy of truck companies to purchase their vehicles in large blocks in one year. The truck companies are currently operating many vehicles from 1975, and they will become more expensive to operate with each passing year.

Both bus and truck companies have been subject to cost increases for the past few years. Wages have been risen at a rapid rate as have most inputs for operations. The organizations have as a rule been unable to collect revenues at the same pace as costs increasing. This trend has apparently produced cost control programs particularly in maintenance for the bus companies, and while the truck companies have not reduced maintenance programs, the truck firms are hard pressed financially. Neither the bus nor the truck companies have generally been able to adjust their income in relation to the expenditure trend. This is having an effect on the ability of the companies to adequately maintain these vehicles and this effect should become more pronounced in the future as the toll on the equipment becomes more visible. In this respect the CTA is fortunate to have recourse to the Ministry of Finance.

4.0

VI ICLES

4.0
VEHICLES

4.1 VEHICLE ACQUISITION

Depreciation of buses and trucks is calculated on a straight line basis, with no salvage value assessed. The useful life of a vehicle is estimated to be 4 years for the Cairo Transport Authority and 8 years for the truck companies and most bus companies. East Delta, due to its combination of urban and intercity service, evaluates the lifetime as 5 and 7 years. Should a vehicle provide service beyond this time, half of the standard depreciation charge is deducted to cover eventual replacement costs. Due to the limited capital budget, however, the life of a vehicle is frequently extended beyond this time, not because the vehicle is still serviceable but due to the impossibility of replacing it. In the bus company fleets the replacement problem is particularly acute, with some buses in service from 10-15 years. Such a situation, in light of the knowledge acquired during this study of the quality of the garage and shop activities, cannot be due to high standards of repair and preventive maintenance.

4.2 VEHICLE AGE

An examination of the vehicle ages of the bus companies shows varying degrees of ability to replace older units. The picture is generally of a fairly old vehicle fleet, somewhat modernized by purchases of the past 2 years. The East Delta and Upper Egypt show a high portion of their fleet reaching obsolescence, with East Delta recording 27% of its vehicles in the 8 years or over classification. In Middle Delta this category reaches 35%, with some vehicles reported to have 15-17 years in service.

Vehicle Age Bus Co.

	Middle D.	E.D.	U.D.	Upper E.
0-2 years	33%	8%	49%	39%
2-4 "	19%	30%	21%)	14%
4-6 "	7%	15%	)	(
6-8 "	6%	10%	12%	(47%
8+ "	35%	27%	17%	(

The buses in Cairo urban service are more modern than those on intercity routes. No vehicle put into service prior to 1973 is currently operating. All buses of the recently created Greater Cairo Bus Company have been in service under 2 years, while 80% of the Cairo Transport Authority fleet is in the 0-4 year old categories, despite the transfer of the new Ward buses to the Greater Cairo Company.

Vehicle Age-Cairo Urban Service

	CTA	GCB Co.
0-2 years	32.3%	100%
2-4 "	47.8%	
4-6 "	19.9%	
6-8 "	0	
8+ "	0	

The truck companies generally have the majority of their vehicles within the 2-4 year range. There was evidently a surge of vehicle purchases in the 1975-78 period. Direct Transport however, appears to be in difficult situation with 60% of the fleet nearing or passed the end of its useful life.

All these companies will confront the need to replace a major portion of their fleet as the 1975-1976 vehicles begin to wear out in the early 1980's.

Vehicle Age - Truck Co.

	Goods	Direct	Rural	Heavy	Trans.W.
0-2 years	10%	9%	6%	7.5	19
0-4 "	90%	31%	84%	67.5	75
4-6 "	-	-	10%	-	6
6+ "	-	60%	-	25	

4.3 REPLACEMENT

Every year, each company prepares a projection of the coming year's operations. The vehicle fleet is analyzed and its adequacy in terms of the expected service requirements is assessed. From this exercise, an estimate of new vehicles needs is produced. No detailed analysis is made of the costs of keeping a given vehicle or vehicle type in operation. The estimation is made of operational time available in broad age categories and also the age of the vehicles is taken as a guide for replacement. An 8 to 10 year old vehicle, after extended service in the local conditions, is obviously ready for retirement.

The estimation of the new vehicle requirements is followed by the examination of the company's financial situation. Accumulated depreciation reserves and profits available for investment are measured against the capital needs for the new vehicles. The Ministry of Transport collects the vehicle requests from the sector and contacts the Ministry of Supply regarding available source of credit. Should the available funds be insufficient, a request is made to the Ministry of Finance for a government grant to make up the difference. This is termed "an addition to capital".

The Ministry decides upon the availability of funds for the purpose, and notifies the companies of the decision. This

grant is of central importance in the case of the initial 20% of the acquisition cost to be paid upon arrival of the vehicles. The bus and truck companies are not required to repay the grant, but are expected to finance the remaining balance from their own capital. The transportation authorities (Cairo, Alexandria) are not expected to be able to purchase their own vehicles, and the government pays the entire cost of purchase. There is never enough revenue to purchase all the vehicles needed by the companies.

The bus or truck firms are able to purchase vehicles independently, but when the purchase is large, it is customary to unify the bids. In the case of the bus companies, East Delta has taken the role of negotiator, while for the truck companies, the General Nile Co. for Automotive Repair still is used. A committee of all the parties is appointed to draw up the specifications and agree upon the exact requirements of the vehicles. Should the number of new units be small, each company handles the entire acquisition on its own.

The drawing up of vehicle specifications and the issuing of the request for tender is followed by the receipt of bids, the examination of the bids, and the awarding of the contract. As with spare parts, this process takes around one year.

It is general policy to request the bidder to submit financing proposals with their documents and this appears to be a crucial factor, given the limitation on resources for the companies. This may explain the bewildering variety of vehicles in the public sector fleet. In other words, the best package receives the contract. While this procedure may save money in the short run, the problems downstream of familiarization of the mechanics with many different vehicle types and the complexity of maintaining adequate inventories for each manufacturer of vehicles may well add costs which exceed the initial savings.

4.4 PRICES

Requests for vehicle prices met with mixed responses from the organizations. The information is incomplete, but it can be assumed that the price per vehicle did not vary from company to company for a given manufacture in the same year. Prices have been steadily increasing in the past 5-6 years. The trend for the bus purchases appears altered by the Ward buses, which are significantly less expensive than the Iran National Mercedes of 1975/1976. The discrepancy in the information is explained by the Ward's exemption from local customs duties, set at 40% of a vehicle's price. If operational reports can be credited, there also is a substantial quality difference between Ward and other buses. The current price of a heavy duty Mercedes bus from Germany is over 70,000 LE.

Bus	Year	Price LE
Ward	1977-78	22,000
Mercedes-Iran 12 row	1976	27,533
Mercedes Iran 11 row	1975	25,661
Mercedes-Germany	1975	28,223
Nasr	1973	13,524

Truck	Year	Price LE
Super Aswar	1972-73	18,970
Pegaso	1972-73	14,750
Saviem	1975	25,800
Fiat	1975	27,785

4.5 OBSERVATION

The large requirements of the bus companies assure a fairly large flow of buses in a continuous stream, with peaks and

valleys to be sure, but still producing a fleet of varying ages. The truck companies however, operating a much smaller fleet of vehicles, purchase units in large blocks at infrequent intervals. Their vehicle fleet is often composed of a few types of truck, all from the same year. The advantage of having a brand new fleet is offset by having all vehicles wearing down and being repaired at an escalating rate year after year, with the consequent increase of parts and service requirements. Should resources not be sufficient to replace the aging units after the end of the economic vehicle life, serious operational difficulties are certain.

A central issue in the policy of vehicle acquisition is the role of locally manufactured vehicles in the context of public sector needs. The government owned Nasr company located in Helwan produces both buses and trucks.

The Nasr bus has been evaluated by the technical members of the Vehicle Maintenance team as a good bus, tested in local conditions and adequate for the demands of service in Egypt. The capacity of the factory is around 600 units per year and plans are underway to expand the bus line. The price of the Nasr bus is comparable or lower than foreign competitors, and with the problem of customs duties, the differential is quite large; for example, a Nasr (heavy) bus at present costs approximately 48,000 LE while a German Mercedes can be purchased for 70,000 LE plus a 40% customs duty.

Bus company officials have expressed satisfaction with the Nasr bus but state that they are not available in the quantities needed by the companies. Nasr is reported to have somewhat erratic production volumes and a backlog of orders. The Nasr production is destined for all of Egypt, including the various ministries, the military and for companies required to provide

transportation for their workers. In addition, the Nasr Co. management likes to export buses when possible, in order to earn foreign exchange. The current volume is clearly inadequate for the potential market.

Nasr also manufactures trucks. Large number of these vehicles are seen carrying military personnel and servicing various governmental agencies. To the best of our knowledge, however, no Nasr truck has been seen in the public sector truck fleet, reportedly because the Nasr truck's cargo capacity (8-10 tons) is too small.

It would obviously be in Egypt's economic interest to manufacture a maximum of its own transportation equipment. The foreign exchange savings, a certain supply of spare parts for local sources, the rationalization of the vehicle type and the ability to incorporate improvements specifically for local conditions, are all large benefits accruing from such a policy. The secondary effects of employment generation and stimulation of industries to produce inputs for the vehicles would all be substantial.

Although examination of this issue is outside the scope of work, the effects of such a policy have important implications for vehicle maintenance. If Nasr company could be induced to expand and diversify its production, and to be responsive to the requests of the public sector bus and truck companies, a large step would be taken to simplify the maintenance operations of the companies. In addition, if other manufacturing firms could be attracted to Egypt, the increased production and the stimulation of competition in the local market would be a positive contribution to the local industrial base. Funds spent for transportation equipment would have a multiplier

effect through the entire economy, thereby serving both company specific vehicle needs and national development goals. It is certainly a matter that merits further study.

5.0
SPARE PARTS

5.1 BACKGROUND

The basic supply of spare parts is included in the requests for tender issued by the public sector organization. The supplier of the vehicles is requested to submit a list of the spare parts needed for service for the guarantee period and for the anticipated useful life of the vehicle. These parts and prices are specified to make up a certain percentage (usually from 20% - 30%) of the total FOB value of the contract.

There is a generalized agreement that this percentage is inadequate for the requirements of maintaining the vehicles in operating condition. It is not clear at present if the problem is in the total value required as a portion of the tender or if the parts supplied do not correspond to those most demanded. Even with adequate inventories, the bewildering array of equipment models and the diversity of shops and garages would produce difficulty in the distribution of parts. A centralized computer system for tracking parts, inventories and locating needed items that would encompass the bus and truck sector would be useful in this regard.

5.2 PARTS INVENTORIES

The status of spare parts supply for the year 1978 is shown below. With the exception of East Delta, all bus companies consumed parts in the range of 1500-1600 LE per vehicle. This appears to be reasonable. The CTA parts consumed per vehicle is substantially higher than for the bus companies and may be explained by the differing vehicle mix and the extreme demands made on vehicles involved in urban service

in Cairo. The truck companies show a greater degree of variation from approximately 1500 LE to 5000 LE.

On examination of the parts inventories at the close of the years 1977 and 1978, of the parts used in the year 1978 and by deduction of the parts purchased, yields interesting observations. The parts purchased appear to far exceed the usage. All organizations with the exception of Rural Transport built up inventory in 1978. Middle Delta, East Delta, Goods Transport, Transportation Works and Direct Transport demonstrate increases varying from 47% to 138%. The CTA's inventory grew at a rate of 39% over the 1977-1978 period. A comparison of parts used with parts purchased in 1978 demonstrates that the general tendency is to purchase parts in excess of operational demand. For the majority of the organizations, the margin was very large. Inventory should not be tied up in unused parts. It is curious that such healthy growth in parts acquisition was registered in 1978 and one must question the purchasing policy that allowed such excessive purchases to take place.

Spare parts (in thousands except for per vehicle figures)

	MD	ED	WD	UP.E.	CTA
inventory end 77	1328	2551	1633	5471	13,729
purchases 78	2623	508	856	2587	14,090
used 78	786	2505	647	1328	8,740
inventory end 78	3165	5132	1842	6730	19,079
% Inventory 77-78	138	101	13	23	39
parts consumed/ vehicle	1541	2561	1646	1572	3939

		G	D	H	R	Transworks
inventory end	77	623	1263	1393	2340	1396
purchases	78	1293	1603	1552	509	1623
used	78	451	1023	897	814	822
inventory end	78	1459	1843	1948	2009	2197
% Inventory	77-78	134	47	40	(-14)	57
parts consumed/ vehicle		1581	4803	3040	2545	3033

5.3 ACQUISITION PROCEDURE

All the public sector companies and authorities covered in the project have expressed concern over the difficulty of securing needed spare parts. Because the vehicle fleet is heavily weighted in favor of foreign equipment, and because the foreign manufacturers do not maintain parts warehouses in Egypt, most spares are imported through direct contact with manufacturers.

Bus and truck companies are free to handle their own purchases, but the cumbersomeness of the legal procedure of tenders and bids influences them to make large parts purchases which unite the requests of sister companies. The bus and truck management personnel have stated that the international tender procedure for parts is accomplished by using funds allocated for that purpose within the company budget from internal funds.

Negotiations start after the size of the purchase is estimated. A letter of credit for foreign exchange is secured from a local bank. The detailed information for the request for tender is then published. Tenders are received, evaluated and a selection is made for the supplier by a committee formed of

representatives of participating companies. The bid is then selected, a contract worded and the receipt of the parts requested is made within a certain time, as specified by the contract. The time lapsed between identification of parts needs and receipt of the parts is reported to be approximately 8 to 12 months.

The day to day requirements of operating a large vehicle fleet obviously are not met by the cumbersome international tender procedure. For more specific, urgent parts needs, the local tender is utilized. A request for tenders is published in the local press, bids received, evaluated, and the parts received in the space of one to two months. The problem is that there are limited parts stocks for trucks and buses in the warehouses of local dealers in parts, and they are significantly more expensive than parts from other sources. For example, a public sector truck company faced a critical need for fans for FIAT trucks. The General Nile Company for Automotive Repair did not have fans in stock as the 30% of the value of the original contract that had arrived in the form of spare parts had been exhausted. The stores Department made a local tender and awarded the contract, securing the vital part. The price difference between the Automotive Repair and the commercial distributor was substantial - 19 LE vs 32 LE.

Emergency parts needs involving a limited amount of money can be authorized by branch director and stores supervisors[1].

---

[1]The magnitude of the parts flow problem was graphically demonstrated during an interview held by the Vehicle Maintenance Study management expert with the director of the Central Stores Department for one of the Delta Bus companies. The director explained that 40% of his effort was expended in the processing emergency parts requests from the various company facilities.

The amounts at the disposition of facility administration vary from 1000 to 6000 LE. This account is for use in the case of emergencies and in the case of East Delta and the truck companies, for various minor overhead expenses. This fund is periodically replenished upon presentation of receipts to the central administration. The parts purchases are intended to be emergency requirements.

5.4 OBSERVATIONS

Conversation with officials of the public sector transport companies has revealed that they consider the spare parts problem to be one of parts flow and not funds. They claim to have enough internal capital to pay for what they need, and do not experience undue hardship in acquiring foreign exchange. It is the time-consuming procurement machinery the public sector is required to observe that is the fundamental problem. Of central importance is the shortening of the time frame for parts purchases. A second problem and contributing factor is the lack of detailed up to date inventory of parts stocks for all public sector organizations, with appropriate flags to indicate the point at which reordering is needed to assure an adequate inventory of items according to their rate of consumption plus the lead time for acquiring the parts.

Improvement in the spare parts situation will allow for less deadline due to parts shortages and reduce the level of cannibalization of vehicles due to parts needs. It would also assure that complete repairs are made using quality parts. The existing repair facilities show much ingeniousness in adapting or inventing replacements for unavailable parts. The effectiveness of these makeshift items and the repair of units without replacing of all worn items however, leads to repeated repair at frequent intervals and to shortened useful life for vehicles.

An additional problem inherent in the present parts acquisition policy is the guaranteed occurrence of parts inventories for obsolete vehicle types. The time frame for parts purchases builds in a lag between identification of requirements and parts use that is 8-12 months, even if there is a rapid initiation of the tender procedure. If the basis used to estimate needs and guide purchases is taken from previous year data, then the lag time approaches 2 years. An example of the final consequence of this procedure is the existence in the CTA's stores of 2,000,000 LE of spare parts for the scrapped Icarus bus.

6.0

BUDGETING PROCESS

6.0
BUDGETING PROCESS

6.1 BUDGETARY PROJECTIONS

During the last half of the year, the public sector bus and truck companies formulate a budget for the following operational year. Estimates of revenues and expenditures are made in line with equipment condition, service demand and the precedents provided by the previous years. The following section analyzes the projection used to estimate future expenditures, particularly for maintenance. Budgetary information is taken from 1979 Estimated Budget.

6.2 REVENUES

6.2.1 TRUCK COMPANIES

Revenues are estimated by evaluating the availability of the vehicle fleet for operations. Age is the only factor evident in this exercise, where vehicles are placed in age groups and the percentage of time of service is calculated.

Truck Companies - Downtime (%)

	Goods	Rural	Direct		Heavy	Trans works
			Cargo	Constr. Equip.		
0-2 years	10	10	10	12	10	10
2-4 "	12	12	12	14.4	12	12
4-6 "	18	18	18	21.6	18	18
6-8 "	20	20	20	24.0	20	20
8-10 "	25	25	25	30.0	25	20
10+ "	30	30	30	36.0	30	20

With the availability calculated, the capacity of the vehicle is multiplied by the availability factor, the average kilometers run, the number of working days, and finally, by the average freight charges per ton kilometer to arrive at total revenues from truck operations.

	Goods	Rural	Direct		Heavy	Trans-works
			Cargo	Const. Equip.		
Av/km day loaded	200	175	200	120	200	200
Operational days	300	300	300	300	300	300
Charge for freight per ton/km in millimes	12	12	10.5	16.6	11.5	12.5

6.2.2 BUS

The bus companies use similar methods to determine vehicle availability, although the percentage of operational vehicles is the measure used.

Bus Companies - operational vehicles (%)

	MD	ED	WD	UP.E.[1]	Greater Cairo
0-3 years	85	75	80	)	80%
3-6 "	80	70	70	)72.3	
6-10 "	75	65	60	)	
10 and over	70	50	50		

The varying available percentages reflect different experience of each company in keeping their vehicles on the road.

[1] Upper Egypt did not provide operational percentages as a function of age. This may be done, but it is not specified in their budget.

313

The Cairo Transport Authority evaluates its fleet by bus type and establishes an availability figure reflecting the condition and reliability of the vehicles. Availability of the buses for the 1979 projection is as follows:

	Cairo Transport Authority	
	% Operational	Year Purchased
Pegaso	67.6	1973-1976
Mercedes	64.4	1974-1977
Sava	40.0	1973
Nasr (Heavy)	81.8	1975-1978

Available capacity is multiplied by the service days, the average kilometers and the average fares. Middle Delta differs from the other companies by utilizing an average revenue per kilometer rather than a revenue per bus day figure. The other bus firms differentiate between urban and intercity service due to the revenue characteristics of the different types of service.

	MD	ED	WD	UP.E.	G.Cairo
Average km/day	280	280	282	331	287
Average revenue/km (millimes)	100.8		141.8		279
Average revenue/day	28.2	-	40	-	80
Intercity		43	41		
intracity		26	18		
Red Sea			151		

The kilometer per bus per day are within a normal range, with the exception of the Upper Egypt Company which covers the largest geographic service area. The revenue figures per bus

per day are interesting in that there is a wide range of estimates. Middle Delta's figures are very low, representing 28 LE of revenue per bus running the average 280 km.

Upper Egypt, East Delta and West Delta's revenues/bus are approximately the same for intercity routes. The low revenue potential of intracity revenue is obvious, although varying substantially from firm to firm. The estimated revenue from Red Sea routes is extremely high, 15.1 LE/bus/day, and appears questionable.

All revenue figures seem to be based on very approximate guidelines. As the structure of the tariff is on a per kilometer basis, a revenue per kilometer figure would be more useful for planning. If accurate passenger figures were available, a revenue per passenger kilometer estimate would appear to most approach reality. The existing fare system however, impedes any formulation of such a statistical base, due to the lack of accurate passenger counts and the procedure of giving various tickets for a single trip. More accurate passenger and fare date is required to remedy this situation.

The Cairo Transport Authority makes revenue projections on the basis that passenger traffic is growing at a rate of 7% per year, and consequently gross revenues will increase at the same rate, regardless of the number of vehicles put on the road.

6.3 COSTS

6.3.1 TRUCK COMPANIES

Expenditures for the public truck sector are estimated in the same manner. Replacement intervals for tires, batteries and fuel, oil grease consumption are all consistent. Greater range is evident in costs for these inputs, and it is obvious that either the inputs are not being secured from the same

sources or some of the companies are adding a factor to their expense projections against unforeseen costs and inflation. The disparities in estimated tire replacement are interesting, and the 140,000 km tire lifetime for Rural Transport doubles the estimates of Goods Transport, and exceeds by a large margin the projection of the Direct Transport Company. It is also not known why oil consumption for the same trucks would vary from company to company, if providing the same kind of service.

Input-Trucks Companies

	Goods	Rural	Direct Cargo	Direct Cons.Equip.	Heavy	Trans-works
Batteries						
Frequency of replacement		2/yr	2/yr		4/yr	4/yr
Fiat 24 t	2/yr					
Saviem 24 t	2/yr					
Saviem 8 t	4/yr					
Cost (LE)	58	64	39		48	48
Tires						
Replacement-km run	70,000	140,000	80,000	60,000	-	-
Cost tube LE				92	-	-
tubeless LE				147		
Saviem 24 t	133	182				
Fiat 24 t	146	141				
Saviem 8 t	30	-				
Pegaso		182				
Fuel						
Cost/litre (millimes)	25	25	25		25	25
km/litre					1.7	2.1
Berliet (Algeria)	-	-	2.5			
Pegaso	-	2.3	2.3			
Berliet (France)	-	-	2.1			
Rapman	-	1.7	-			
Saviem	2.5	2.3	-			
Fiat	2.5	2.3	2.1			
Oil						
Cost/kg	235	360	275		345	345
Consumption (kg/1000/km)	-	-	-		10	11
Fiat	11.5	5	11			
Saviem	11.5	5	-			
Pegaso	-	12.4	10			
Rapman	-	6	-			
Berliet (A)	-	-	11			
Berliet (F)	-	-	10			

	Goods	Rural	Direct	Heavy	Transwork
Differential Oil cost/kg	350	340	275	318	340
Consumption k/1000 km	3	2.5	25	-	-
Grease					
Cost/kg	400	430	290	370	390
Consumption kg/1000 km	1	1	1	1	1

Of major importance to the vehicle maintenance study is the manner in which spare part purchases and maintenance activities are budgeted. For the truck companies, a fixed amount per vehicle is integrated into expenditure projections. This amount, 1500 LE, is determined by a decision of the General Assembly for the public sector transportation companies. It includes all maintenance and spare parts, divided into either 1/3 or 25% for maintenance and 2/3 or 75% for spare parts. No account is taken of the age, characteristics or history of each vehicle type. The only exception to this rule were the 50% (750LE) allocation for the smaller (8 ton) Saviem trucks acquired by Goods Transport in 1978 and the allocation used by Heavy Transport and Direct Transport. Heavy allots 500 LE more than the basic 1500 LE for older vehicles in its fleet. The new vehicles are from 1977, old vehicles from 1975 or earlier. Transportation Works follows a different guideline, allocating 1250 LE for older vehicles and 1500 LE for newer ones. The new vehicles also use 1/3 of their maintenance and repair budget for provision against unforseen contingencies. For Transportation Works, a vehicle is classified as old if it entered service in 1972/73, the 1975-78 trucks are regarded as "new".

Annual Budget Allocation for Maintenance and Spare Parts

	Goods	Rural	Direct	Heavy	Transworks
Expenditure	1500	1500	1500	2000	1250
maintenance	495	495	375	667	833
spare parts	1005	1005	1125	1333	416
New Saviem 8 ton	750			1500	1500
maintenance	250			375	750
spare parts	500			1125	375
provisions					375

6.3.2 BUS COMPANIES AND AUTHORITIES

The bus companies utilize the same operational inputs, and estimates of requirements for fuel oil, tire, batteries and grease should be made on a similar basis. The East Delta, West Delta and Upper Egypt Companies utilize similar methodologies for cost projections. Middle Delta's estimates, however stand out due to the greater detail and differentiation by vehicle types.

As with the truck companies, the different costs for identical inputs raise questions as to procurement policies or the effect of added margin included in expenditure projections.

Inputs Estimate

	MD	ED	WD	UP.E.	CTA	G.C.
Batteries						
Frequency (sets)	2,500	2/yr	-	2/yr	2/yr	2/yr
Cost LE (each)	37	39		50	40	40
Tires						
Frequency	65,000km	68,000	60,000	121,000	40,000	52,400
Av.cost/LE						
local	57)	77	) 80			
import	78)		)			
Ward, Mercedes Pegaso,Barrieros				900/set		
Other bus				600/set		
Fuel						
Cost/litre	25	25	25	25	25	25
Consump/100 km	-	30	30	30		65
Tata	25	-	-	-	50	
Barrieros-Nasr	27	-	-	-		
Mercedes - Iran	32	-	-	-	40	
Mercedes Ger	36	-	-	-		
Pegaso					40	
Oil Grease						
Kg/1000 km	-	1.62	1	1.3	7	
Cost/kg	-	305	350	400	345	345

For budgeting for spare parts, the bus companies utilize differing formulae. The least sophisticated method is that of the East Delta Company, which projects 750 LE in spare parts for a Ward bus, presumably because these buses have been in service under two years, and 1400 LE for all other models. Information submitted by this company indicates that it operates 9 different vehicle types which range from 1 to 18 years of service.

East Delta Spare Parts

Ward	750
Other	1400 (increased from the 1300 of 1978 due to inflation)

The West Delta Company uses a parts consumption per day estimate to establish parts costs. The consumption rate varies from 1 LE/day to 4 LE/day. Comparison of the age distribution of the vehicle fleet with the parts needs reveals the requirement as shown below:

West Delta Spare Parts

Age/Vehicle	Amount
0-2 year	365
2-3 "	912
3-6 "	1,460
6 plus	2,190

The Upper Egypt Company expresses parts needs as a function of vehicle type. Ward, a bus in service since 1977 is budgeted the same amount of parts as the rest of the vehicle fleet with the exception of Iran National and German Mercedes. These other vehicles (Tata, Barrieros, Nasr) are over 4 years old.

Iran and German Mercedes acquired in 1976-1977 are allocated 3000 LE/years in spare parts.

Upper Egypt Parts Consumption

Bus	Value spare parts (LE)
Ward	2,000
Mercedes	3,000
Other	2,000

The East Delta, West Delta and Upper Egypt Companies use age as the principal determinant of parts requirements. Even if this is accepted, the parts consumption rates yield interesting rates of increase. These rates are at variance with the general expectation of parts demand as a function of age; considered to develop at a gradually increasing rate, and becoming quite dynamic as the vehicle wears out.

Rate of Increase in Parts Consumption

	Year	Rate
East Delta	0-3 to 4+	100%
West Delta	0-2 to 2-4	149%
	2-4 to 4-6	60%
	3-6 to 6+	50%
Upper Egypt	0-2 to 2-4	50%
	2-4 to 4+	33%

The Middle Delta organization provides more information on parts requirements than the other companies. Each vehicle type is assigned an average parts demand, not entirely determined by age. Spare parts are also broken down into foreign source, local source and materials used in repair.

322

Middle Delta - Spare Parts (LE)

Bus	Age	Foreign	Local	Material	Total
Nasr	14+	750	450	300	1500
Barrieros	8+	1100	250	300	1650
Tata	10	600	250	300	1150
Mercedes	2-3	350	200	300	750
Ward	0-2	350	200	300	750

These parts statistics demonstrate that Middle Delta has apparently examined each vehicle type to establish the frequency of breakdown and repair.

All the bus companies are facing serious problems with their fleet of Ward buses. These vehicles, from 1-2 years in operation have been projected for the budget to consume parts at a rate similar to the general experience with new buses, which is very low maintenance expenditure for the first 2-3 years of service. New vehicles are usually expected to demand approximately 750 LE/yr in spare parts. Previous experience, however, does not seem to apply to Ward. The 1979 operating accounts show substantially higher maintenance costs for Ward bus operations.

While this material is still being analyzed for use in 1980 budget estimates, the indications are that the new Ward bus has been using parts at a rate of 3,400 to 3,500 LE per year. The Ward is creating problems for the anticipation of costs.

The bus and truck companies utilize 3 or 4 years' experience to project other categories of costs - wages, fringe benefits and miscellaneous items. The number is frequently the average of the past few years. Expected change in legal fringe benefits or regulations are incorporated, as are the salary

increments for the employees which are based on years of service.

All projections are reported to be evaluated each year by the technical departments to assess their accuracy. In practice, however, they did not change in any significant way for the period analyzed in this report.

The Cairo Transport Authority does not budget spare parts for the first 2-3 years of a vehicle in service, as it considers that the 30% of the vehicle purchase price that is supplied in spare parts under the international tender procedure is sufficient. After this period, it is estimated that 25% of the value of the vehicle will be consumed in spare parts each year. This practice would signify that as the vehicle grows older, the amount of spare parts available would decrease in line with its value.

The New Greater Cairo Bus Company estimates that its vehicle will require 1400 LE of spare parts and 400 LE of miscellaneous maintenance equipment. Since the Company is of recent creation, with new buses, this formula is not varied for the age of the vehicle.

6.4 OBSERVATIONS

The budget estimates provided by the bus and truck companies underscore the difficulties facing research into the finances of these companies. The basis for many of the projections is extremely weak. The use of broad assumption and percentages concerning the performance of a vehicle fleet is less than adequate to the task of anticipating needs and lining up resources to meet them. The CTA's estimates in particular appear to be extremely primitive.

The current system appears to function due to the roughness of the estimates which contain sufficient leeway to cover most contingencies.

Vehicle availability should be determined by a thorough study of the condition of each vehicle - this study is the same one used to fix the opportune time to replace the unit - determined on a per vehicle basis, founded upon factors which move beyond age as a sole determinant.

More data is needed to determine with greater precision the kilometers to be run as well as the revenue to be derived from operations. Flat averages of kilometers and revenues for the great variety of routes can obscure more than what it reveals.

Given equal preventive maintenance, equipment such as batteries and tires should last approximately the same amount of time for identical vehicles. Consumption of fuel, oil, and grease should also be approximately the same for similar types of service. One of the most curious results for an examination of the budgetary projection is the variations in cost for oil, grease, batteries, tires, all presumably for the same vehicles. The public sector should make every effort to purchase required material at the least cost. If one company has uncovered a cheaper source, it should reveal it to the others. If it is padding its cost to guard against inflation or to protect poor planning, this should be made clear in the projection.

From the viewpoint of maintenance, the weakest portion of the budget projection is the estimate for spare parts consumption. The truck company division of maintenance and spare parts needs is entirely too mechanical. Many other factors including age, vehicle type and preventive maintenance and overhaul history, are necessary. A fixed amount for all vehicles is inadequate

for planning purposes. The situation in the bus companies is somewhat better, in that age plays a central role. However, other considerations, such as the frequency of repair of a specific bus type are not determined entirely by age. Each bus also has its own parts demand, with prices that are different for each component. Parts demand that does not increase as a function of age after the initial break in period does not correspond with general experience in vehicle operations.

Parts requirements must be based on detailed feedback. Once again, the general statement has obscured the necessary detail for establishing requirements and controlling costs. Middle Delta appears to be the only company that has established part demands for each bus type, which are based on actual experience not just age factors. The establishment of different parts demand of each type of bus and the mix of local and foreign sources for parts are crucial elements in effective planning of maintenance activity.

7.0

THE NATURE OF THE TRANSPORT ORGANIZATIONS

7.0

THE NATURE OF THE TRANSPORT ORGANIZATIONS

7.1 BACKGROUND

The common denominator of the public sector transportation organizations is that all are wholly owned government entities. The three kinds of organization, however, have differing missions and characteristics. A grave problem that has been observed in this study is the lack of a clear purpose, and often the creation of regulations that conflict with the declared financial nature of the organization.

7.1.1 URBAN PASSENGER SERVICE

In urban transport, there has been a determination that this service will not be self financing, and that the transport will be provided at below the cost of producing it. Fares have been controlled for long periods and allowed to marginally increase only as a function of the progressive unification of the fare system. In the past year, there has been a move to control the apparently uncontrollable cost of the CTA by decentralizing operations. The most significant manifestation was the creation of the Greater Cairo Bus Company with the new Ward buses. It is intended that the Company operate on commercial lines, and meet its expenses. The basic fares are higher, up to 10 piasters in comparison to the 2-3 piasters of the CTA.

Unless the Company is allowed to control its revenue, the likelihood of a profit is not great. Whether 10 piasters is sufficient is not yet clear, although the first 6 months produced a loss.

For the Urban Service, what is required is a policy decision on whether transport shall be self-supporting. The creation of new companies sidesteps this issue. Costs should be controlled as closely as possible and the decision on how to charge for these costs should be made. Creating a new company in order to increase fares is not the solution.

7.1.2 INTERCITY PASSENGER SERVICE

The intercity bus companies are currently in a quandry. They provide a public service, but are companies and not to be subsidized for operations. In the context of their regulations, however, they are unable to effect their revenues and to a great extent costs are not variable. With the exception of small adjustments, the basic structure of the fares has been unaltered since 1964, the date of the creation of the current configuration of bus companies[1].

On the cost side, the entire sector has been subject to price escalation of all inputs. Prices of vehicles, fuel, spare parts, and oil are beyond the control of any organization. In the Egyptian system, even such usually variab le costs such as wages are not in practice determined by the employer. Employees are not dismissed except for very grave reasons, and most senior company officials could only recall one or two cases of such an event. The government regulates the wage scale, decrees bonuses on holidays and each year a new step in the salary scale is allowed on the basis of seniority. The rapid escalation of costs is evident from company accounts. Costs in the intercity companies has been increasing at the rate of 33% per year over 1977-1978.

---

[1] A 10% increase in 1973 was allowed to cover higher defense taxes and another 10% was granted in 1976 for LUX bus service only. In 1979, the Port Said routes of the East Delta Company were permitted to charge 10% more.

If revenue is fixed and costs cannot be adjusted, how is a profit possible? This question must be asked. Since most companies have recorded profits, one must question the cost and revenue accounts. An examination of the accuracy of these statistics has not been possible within the scope of this study, although such a study would undoubtedly prove to be very edifying. A bus company official indicated that the tools at his disposal for the improvement of the financial situation included reduction of overtime, restriction of bonuses, delay of purchases and the dispatch of LUX or Deluxe buses to serve ordinary bus routes. The net effect of these measures would seem so minor, and the resistance of workers and riders so likely that they cannot prove adequate. It is a testament to the true nature of these organizations that they must resort to such inventive actions in order to improve their profit and loss figures.

From the government the companies secure assistance in the acquisition of new vehicles. The Ministry of Finance puts up some of the initial price of the buses, calling it an "addition to capital". Accounts show grants ranging from 25,000 to 50,000 LE., with some as large as 1.4 LE million. The extent of this subsidy, however, does not appear to be very large, and it is not utilized to make up operational losses. When measured against the array of taxes and fees paid by the companies to the public treasury, the assistance for the purchase of vehicles is further reduced.

The existing system in which the companies operate gives the impression of a patchwork that has evolved over the past twenty years without any coordinated plan into a complex array of regulation and practice combining to have an unintended negative effect on intercity service. As is the case with urban transport, a fundamental decision has to be made - is transportation a subsidized public service or a

self-supporting activity? If a commercial activity, the companies should be able to charge according to costs, providing a system is established to determine these costs. If it is to be a public service, the government should openly subsidize the companies on a per passenger kilometer basis, provided the costs of providing that service are known. The current situation is unsatisfactory from any viewpoint, and the organizations are never sure of their mission and the management expends hours on the creation of profit in extremely difficult circumstances.

7.1.3 TRUCK COMPANIES

The public truck companies are capable of negotiating increases in freight rates in line with increasing operating costs. The restrictions on price increases apparently does not apply to cargo transport. Actual revenue figures for one company showed an increase in ton kilometer revenue from 1978-1979 of 8%. Despite this greater freedom, the truck companies do not appear to be very robust financially. Furthermore, they are incapable of purchasing their vehicles from their own resources.

There is no reason why truck companies cannot be independent financially while being government owned. This is the preferred alternative for keeping subsidies to a minimum. Furthermore, it is obvious that much more can be done to reduce overlap in service areas and foster interchange of cargo from company to company. The rationale for the present structure of 5 companies and the division of labor between the organizations is the product of decisions made a decade ago. Alternatives to the present system, including the centralization of the companies and garages under one organization, or even the use of private trucks to haul public sector cargo must be considered. Given the employment practices and financial situation prevailing in the public sector, the latter may well be the least cost alternative.

8.0
RECOMMENDATIONS AND CONCLUSIONS

8.1 RECOMMENDED DEVELOPMENTS

The recommendations contained in the financial section of this report can only be considered in the context of the entire Vehicle Maintenance Project, and as a portion of an interdependent program of improvement. In isolation, or individually, the changes proposed in these pages will have little impact on the total system. The problem areas to be addresses are the following:

1) The absence of a cost system
2) The diversity of vehicle types
3) The flow of spare parts
4) Coordination within the transport sector
5) The Nature of the Transport Organization

8.2 COST SYSTEM

The fundamental underlying deficiency of the financial and planning system in the public sector transportation organizations is the lack of fiscal control in the form of cost accounting. Despite the impressive volume of records being maintained by the organizations, the information is either not properly utilized or it is inadequate for accurate planning. This dilemma is general, and spans the entire sector, although it varies in degree for the different organizations.

This study has not managed to uncover any facility with data on the costs of performing various maintenance tasks. For

bus and truck companies, even cost information on the individual maintenance facilities was lacking. Furthermore, accounts of the entire company did not accurately separate operations from maintenance expenditures. The Cairo Transport Authority did possess facility costs and it separated expenditure into operations, maintenance and administration, but no breakdown into subunits and output was available[1].

The absence of accurate cost information is demonstrated in the budget estimate. Very rough approximations are made to predict expenditures using averages or the remaining value to the vehicle. Little differentiation is made by vehicle type, the demands of specific routes and other important factors.

Effective management is impossible without detailed knowledge of costs. No planning is adequate unless costs and output are assigned to cost centers. At each level, output has to be measured against inputs to establish needs and evaluate efficiency. There is no other way to control expenditures, judge performance, pinpoint problems or develop feedback in order to verify the outcome of management decisions.

8.2.1 RECOMMENDATIONS

The establishing of a cost accounting system is required. Forms used to record tasks performed should be revised in order to satisfy informational need of the various administrative levels in need of data. Each unit or facility should be divided into cost centers, with appropriate subunits down to the smallest funcational division.

Production in terms of measurable output - engines rebuilt,

---

[1] The CTA is currently moving to computerize its accounts, and institute a cost accounting system. Properly designed, this system should be adequate for financial control.

transmissions repaired vehicles inspected etc... should be measured along with total input costs, both material and man-power. Once adequate data is assembled, standard input costs for various operations can be established and used for planning and efficiency evaluations. There is no other way to gain control over costs. This cost accounting system should be implemented in conjunction with the computerization of the costs and operational data.

The effectiveness of the cost system will only become a reality if verification of the quality of the work performed is possible. Although this is not a financial problem per se, it has implications for the final cost of maintaining equipment. At the present, there are inspection staffs in the facilities. The activities of these staffs should be expanded to record not only the life of an overhauled part, but also the completeness of routine servicing and safety inspections. Work teams (engine, breaks, transmission, etc..etc.) should be identified and their output tracked. Poorly performed servicing or incorrectly repaired components must be traced to their origin and corrective measures taken. Investigation of equipment failure or accidents must be carefully conducted to isolate causes. This, however implies that required equipment and spare parts are available to the employees to complete a service or repair action.

Inspection of facilities could be reinforced and emphasized through the creation of an independent team of technically proficient employees who would be established in central or regional offices, to visit the workshops and garages on an unscheduled basis and randomly select a vehicle or a repaired component to evaluate the quality of the labor in a given unit.

It must be emphasized that these measures are not to retaliate against employees for incorrect or inadequate performance. They are to enable problem areas to be identified and to accurately tailor corrective action - more training, a complete set of tools, enough parts. Appropriate recognition should be given to superior performance, perhaps through bonuses, or added benefits. The object is to communicate to workers that management is concerned about the quality of their work so that a good employee is satisfied that his work is appreciated, as well as to stimulate workers to take their tasks seriously. This message should be given to individual laborers, repair and servicing teams, supervisors and to facility administrators.

8.3 DIVERSITY OF VEHICLE TYPE

The operating of 4-5 different kinds of vehicle is a serious problem in the public sector transportation organizations. The reason for this diversity appears to be the shopping for the best terms for financing the vehicles purchased. This policy is short sighted if no consideration is taken of the costs involved in keeping the vehicles in operation. Direct financial costs are incurred in keeping accurate parts inventories for each vehicle, in training mechanics and technicians in the care and operation of an unfamiliar piece of equipment, and in the post-delivery adapting of a vehicle to the service requirements of Egypt.

8.3.1 RECOMMENDATIONS

A thorough study should be performed by the Ministry of Transportation with the collaboration of the bus and truck organizations to determine the "life cycle" costs (acquisition and operating) and the useful life of the different trucks and buses that have been used in Egypt. Ranking as to the

suitability and total cost in local conditions should be made, and the results followed as a guide in vehicle purchase. This study would be periodically updated by the Ministry. The present practice of each company purchasing its vehicles on a sector-wide basis should be encouraged and made a policy.

Serious consideration must be given to the role to be played by locally manufactured vehicles. Factors to be included in the analysis are the foreign exchange cost, the additional cost involved in modifying a vehicle to local needs, the time involved in securing spare parts outside Egypt and the price of training local mechanics by foreign experts. Externalities flowing from the local manufacturing of trucks and buses as well as spare parts will be large, and are properly to be included in the study. Such an analysis would objectively determine the most beneficial course to be followed in the purchasing of trucks and buses for the public sector transport organizations. This however, must be considered in the context of the national economy and the requirements of the other consumers of these capital goods. It could possibly be uneconomic to establish a production line for buses and trucks solely for the requirements of the organizations analyzed in this present Study.

8.4 THE FLOW OF SPARE PARTS

One of the largest problems in the maintenance field is the supply of spare parts. Although the quantity of resources will be a limitation, the central problem in Egypt appears to be the flow of parts. Adjustment in the present policies of purchase and distribution will greatly extend the effectiveness of available resources. The present system is cumbersome and inefficient, resulting in unnecessary deadtime for vehicles and improper repair procedures. An 8-12 month

wait for a spare parts order is entirely too long. Also the lack of central control over parts inventories and the absence of a formal policy of inter company parts interchange is very costly.

8.4.1 RECOMMENDATIONS

The international tender procedure utilized for large parts purchases should be reformed to shorten the time frame between need identification and receipt of the part. Continuing and up-dated direct contact with the manufacturer and a central library of parts suppliers specifying past experience in terms of reliability of delivery, part quality and price will do much to replace the existing tender system. This centralized information would perhaps be located in the Ministry of Transport. An estimation of spare parts requirements could be transmitted to the suppliers for a cost quotation in a fairly short time. This would allow for quick determination of the best condition and the placing of the order.

The major problem with the streamlined parts purchasing system is that of accountability. The system must be subject to periodic auditing of the quantities and prices to ensure that the best interests of the public sector are being served. This would require the establishment of an independent auditor.

The current practice of the bus and truck companies to band together for large part purchases should be encouraged and institutionalized. Due to their different demand and scale, the Authorities should continue to handle orders separately.

The logistics of parts distribution must allow for the maximum use of the parts inventory. Each facility may maintain an accurate record of its stock, but this information should be

centralized in company headquarters for ready access and continuing analysis in order to begin acquisition at the opportune moment. The company parts inventories should be available to other organizations and interchange of spares be permitted on a sector wide basis in order to minimize vehicle deadlining and incomplete repair actions. In the long term, a computerized system to track inventories would be advantageous for each individual organization and for the entire transport sector.

8.5 COORDINATION WITHIN THE TRANSPORT SECTOR

At present institutionalized coordination between the transport organizations is minimal. Bus and truck companies handle their operations independently and determine priorities for investment. Common interest and personal inter-relations enhance the informal area of coordination to include the sector wide purchase of foreign vehicles and spare parts.

The formal coordination is quite reduced and there is wide-latitude for ambitions of company directors. This independence leads to a waste of resources and duplication of effort. The penchant for spectacular sized new facilities, far beyond the needs of one organization, has been seen in the East Delta, Middle Delta and Cairo Transport Authority. These overdesigned facilities represent millions of pounds in investment. Plans for tire retreading equipment, engine overhaul capability, and frame straighteners all are made in isolation, without regard to the maximum utility of the limited investment capacity in Egypt.

8.5.1 RECOMMENDATIONS

A central authority is needed to analyze investment decisions and reduce overlap in facilities. This organization should be

composed of representatives of the transport sector and of the Ministries of Transport and Finance. The decisions should be weighted in favor of the transport organization. It should be empowered to review and sanction investment plans to ensure their necessity and the required scale for efficient operation. Wherever possible, existing capability should be utilized to its full capacity prior to additional investment.

This organization should also foster the centralization of company or authority wide rebuild and overhaul facilities to concentrate parts supplies, testing equipment, specialized tools and skilled technicians for their maximum effectiveness.

8.6 ILL-DEFINED CHARACTER OF TRANSPORTATION ORGANIZATIONS

All the organizations analyzed in the Vehicle Maintenance and Feasibility Study are publicly owned and provide transport services. Beyond these fundamental characteristics, however, there is a great deal of confusion concerning the nature of the individual organizations.

8.6.1 STATEMENT OF PROBLEM

The Truck companies are classified as commercial organizations, and their accounts generally reveal profits from operations. They serve almost exclusively the government sector, and their capacity is a small portion of the national trucking capability.

The service provided by the companies is a mixture of exclusive geographic zones and shared metropolitan areas. All companies carry general cargo and some have specialized freight. There appears to be no over-riding logic to this sytem of 5 separate companies serving the public sector. The division of service areas does not conform to a systematic approach to freight business and it is clear that the purpose is not to provide rate competition.

8.6.2 RECOMMENDATIONS

Action should be taken to consolidate the trucking companies to provide less overlap in service area, and hence more efficient use of vehicles. Interchange of cargo between the companies is required to extend the range of the individual firm and decrease duplication of service.

A longer term effort to examine the structure of the public trucking sector should be undertaken to examine the advantages of centralization of garages and workshops and perhps even the consolidation of all companies into a central authority.

One alternative to be evaluated is the rationale for the public sector being involved in truck operations. If there is no unique freight service that can only be provided by the government, and if there is already a privately owned vehicle fleet capable of carrying the load, it perhaps would be less costly to utilize private vehicles.

Much more than the truck companies, the bus companies are harmed by an institutional confusion fostered by the formal structure in which they have been placed. As commercial organizations they are required to cover expenses. Direct subsidies are not granted, and public assistance is limited to a portion of vehicle purchase cost. Revenues are fixed, and the fare schedule has not been subject to a significant change in over a decade. The national government has repeatedly refused to accept any upward adjustment in fares.

Costs are subject to continual escalation, beyond the control of any company. Vehicles, spare parts, gasoline and oil expenditure can be curtailed only at the expense of service. Labor costs are not variable to any great degree, because dismissals are virtually unheard of and annual raises are

decreed by the government without considering the financial consequences. The current situation is one of a slowly tightening fiscal situations and of desperate maneuvers to create a positive operational account in the face of all obstacles.

8.6.3 RECOMMENDATIONS

A basic determination must be taken to clear away the debris of the past 20 years. The pending requests to exempt the companies from some taxes, or to allow them to retain taxes for their use as well as eliminating customs payments are all makeshift measures, of limited effectiveness.

If intercity transport is to be a net revenue generating activity, companies must be free to adjust their fare structure to reflect the cost of providing transport service. With a cost accounting system in operation, detailed verification of cost will be possible, and companies could be permitted to collect revenue sufficient for operating expenses, administration and vehicle purchase, without recourse to the public purse.

Should transport service be determined as a public service, not intended to cover its costs, then this must be made clear, and a direct subsidy paid on a per passenger kilometer basis to meet costs and depreciation charges. In this case, a cost system would be used to limit the level of subsidization.

These decisions will put the intercity service back on the true purpose of the operations, to provide dependable, economic transport for the intercity traffic.

8.7 URBAN BUS SERVICE

Both the Cairo Transport Authority and the Alexandria Transport

Authority do not face the problem of profitability, and indeed the dilemma appears to be one of lack of accountability. It is clear, however, that they are service organizations, intended to provide mass transportation below the cost of producing it. The same problems as those faced by the intercity bus companies will almost certainly be encountered by the new Greater Cairo Bus Company. If the urban authorities cannot make a profit on their operations, there is no reason to expect that the new company will do any better unless given a free hand to adjust revenue in line with costs. This however would seem a fairly remote possibility.

8.8 CONCLUSION

The recommended improvements suggested in this section of the Vehicle Maintenance and Feasibility Study is a program designed to remedy the problem encountered in the financial area of the Study. The general thrust of the recommendations are toward the more effective use of resources already at hand in the public sector transport organizations. The problems identified are principally systems problems and do not require heavy outlays of funds for correction. These steps are a first priority, involving streamlining, centralization, collection of basic data, dissemination of information and coordination. These measures are required prior to moving to the subsequent level of action. Only after efficient utilization of existing potentials and resources, is it reasonable to examine the need for additional resources.

APPENDIX VI

JOB DESCRIPTIONS IN THE ENGINEERING SECTOR

APPENDIX VI

Job Descriptions of the Chairman and Managers in the Engineering and Equipment Sector

Chairman

General description:

- Represents the company in all external transactions
- Responsible for the execution of company policy
- Responsible for implementing plans to achieve company objectives
- Oversees the execution of plans in the various sectors of the company

Duties and responsibilities:

- Chairman of the Board
- Oversees all transactions involving the purchase of vehicles, spare parts, equipment and all other company needs
- Reviews progress of the sectors toward completion of plans to achieve company objectives
- Approves all capital projects undertaken by the company and is responsible for monitoring execution
- Coordinates the activities of the sectors
- Responsible for signing all company contracts
- Appoints and chairs councils for consideration of bids that result from tenders by the company
- Oversees the preparation of the yearly budget
- Reviews yearly financial report with the Board.

Chief of the Engineering and Equipment Sector

General description:

- Oversees the departments of technical affairs, stores and purchasing, inspection, building construction and maintenance, and industrial security.

Duties and responsibilites:

- Develops general policy for the technical affairs department and the stores and purchasing department. Upon approval by the Board, implements the policy.

- Determines equipment and machinery needs for the workshop
- Develops the training program for mechanics and oversees the execution of the program.
- Develops and executes building construction and renewal programs
- Determines spare parts needs for the company and insures timely delivery to the workshops in adequate supply
- Develops shop procedures for maintenance and overhaul
- Makes periodic inspections of workshops and branches to check maintenance procedures
- Makes recommendation to the Board concerning number and kinds of buses needed by the company
- Maintains records on fuel, oil, spare parts, battery, and tire consumption
- Insures that sufficient levels of spare parts and materials are on hand at stores facilities
- Responsible for shop safety and shop security procedures
- Oversees technical studies and research

Position Requirements

Suitable degree in engineering and at least 16 years experience in the field.

General Manager of Technical Affairs

General description:

- Head of the department of technical affairs
- Shares in the development and execution of programs of the engineering and equipment sector
- Reports to the chief of the engineering and equipment sector
- Oversees the activities of all units within the department of technical affairs.

Duties and Responsibilities:

- Executes and follows up on programs and plans of the sector concerned with technical affairs

- Determines equipment and machinery needs for the workshop
- Develops the training program for mechanics and oversees the execution of the program.
- Develops and executes building construction and renewal programs
- Determines spare parts needs for the company and insures timely delivery to the workshops in adequate supply
- Develops shop procedures for maintenance and overhaul
- Makes periodic inspections of workshops and branches to check maintenance procedures
- Makes recommendation to the Board concerning number and kinds of buses needed by the company
- Maintains records on fuel, oil, spare parts, battery, and tire consumption
- Insures that sufficient levels of spare parts and materials are on hand at stores facilities
- Responsible for shop safety and shop security procedures
- Oversees technical studies and research

Position Requirements

Suitable degree in engineering and at least 16 years experience in the field.

General Manager of Technical Affairs

General description:

- Head of the department of technical affairs
- Shares in the development and execution of programs of the engineering and equipment sector
- Reports to the chief of the engineering and equipment sector
- Oversees the activities of all units within the department of technical affairs.

Duties and Responsibilities:

- Executes and follows up on programs and plans of the sector concerned with technical affairs

- Participates in the scheduling of work in the department
- Reviews execution of programs for the department
- Develops the maintenance and repair schedule and reviews work in progress
- Oversees technical research in the department
- Monitors fuel, oil, spare parts, tire and battery consumption
- Make periodic performance reports on subordinates
- Oversees the distribution of bonuses.

Job Requirements:

Must have demonstrated supervisory capability and must have participated in required company training programs. Must have a degree in engineering and 16 years work experience in the field.

General Manager of Purchasing and Stores

General Description:

- Responsible for supplying stores to the company in accordance with prescribed rules and laws
- Responsible to the chief of the engineering equipment sector

Duties and responsibilities:

- Responsible for all company activities involving purchasing and stores
- Monitors levels of stock in the stores facilities to insure adequate supply is on hand
- Insures that foreign tenders are executed properly
- Studies both domestic and foreign markets to insure parts and supplies are purchased at the lowest price
- Approves purchases that are in accordance with appropriate rules
- Makes periodic reports on performance of subordinates

Position Requirements:

University degree in engineering. Two years experience in this field of work at the 1st grade level.

Manager of the stores department

General description:

- Oversees main and branch stores facilities and determines optimal highest and lowest levels of stock
- Reports to general manager of purchasing and stores.

Duties and responsibilities:

- Insures that stores received meet tender specifications
- Applies scientific methods to insure stocks remain in good condition
- Insures stock levels do not exceed nor fall below established levels
- Oversees the distribution of stocks to the branches
- Insures established stock inventory system is followed
- Follows up on stock deliveries to branches and workshops to insure that specified quantities and types of stock are delivered.
- Responsible for disposal of outdated stocks
- Makes yearly and surprise inspections of facilities

Position requirements:

University graduate with at least 4 years experience in the field

2 years of education beyond high school and at least 5 years experience in the field

1 year of education beyond high school and at least 7 years experience

High School diploma and at least 10 years experience in the field

General manager of purchasing and stores

General description:

- Insures that company policy concerning levels of stores at the facilities is followed

- Is responsible to the chief of the engineering and equipment sector

Duties and responsibilities:

- Develops and executes plans for the supplying of stores to the company
- Insures that proper work procedures are followed within the department
- Determines company needs for spare parts, batteries, tires and other supplies
- Insures procedures for importing parts is followed
- Implements plans for buying parts and materials used in maintenance and operations
- Studies markets to determine how to supply company needs at the lowest price (domestic and foreign).
- Writes reports concerning status of purchasing and stores department
- Approves purchases
- Insures that company work rules are followed by employees
- Furnishes performance reports on subordinate managers.

Position requirements:

University graduate with 2 years experience in the field in first grade position.

Manager of the central workshops

General description:

- Head of the central workshops of the engineering and equipment sector
- Responsible for execution of repair and maintenance operations for vehicles and equipment

Duties and responsibilities:

- Insures that repair and overhaul activities are carried out in accordance with company rules
- Prepares repair estimates for all work done
- Develops repair and overhaul plan for each facility

- Responsible for bonus awards
- Follows up on completed work

Position requirements:

B.S. degree in engineering
Experience in the field of at least 14 years
Technical high school graduate-
14 years experience in the field

Manager of the central workshop

General description:

- Oversees all repairs and overhaul activities in the workshop
- Reports to the general manager of technical affairs.

Duties and responsibilities:

- Develops maintenance and overhaul plans for the workshop
- Insures maintenance and overhaul plans are carried out on schedule
- Oversees training in the company technical training center
- Overseas manufacturing of spare parts in the shop
- Helps develop workshop rules and procedures
- Oversees repair and renewal of vehicle bodies
- Estimates the cost of repair and overhaul work done in workshop
- Develops program for maintenance and overhaul of shop machines and equipment

Position requirements:

B.S. degree in Engineering
14 years experience in the field

APPENDIX VII

MANAGEMENT INFORMATION ANALYSIS

Best Available Document

352

Buses, trips, working hours, K-m's in april 1979

	Bus-Days/Mo (D) Buses: theorit	Buses: actual	Buses: 16 hours	Trips/Mo: theorit	Trips: actual	Trips: Loss	Working hours: theorit	Working hours: actual	K-m's (A): theorit	K-m's: actual	%	I/A (D)	I/A (A)	BD/Mo	BD/km
masr Mix	4190	3893	3409	56246	41741	14505	69922	54549	1213260	998736	78%	.93	.82	3011	3962
Fath D	4214	4179	3734	73809	60552	13057	71296	59748	1204219	1068904	83,8%	.99	.88	2487	2958
omeu Mix	3174	2996	2346	39824	27175	12649	54397	37538	857034	636510	69%	.94	.74	2480	3544
Gizel seg P	3375	3069	2448	36858	25535	11323	54867	39169	1026073	778771	71,4%	.91	.76	2773	4019
East unit	14954	14137	11937	206537	155003	51534	250482	191004	4297554	3481021	76,3%				
mostafat Mix	5530	5193	4226	74207	51486	22721	97118	67609	1541186	1136926	69,6%	.94	.74	2794	3991
Fazi D	5470	5146	4414	85716	63967	21748	93603	70629	1359404	1096979	75,5%	.94	.81	2190	2889
West unit	11000	10339	8640	159923	115454	44469	190721	138238	2900590	2233905	72,5%				
[illegible] M	4630	4576	4233	87559	58093	9466	78677	67732	1033050	1197128	86,1%	.99	1.16	472	410
[illegible] M	1749	1726	1577	30319	25186	5133	30270	25234	534697	473004	83,4%	.99	.88	57	46
[illegible] M	4088	4025	3924	69165	66786	8379	71517	62776	1059686	989675	87,8%	.98	.93	612	672
[illegible] unit	10464	10327	9734	167043	144065	22978	180464	155742	2896844	2658727	81,3%				
[illegible] M	3228	[illegible]	2601	50429	39915	10514	53221	41614	1657[illegible]	[illegible]	79,2%	.98	.82	2317	2896
[illegible] M	4788	4773	4269	94048	79164	14884	81771	68298	1243634	1111660	83,5%	1.00	.89	1293	[illegible]
[illegible] unit	8016	[illegible]	6870	144477	119079	25398	134992	109912	[illegible]	1977673	81,4%				
Total	44434	[illegible]	37181	677980	533664	144316	756659	594896	12391131	10357326	78,6%				

APPENDIX VII
ITEM A
EFFICIENCY INDEXES

Best Available Document

Best Available Document

353

APPENDIX VII
ITEM B
ENGINE BREAKDOWNS

Various breakdown monthly from Sep 78 upto Dec. 78

Mercedes Group

Breakdown area	Month	Masr	Fatih	Amria	Sirel Guy	Nigeel	Tarho	Ilorin	Biga	Imbabe	Ahmed Nabi	Bacata	total	average daily	average 100,000 km
Engine	Sep. 78	729	618	750	678	473	497	18	26	302	896	181	5165	172	58
	oct.	769	601	692	854	575	470	6	29	284	854	314	5442	175	57
	nov.	701	604	726	697	656	379	13	11	121	729	222	4859	162	51
	Dec.	802	621	577	832	774	428	25	16	186	535	294	5090	164	52
Elect. parts	Sep. 78	240	416	239	112	761	239	27	28	168	335	206	2771	92	32
	oct	240	335	201	145	753	224	23	37	146	311	262	2727	88	28
	nov	254	570	198	97	591	230	32	34	86	350	247	2688	90	28
	Dec.	356	431	205	119	764	254	30	27	149	395	324	3097	100	31
Gear box	Sep 78	235	153	332	326	190	100	1	3	21	23	15	1399	47	15
	oct.	232	182	337	292	202	76	2	0	8	21	4	1416	46	15
	nov	262	162	256	236	250	75	0	2	19	29	11	1302	44	14
	Dec.	314	143	362	257	212	76	1	1	32	38	13	1448	47	14
Clutch	Sep 78	153	342	32	0	205	187	8	8	81	135	57	1238	41	12
	oct	283	369	56	0	162	148	15	17	65	109	95	1319	42	12
	nov	263	421	50	[illegible]	199	[illegible]	13	14	52	133	[illegible]	1422	47	15
	Dec.	255	363	105	[illegible]	152	174	13	18	74	116	[illegible]	1401	[illegible]	[illegible]
Steering	Sep 78	35	274	72	37	136	21	0	3	54	135	17	799	27	8
	oct.	50	242	86	43	168	28	0	4	29	117	[illegible]	[illegible]	[illegible]	[illegible]
	nov.	55	211	112	53	168	27	0	2	42	124	27	823	27	9
	Dec.	78	251	140	57	175	33	0	7	71	105	26	935	31	10

Best Available Document

Appendix VII
Item 8
ENGINE BREAKDOWNS

Page 2

Total various breakdowns monthly
From January upto April.

MERCEDES GROUP

Break down Area	Month	WHSK 1	Fatha 2	Amarina 3	Giraffa 4	Meyaler 5	Etrebo 6	Mounib 7	Birga 8	Embabo 9	Other drivers 10	Basafura 11	Total 12	Quarterly 13 (1st 1365) Daily	100,000 Km
Engine	Jan.	556	513	620	796	806	429	39	96	152	362	366	4708	152	47
	Feb.	515	462	427	653	726	437	39	23	145	359	274	4072	145	45
	March	563	541	553	815	852	440	34	26	137	536	244	4742	156	48
	April	521	485	614	870	791	511	27	11	164	453	244	4710	157	46
		2165	2001	2214	3133	3175	1817	138	156	598	1710	1110	17332	610	186
		640	580	553	783	793	454	34.5	36.5	149.5	442	285	4333	152.5	46.5
Alternator	Jan.	–	19	62	43	131	33	[illegible]	–	–	23	2	375	12	4
	Feb.	117	65	41	44	104	27	13	–	–	[illegible]	[illegible]	465	17	5
	March	–	60	51	38	88	27	20	–	–	22	10	316	10	3
	April	–	89	70	44	130	52	10	1	–	26	8	430	14	4
		117	293	226	169	453	141	53	[illegible]	–	[illegible]	[illegible]	1595	53	16
		29.5	70.7	56	42	113	35	10.7	0.25	–	26.7	10	398	13.2	4
Starter motor	Jan.	12	54	17	10	17	15	–	–	–	52	[illegible]	[illegible]	[illegible]	2
	Feb.	–	49	18	15	16	28	–	–	–	39	27	192	7	2
	March	121	51	7	7	24	34	–	1	–	44	20	310	10	3
	April	120	57	23	18	35	37	–	1	–	56	38	[illegible]	[illegible]	4
		253	231	65	50	92	104	–	[illegible]	–	[illegible]	[illegible]	[illegible]	[illegible]	11
		63	57.7	16	12.5	23	26	–	0.5	–	47.7	27	274	9.5	3
Others	Jan.	174	222	44	61	237	163	11	[illegible]	[illegible]	174	263	[illegible]	49	15
	Feb.	170	135	39	44	220	135	17	[illegible]	122	212	255	1435	51	16
	March	130	196	39	52	174	162	33	14	106	227	218	1351	44	13
	April	130	187	35	47	213	185	30	6	52	182	271	1333	45	13
		[illegible]	740	[illegible]	204	844	645	77	125	426	810	1007	5654	189	57

354

APPENDIX VII

ITEM B

ENGINE BREAKDOWNS

Various breakdowns monthly

From Mai 78 up to Aug. 78

← Mercedes Group

Breakdown area	Month	Nairobi	Eldoret	Kisumu	Gisenyi (Rwa)	Kigali	Tororo	Mombasa	Kitale	Kericho	Baraton	total	average daily	average 100,000 km
Engine	Mai 78	975	422	626	767	505	569	15	24	250	1132	167	5810	187	59,8
	June	929	418	621	774	519	494	19	26	314	1383	162	5771	192	~~62,1~~
	July	990	554	690	701	528	524	15	33	311	2142	191	6679	215	70
	Aug.	731	710	704	596	477	551	27	27	223	475	195	4731	152	40
		885	523	660	709	509	534	19	27.5	275	1243	176	5347	136	50
Elect. Parts	Mai	312	206	210	161	610	187	16	13	106	463	183	2666	84	26,8
	June	304	226	134	192	472	214	12	27	84	440	192	2355	79	~~26,3~~ 25,3
	July	361	214	180	181	469	234	21	26	137	505	116	2503	81	26
	Aug.	290	305	168	140	550	235	14	23	114	294	190	2323	75	24
		316.7	237.7	173	168.5	525	217.5	15.7	22	110	425	177.7	2466	79.7	25.5
Gear box	Mai	624	116	247	303	207	74	3	1	19	32	4	1485	48	15,3
	June	430	95	204	375	179	76	4	0	10	24	6	1411	47	~~15,3~~ 15,3
	July	374	69	222	407	230	91	2	0	12	43	6	1456	47	15
	Aug	279	119	283	371	175	96	2	6	27	19	10	1381	45	14
		376.7	99.7	245.7	364	197	84	2.75	0.75	17	29.5	6.5	1433	46.7	15
[illegible]	Mai	339	238	1	1	137	151	20	5	63	153	31	1192	38	12,3
	June	188	215	6	0	151	160	8	4	77	212	37	1106	37	~~14,9~~ 14,9
	July	259	274	10	0	156	213	12	3	69	226	54	1276	41	13
	Aug	239	295	18	2	155	202	21	12	105	100	52	1211	39	13
Steering	Mai	80	236	93	52	152	26	0	5	30	130	12	381	28	9,1
	June	50	249	108	67	136	15	0	4	40	218	20	917	30	9,9
	July	75	224	203	25	148	31	0	1	71	332	21	1054	34	11
	Aug.	50	235	71	37	120	28	0	4	55	150	26	777	25	8

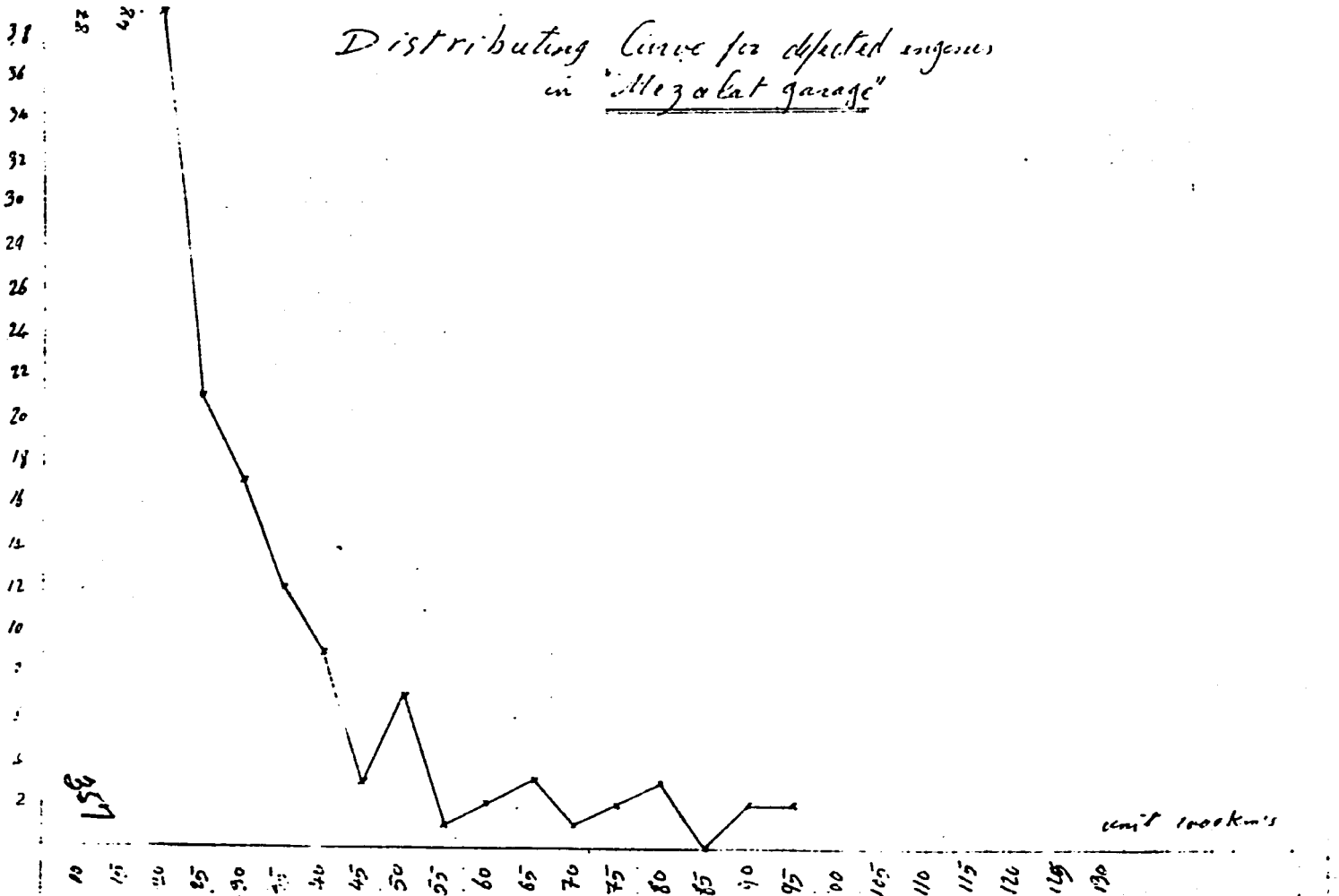
ENGINE FAILURES

This engines are overhauled at:
N : nasr general workshop
A : amana " "
[illegible] : north unit shop

Classification of defected engines due to running Km's monthly in "illegalat Gauge"

unit 1000 Km	upto 9			10 – 14			15 – 19			20 – 24			25 – 29			30 – 34			35 – 39			40 – 44			45 – 49			50 – 54			55 – 59			60 – 64			65 – 69			70 – 74			75 – 79			80 – 84			85
	Na	A	N	Na	A	N	Na	A	N	Na	A	N	N	A	n	N	A	n	N	A	n	N	A	n	N	A	n	N	A	n	N	A	n	N	A	n	N	A	n	N	A	n	N	A	n	N	A	n	N
Mai 78	–	–	6	–	–	4	2	–	1	–	–	2	–	–	3	1	–	1	–	–	2	–	–	–	1	1	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
June	2	–	8	1	1	2	1	–	5	–	–	1	–	–	–	1	–	1	–	–	1	–	–	–	–	1	–	–	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1
July	3	–	13	2	–	8	2	–	1	2	–	1	–	–	2	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–
aug	–	–	10	2	–	5	1	–	3	–	–	1	–	–	1	–	–	1	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–
sep	1	–	4	2	–	6	1	–	1	1	–	3	1	–	1	–	–	2	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–
oct	2	–	12	–	–	2	1	–	7	–	–	1	1	–	1	1	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–
nov.	–	–	4	–	–	2	–	–	5	–	–	3	–	–	3	–	–	–	–	–	1	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–
dec.	–	–	8	1	–	3	–	–	5	1	–	1	–	–	–	1	–	1	–	–	1	–	–	–	–	–	1	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1
Jan 79	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
feb	1	1	2	–	–	4	1	–	1	–	–	1	1	–	1	1	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
march	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
april	1	2	7	–	–	2	–	–	1	2	–	1	–	–	2	–	–	1	1	–	1	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	–	–	–	–	–	–	–
	10	3	74	8	1	39	9	–	30	6	–	15	3	–	14	5	–	7	1	–	8	–	–	3	4	2	1	–	–	1	2	–	–	1	1	1	–	–	–	1	–	–	–	–	–	–	–	–	–
	87			48			39			21			17			12			9			3			7			1			2			3			1			2			3						

356


Distributing Curve for defected engines
in "Mezolat garage"
unit 1000 km's
357

APPENDIX VII
ITEM B

quantity of defected engines, its average running Km's - Peggaw
Mezalate

	Nasr W.Shop		American		North workshop		Total	
	No	AV	quantity	AV	No	AV.	No	AV
Mai 78	5	34,000	1	47,000	21	15,000	27	18,000
June	7	32,000	4	42,000	18	13,500	29	21.900
July	11	23,000	—	—	26	11,500	37	15,000
Aug	4	23,000	1	76,000	21	11,500	2	15.750
Sept	8	27,000	—	—	20	21,000	28	22.700
oct	6	30,000	—	—	25	13,500	31	16.700
Nov	—	—	—	—	21	21,000	21	21,000
dec	4	40,000	1	108,000	21	17,000	26	24,000
Jan 79	—	—	—	—	—	—	—	—
feb	4	22,000	1	[illegible]	10	15,500	15	16.600
March	—	—	—	—	—	—	—	—
April	5	26,000	2	3,500	17	19,000	24	19000
338							244	

average running Km's for 19,065 Km in this period

Page 6

ENGINE FAILURES

The shops
N: near workshop
A: amenia
E: east unit

Classification of defected engines due to running K.m's monthly in Amenia garage

unit 1000km	upto 9			10—14			15—19			20—24			25—29			30—34			35—39			40—44			45—49			50—54			55—59			60—64			65—69			70—74			75—		
	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E
mai 78	1	–	–	1	1	–	1	–	–	5	–	–	3	2	–	–	–	–	–	2	–	1	1	–	1	–	–	1	1	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
june	–	1	1	3	–	1	1	–	1	–	1	–	2	4	–	–	–	–	–	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
july	–	–	–	3	1	–	–	–	1	–	–	–	2	4	1	–	–	–	2	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
aug.	–	–	–	5	2	–	1	–	–	2	1	–	–	7	–	1	–	–	–	1	–	–	–	1	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–
sep	–	–	–	–	1	–	2	2	–	3	–	–	–	–	–	–	–	–	–	–	1	2	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–
oct	–	1	1	–	–	–	–	–	–	–	1	–	–	7	–	–	2	–	–	–	1	–	1	–	–	–	1	–	1	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–
nov.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	3	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–
dec	–	–	–	–	–	1	1	–	1	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
jan 79	–	–	–	–	–	1	–	–	–	–	–	1	–	7	1	–	1	1	–	–	–	–	1	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
feb	–	–	–	1	–	–	–	–	–	1	–	–	–	1	–	–	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
mar	–	2	2	2	–	1	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	1	2	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	–	5	–	–	–	–	–	–	–	1	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	1	9	4	15	5	4	6	2	3	12	5	1	7	6	4	5	3	1	3	4	2	3	4	4	4	3	2	3	2	3	2	–	–	–	2	1	1	–	–	1	–	–				
	14			24			11			18			17			9			9			11			9			8			2			3			1									

359

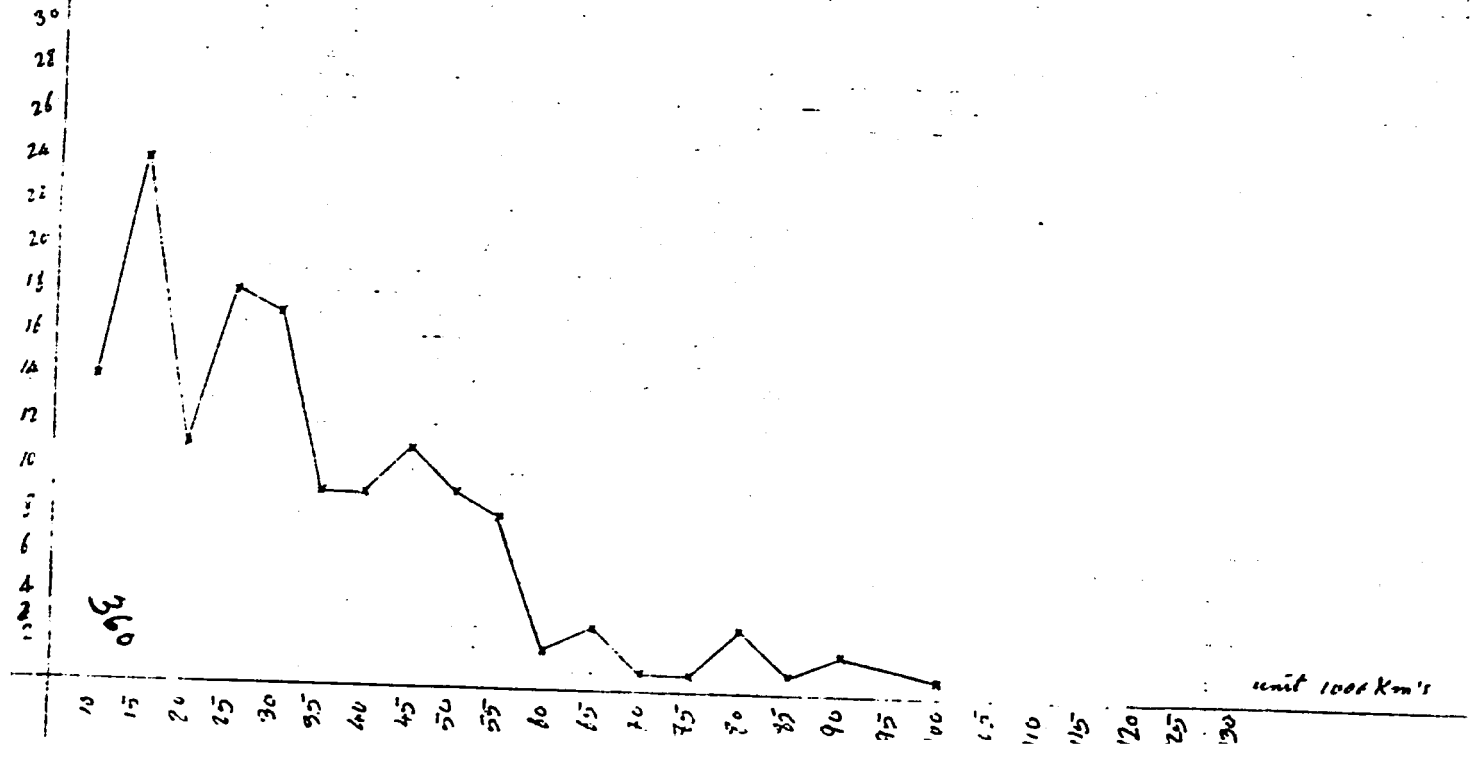
PIECE DIX TEM B

Pg 1

APPENDIX VII
ITEM B

Page 8

Distributing Curve for defected engines (all makes)
in "Almeria garage"



APPENDIX VII
ITEM B

Page 9

Rate of engine failure in Ameria Garage

Pegasus

	Vasr workshop		Ameria workshop		East-unitshop		Total		
	Qua	Avar km	Qua	avar km	Qua	avar km	Qua	avar km	
maj 78	12	23 000	7	33 500	—	—	19	26 800	
juni	7	25000	5	33 000	3	11 000	15	24 800	
july	7	24 000	2	51 000	3	31000	12	30 250	
aug	11	25 500	5	23 000	1	40 000	17	25400	
sep	11	39 000	3	15500	1	39000	15	34 300	
oct	—	—	7	30000	5	48000	12	37500	
nov	7	36 000	—	—	—	—	7	36000	
dec.	4	37000	—	—	3	24 000	7	31 400	
jan 79	1	25000	3	32000	4	22000	8	33600	
feb	3	20 000	2	29000	—	—	5	23600	
march	3	43000	5	32000	9	32000	17	34000	
april	5	41000	7	9500	7	31000	19	25700	
36	avarage 35 200 km 31021		avarage 27270 28850 Km		avarage 30833 30880 Km		153	avarage	running Km's 30300 Km's

ENGINE FAILURES

Classification of defected engines according to running Kms monthly in Basatesi garage

mercedes buses

	up to 9	10—14	15—19	20—24	25—29	30—34	35—39	40—44	45—49	50—54	55—59	60—64	65—69	70—74	75—79	80—84	85—89	90—94	95—99	100—104	105—109	110—114	115—119	120—124	more than 124 work
dec 78	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	
june	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
july	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
aug	–	–	–	1	–	1	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	
sep	–	–	1	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
oct.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
nov	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	1	1	
dec	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	1 190,000
jan 79	1	–	–	–	–	–	–	–	–	1	1	–	–	1	1	–	–	–	–	–	–	–	–	–	1 130 000 1 160 000
feb	–	–	–	–	1	1	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	
march	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	1	–	1	–	1	–	–	–	–	1 165 000
april	–	–	1	–	–	–	–	–	–	–	–	–	–	1	–	–	2	–	–	–	1	2	1	–	1 175 000 1 220 000
total	2	–	2	1	2	4	–	–	1	1	3	–	–	2	3	1	3	1	–	3	1	2	3	1	6 42

362

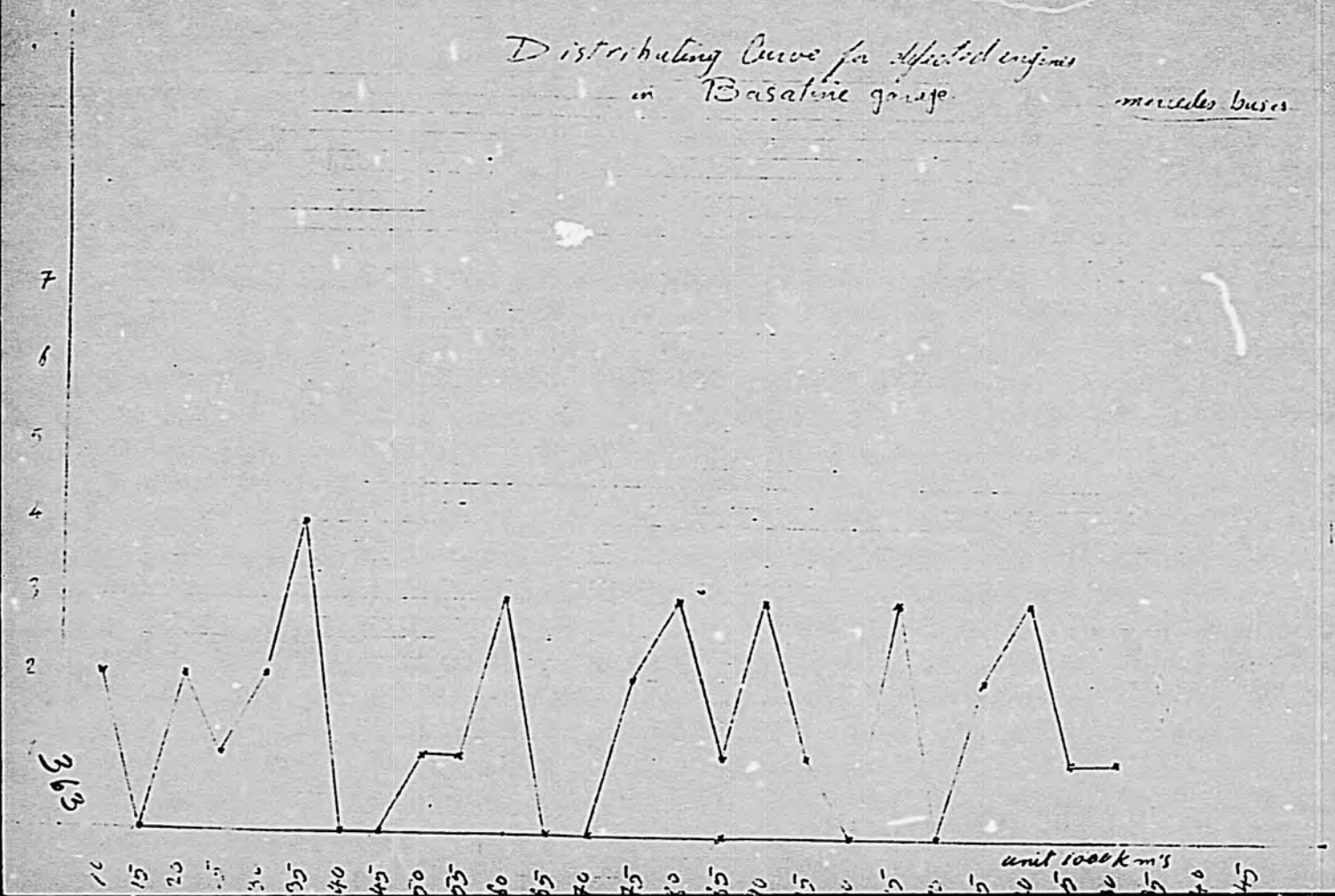
APPENDIX VII
ITEM B

Page 10

APPENDIX VII
ITEM B

Page 11

Distributing Curve for defected engines
in Basaltic gauge



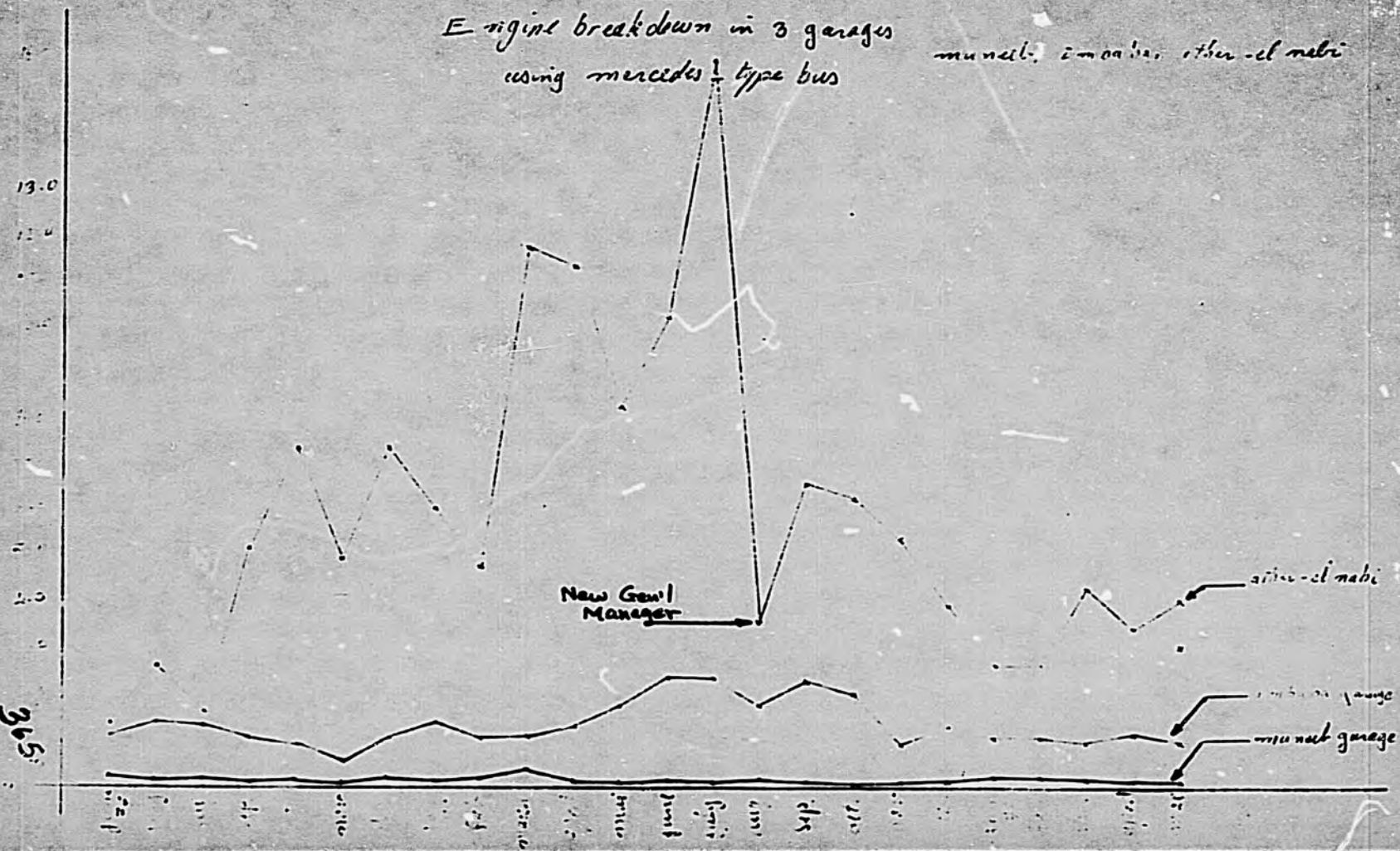
APPENDIX VII
ITEM B

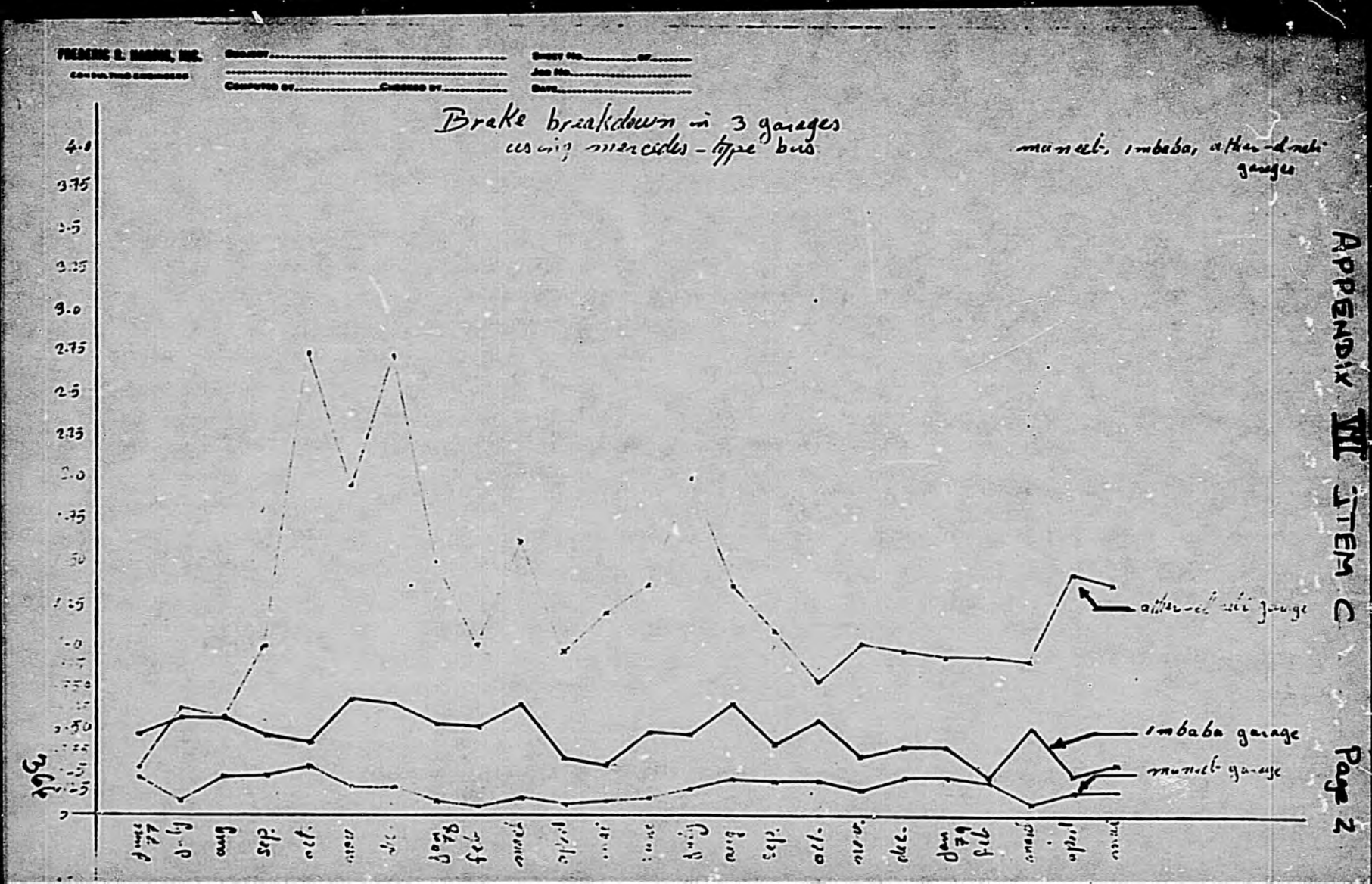
[illegible] average km's monthly
[illegible] Based on the garage
mercedes
all engines are overhauled in South West shop

	Given	average Km's
'Mar 7'	–	–
[illegible]	1	130000
uly	–	–
ug	3	35300
Sep	2	22.500
ct	–	–
ov.	4	100000
ec	4	123000
an 79	7	78000
eb	4	58000
arch	6	84000
pr. 1	10	110000
otal	41	82300 Km's

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT _____ SHEET No. ____ OF ____
JOB No. _____
COMPUTED BY _____ CHECKED BY _____ DATE _____

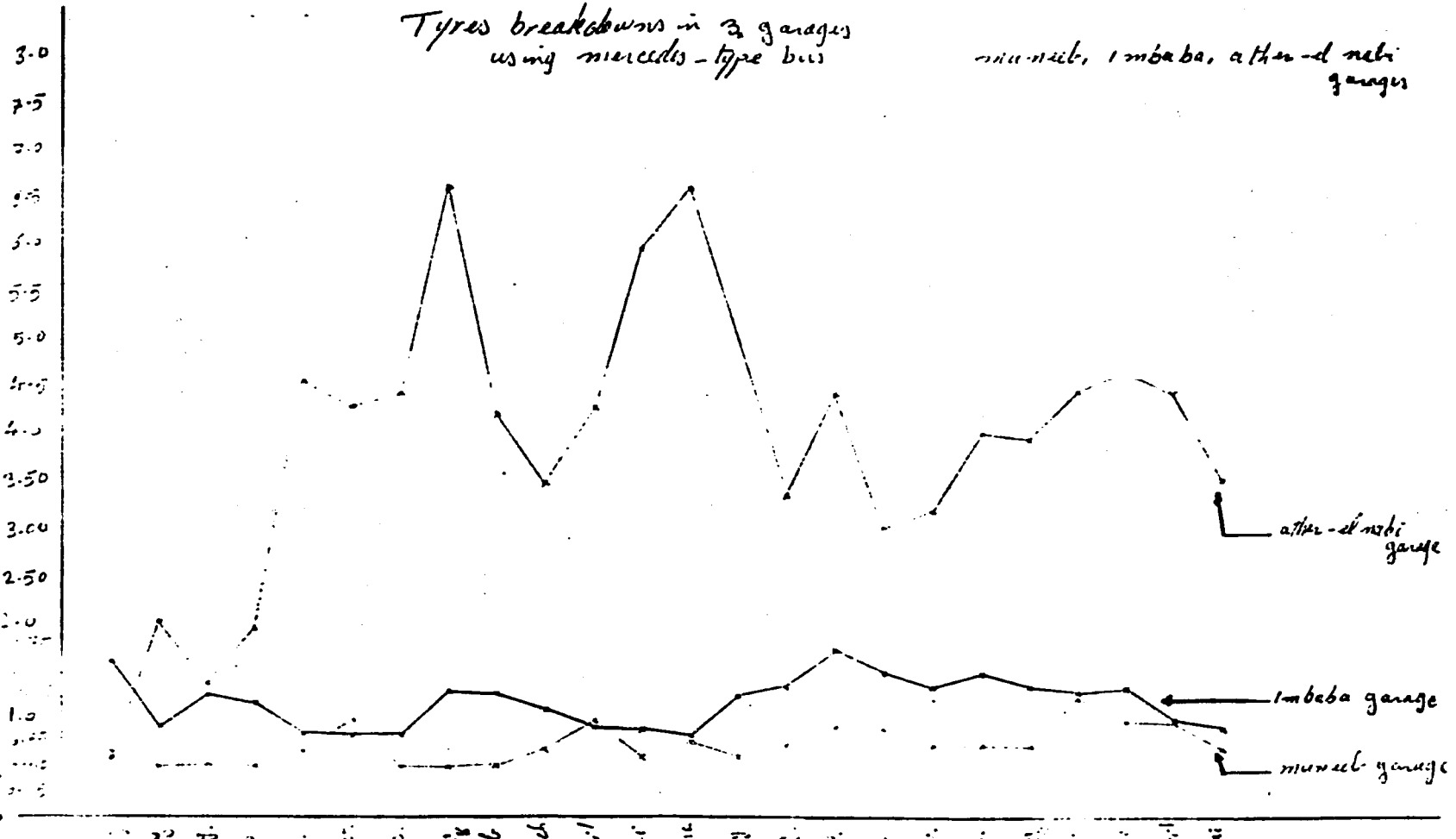



Brake breakdown in 3 garages
using mercedes-type bus
munali, imbaba, other-d-nali
garages
other-d-nali garage
imbaba garage
munali garage
4.0
3.75
3.5
3.25
3.0
2.75
2.5
2.25
2.0
1.75
1.50
1.25
1.0
.50
0
jan 77
feb
mar
apr
may
jun
jul
aug
sept
oct.
nov.
dec.
jan 78
feb
may
aug
sept
oct.
nov.

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT _____ SHEET NO. ____ OF ____
JOB NO. _____
COMPUTED BY _____ CHECKED BY _____ DATE _____

Best Available Document



APPENDIX VII ITEM C

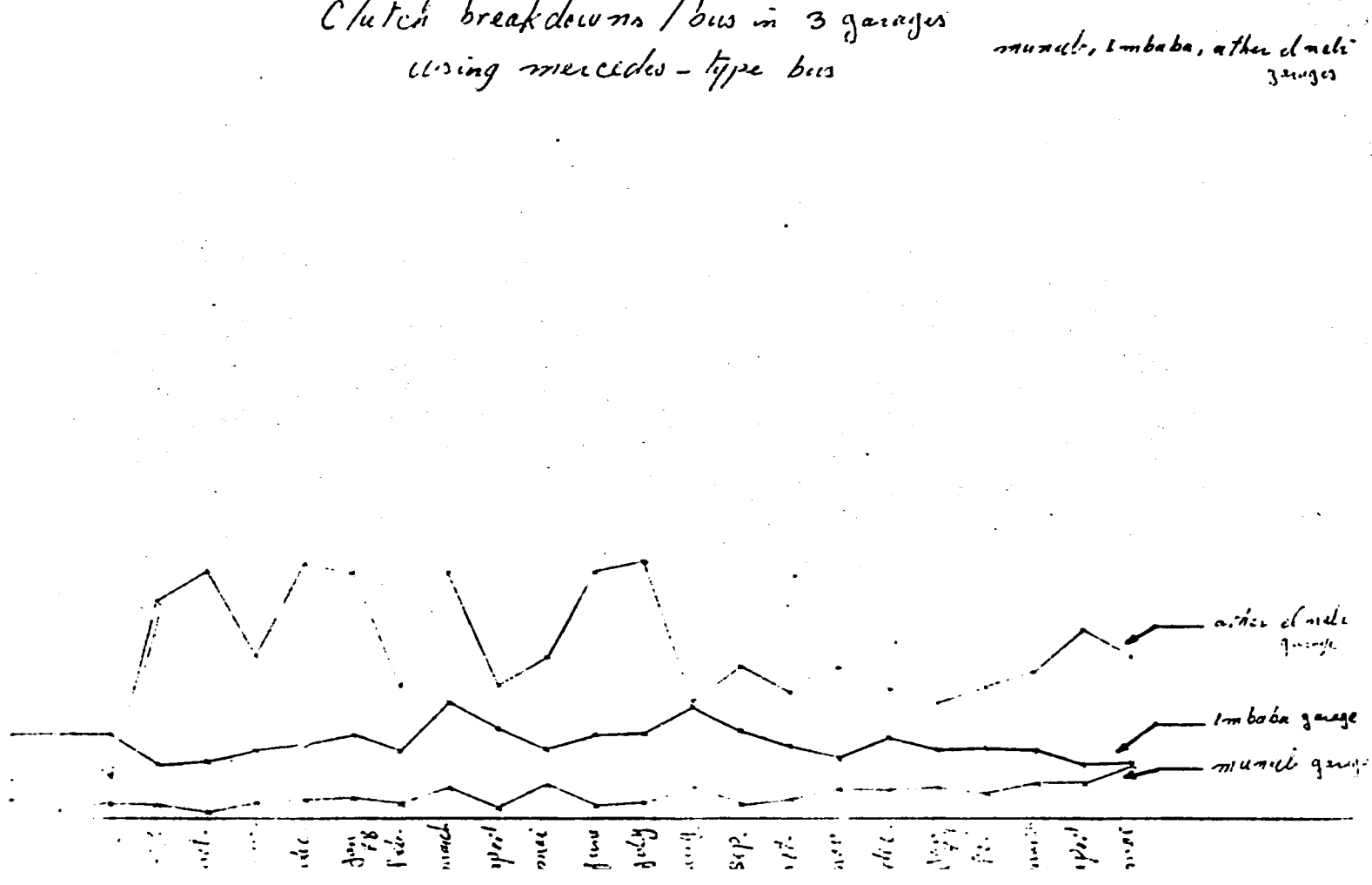
Page 3

367

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS
SUBJECT ..... SHEET NO. ..... OF .....
COMPUTED BY ..... CHECKED BY ..... JOB NO. ..... DATE .....

Best Available Document

Clutch breakdowns / bus in 3 garages using mercedes-type bus

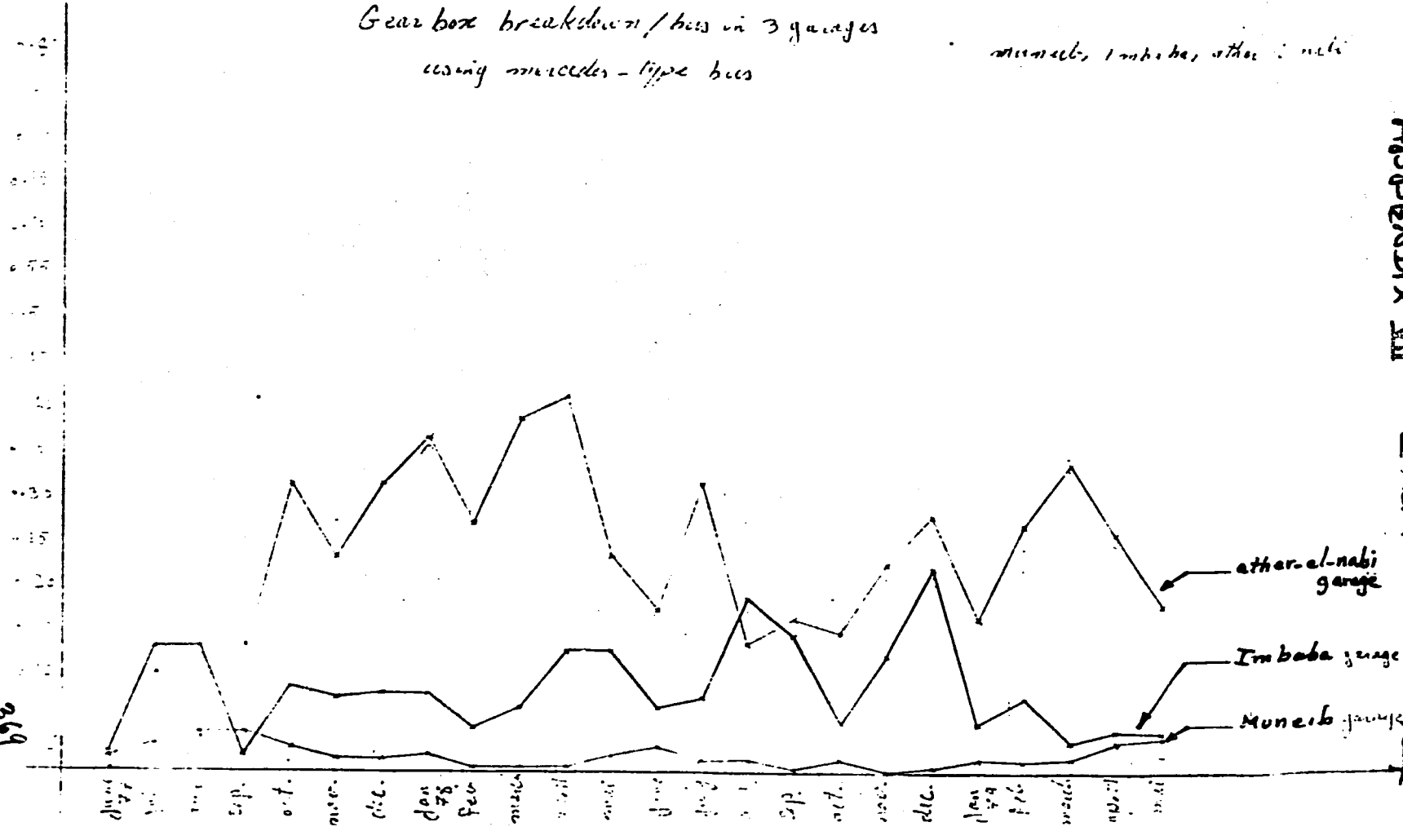


FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERING

Drawn by ____ Sheet No. ____ of ____
Computed by ____ Checked by ____ Job No. ____ Date ____

Best Available Document

Gear box breakdown / hrs in 3 garages using mercedes-type buses



APPENDIX VII ITEM C Page 5

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

Subject ..... Sheet No. ..... of .....
Job No. .....
Computed by ..... Checked by ..... Date .....

June 77 — mai 78 Various breakdowns Aiher - EL Nabi

	Engine	electrical	steering	other equipment	Gearbox	clutch	stuffing	propeller shaft	rear axle	lead spring	brake	tyres	other items	total miles B.D	average / day	average / 100 km	average / bus day	Downtime / min.
June 77	191	10	21	55	—	38	23	3	—	—	39	89	—	545	18	59	0.1	69
July	363	18	58	140	14	68	86	—	35	4	85	275	—	1331	43	152	0.4	67
aug	218	13	51	133	5	40	44	—	—	—	82	189	—	954	31	111	2.9	85
sep	704	17	63	103	19	181	146	—	—	7	190	267	—	1889	63	264	0.6	136
oct	1005	17	151	547	43	213	209	—	—	25	377	616	—	3669	118	484	1.2	67
nov	674	31	100	375	31	150	208	3	—	5	259	580	—	3040	101	402	0.9	70
dec	1005	17	151	547	43	222	200	—	—	25	377	597		3650	118	412	1.2	87
Jan 78	818	26	115	461	50	212	225	5	—	18	211	899	—	3656	118	441	1,2	68
Feb	653	32	66	148	37	119	106	—	—	14	146	534	—	2233	80	275	0.8	69
march	1592	33	34	180	52	214	95	—	—	35	223	453	—	3432	111	368	1.1	51
april	1541	49	47	197	56	120	133	—	—	13	122	552	—	3196	107	358	1.0	51
mai 78	1132	113	74	196	32	153	130	—	—	42	161	807	—	3306	107	346	1.0	62

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT _____ SHEET NO. ____ OF ____
JOB NO. _____
COMPUTED BY _____ CHECKED BY _____ DATE _____

APPENDIX VII ITEM C

[illegible] — [illegible] #7 — Various breakdowns [illegible] — Ethe – El nabi

	Engine	Alternator	Stator	Other parts	Exciter	Cylinder	Stator	Piston & rings	Rear cover	Fuel system	Brake	Fuel	Other	Total cost B.D.	Average P.M.H.	Average P.M.H. / Engine	Average / Breakdown	Down time per month
																		min.
June 78	1383	35	119	207	24	212	216	–	7	7	134	900	–	3814	127	416	1.2	59
July	2142	35	94	281	43	226	332	3	8	5	[illegible]	1114	–	5325	172	593	1.7	54
Aug	475	24	53	161	19	150	150	–	1	3	138	459	–	1445	63	224	0.6	154
Sept.	894	13	57	204	23	135	138	–	–	3	149	602	–	2524	84	311	0.9	123
Oct.	854	13	57	175	21	109	119	–	–	11	128	449	–	2156	70	253	0.7	117
Nov.	724	20	63	175	29	133	124	–	–	5	142	435	–	2195	73	265	0.8	111
Dec.	535	27	53	219	38	116	105	–	–	4	133	545	–	2130	64	254	0.8	130
Jan. 79	362	23	52	134	23	102	134	–	–	5	116	524	243	1182	60	216	0.6	152
Feb.	359	36	39	217	32	115	142	–	–	9	117	518	243	1276	72	226	0.7	154
March	530	22	44	227	46	127	215	–	–	8	113	636	220		79	285	0.8	162
April	463	26	56	182	35	163	240	–	–	7	143	606	–	1516	77	268	0.7	158
May	551	32	59	223	25	143	195	–	–	2	185	479	–	2205	71	238	0.7	153

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

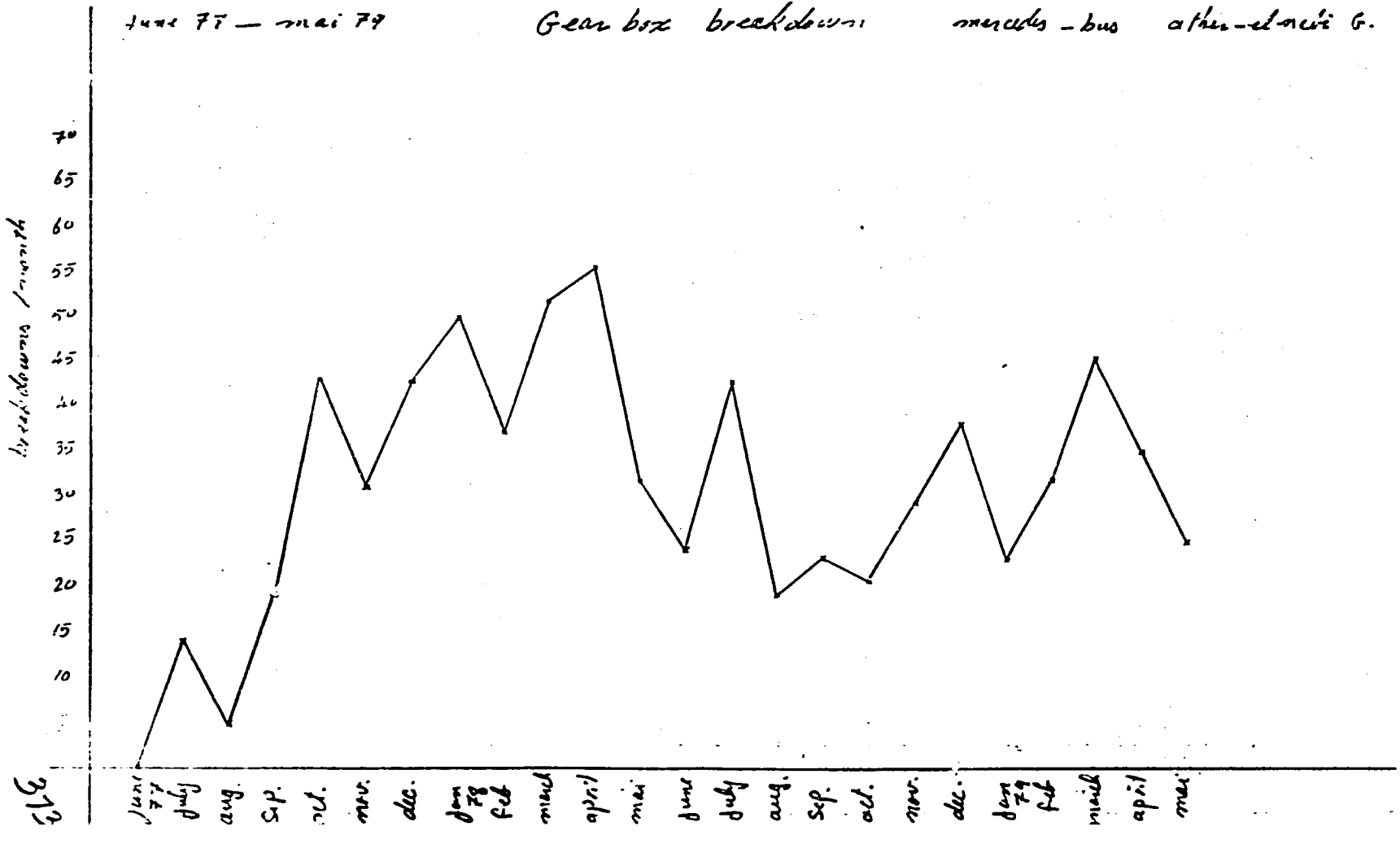
SUBJECT _____ SHEET NO. ____ OF ____
JOB NO. _____
COMPUTED BY _____ CHECKED BY _____ DATE _____

APPENDIX VII ITEM C

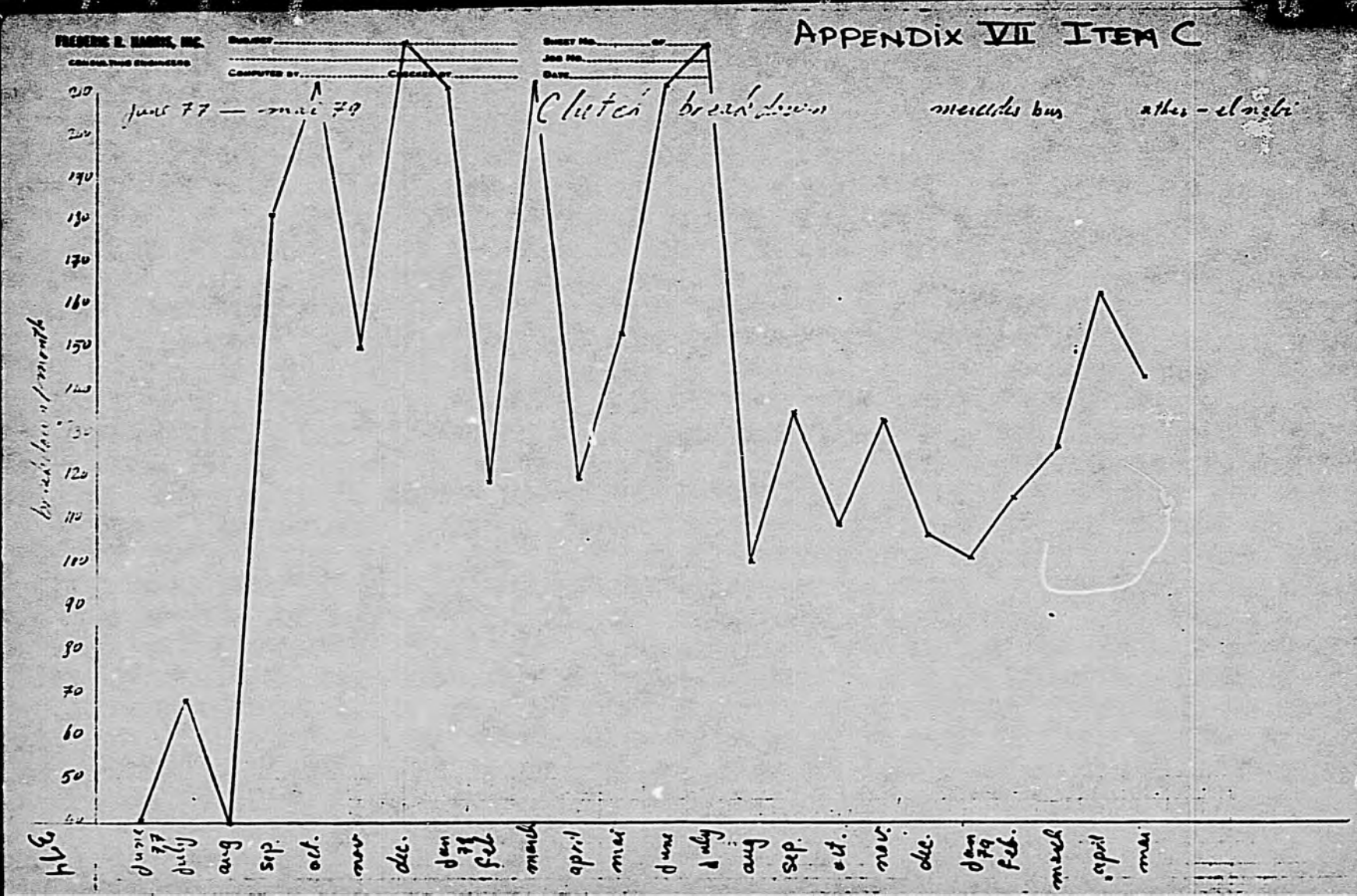
FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT _____ SHEET NO. ____ OF ____
JOB NO. _____
COMPUTED BY _____ CHECKED BY _____ DATE _____

APPENDIX VII ITEM C



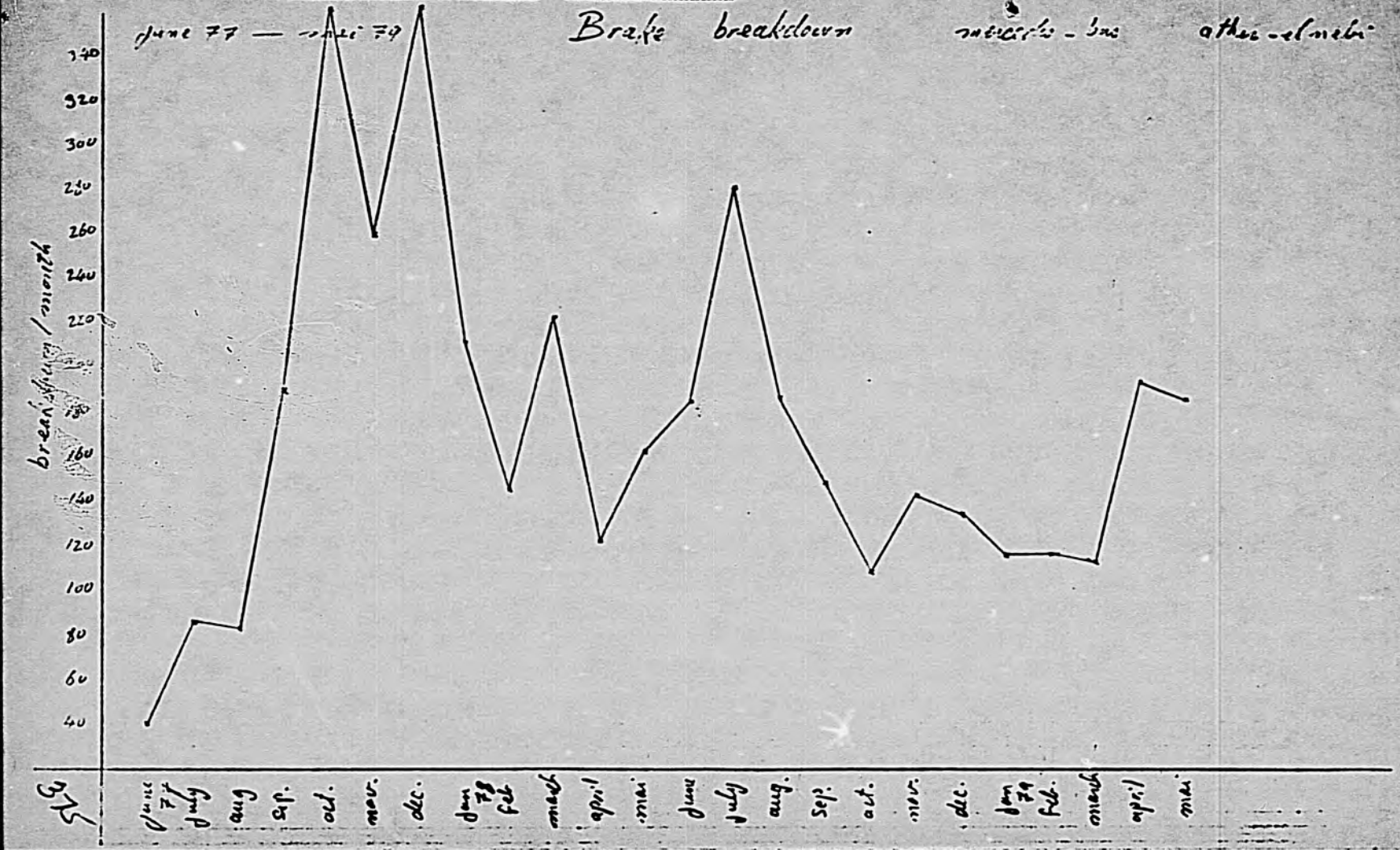
APPENDIX VII ITEM C



FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

Subject _____ Sheet No. _____ of _____
Job No. _____
Computed by _____ Checked by _____ Date _____

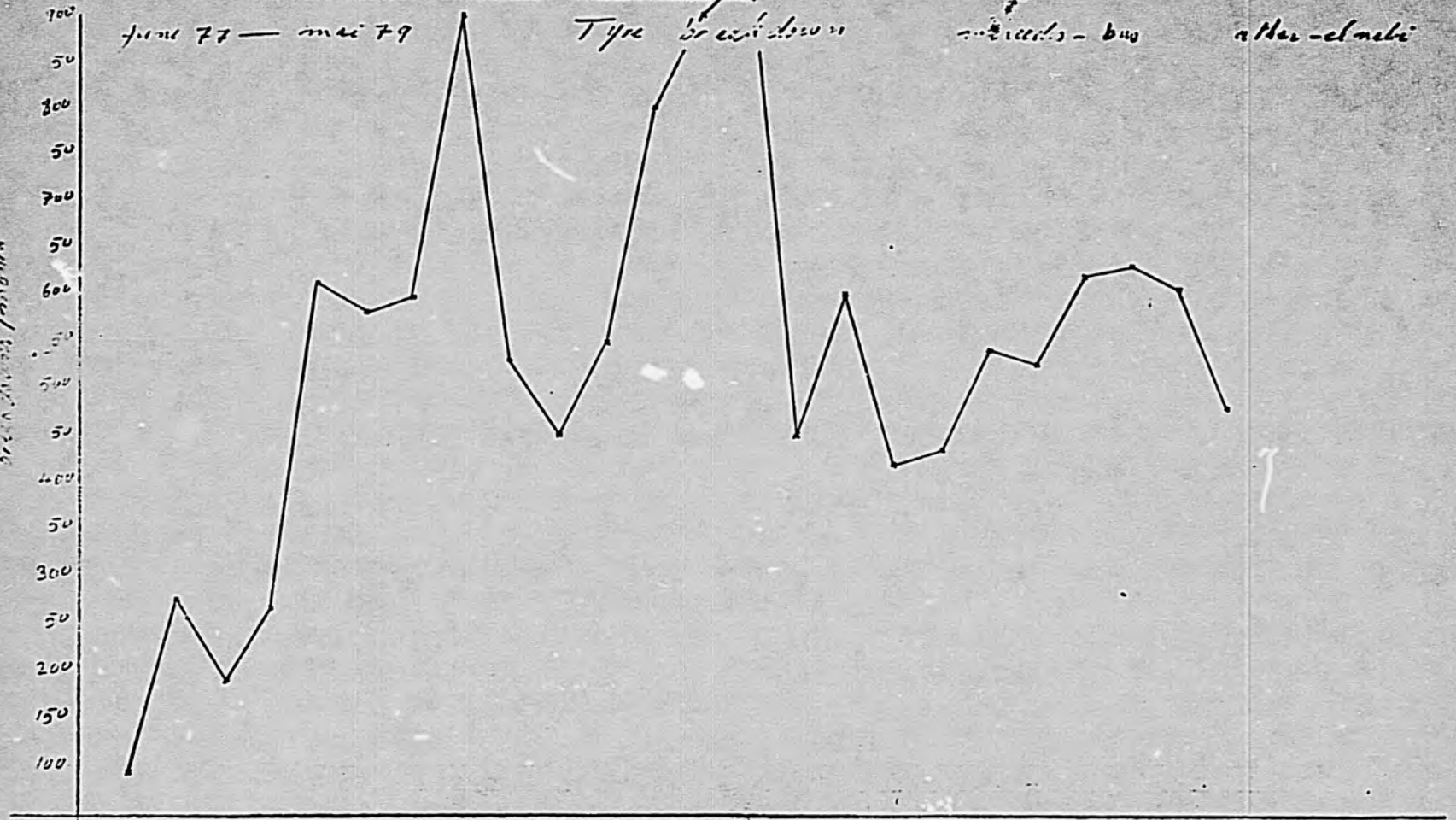
APPENDIX VII ITEM C



FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT
COMPUTED BY CHECKED BY
SHEET NO. OF
JOB NO.
DATE

APPENDIX VII ITEM C



316

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT _____ SHEET NO. ____ OF ____
JOB NO. _____
COMPUTED BY _____ CHECKED BY _____ DATE _____

APPENDIX VII ITEM C

[illegible] Technical efficiency [illegible] gauge

	Service effi			maintenance effi			operation efficiency			repair of buses in service	
	scheduled no of buses / month	short of buses in service	effic	scheduled bus operating hours	Lost hours due to train causes	effic	scheduled km's	running km's	effic	down time total in min	DT / 100 mi
[illegible]	3231	81	97.5%	54057	625	98.8%	984938	882167	89.6	37500	12
july	3348	34	99.0	55473	1608	97.1	1021740	826501	80.9	89400	27
aug	3348	159	95.3	53416	1893	96.5	981243	811464	82.7	81720	25
sep	3240	142	95.6	51858	5324	89.7	953679	670009	70.1%	257400	83
oct	3240	150	95.4	52428	4360	91.8	964876	698628	72.5%	233620	75
nov	3240	154	95.2	52728	3569	93.2	975898	709632	72.7%	214140	69
dec	3330	184	94.8	55596	3261	93.1	1114070	851500	76.1%	203416	65
[illegible] 1975	3331	176	94.7	54924	4126	92.5	1063773	786730	73.4%	247560	52
feb	3012	203	93.3	50242	2578	94.9	1006934	768587	76.3	154680	55
march	3330	238	92.8	55598	4522	91.9	1114074	851546	76.4	174240	56
april	3228	208	93.6	54485	4414	91.9	1080034	847205	78.4	163560	54
may	3336	97	97.1	55692	3941	92.9	1116309	907768	81.3%	203640	63

Page 13

377

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT ..... SHEET NO. ..... OF .....
JOB NO. .....
COMPUTED BY ..... CHECKED BY ..... DATE .....

APPENDIX VII ITEM C

June 1977 — mai 1978 Passengers (thousands), income other - all metro garage

	Passengers (thousands)						Income						
	Kind of classe		total	% ge to total of C.T.A.	average		Kind of classe		total	% ge to total of C.T.A.	average		
	1st	2nd			/ day	/ running km's	1st	2nd			/ day	/ km's within	/ bus in service
June 1977	1 78	4464	5642	7.2%	188	6.3	32902	60095	92997	7.4	3100	105	30.600
July	1 29	3762	5691	7.0%	184	6.9	48570	46357	94927	7.2	3062	115	33.830
aug.	47	3485	5432	7.1%	175	6.9	43991	41619	90610	7.2	2923	112	32.960
sep.	301	3449	5250	7.2%	175	7.8	45848	42861	88709	7.4	2957	132	38.590
oct.	915	3641	5556	7.0%	179	7.8	48557	45210	93767	7.2	3025	132	38.680
nov.	253	3456	5309	7.2%	177	7.4	46762	42927	89689	7.4	2990	126	36.98[illegible]
dec.	85[illegible]	3453	5550	7.0%	178	7.6	46760	42925	93178	7.3	3003	119	36.328
jan 1978	1368	3421	5289	6.9%	171	6.7	49069	44113	93182	7.3	3006	119	36.400
fev.	1885	3132	5017	7.0%	179	6.5	53199	40121	93320	7.8	3333	121	38.210
march	2057	3677	5734	7.1%	185	6.7	59564	47418	106982	7.9	3451	126	39.650
april	2656	2953	5609	7.1%	187	6.8	71395	33756	105151	8.0	3505	124	38.830
mai.	2040	3680	5720	7.0%	186	6.7	76551	34741	111292	8.4	3590	123	39.010

378

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT ..... SHEET NO. ..... OF .....
COMPUTED BY ..... CHECKED BY ..... JOB NO. ..... DATE .....

APPENDIX VII ITEM C

from june 977 – mei 979 Technical Condition of busses monthly Ahmad nabi G.

Mercedes type (Iran)

Condition \ month		june 77	july	aug	sep	oct.	nov	dec.	jan 78	Feb	march	april	may	june	july	aug	sep.	oct.	nov.	dec.	jan 1979	Feb.	march	april	mai
1	in service	105	106	107	102	103	102	106	108	100	102	103	105	101	100	99	95	95	97	97	96	99	105	106	105
2	P. maintenance	12	10	10	13	13	16	12	10	9	7	8	10	9	8	8	8	8	9	9	8	10	9	9	9
3	in garage	14	14	14	14	13	11	10	10	19	16	14	12	19	21	24	26	24	24	22	28	23	17	15	14
4	under repair in general workshop	4	5	4	6	6	6	7	7	7	10	10	8	6	6	4	6	8	5	7	3	3	4	5	6
	waiting	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	stand-by	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	total	135	135	135	135	135	135	135	135	135	135	135	135	135	135	135	135	135	135	135	135	135	135	135	135

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT ..... SHEET NO. ..... OF .....
JOB NO. .....
COMPUTED BY ..... CHECKED BY ..... DATE .....

APPENDIX VII ITEM C

June 1969 — mai 1971 workers absence drivers & other-le-mois gare

	June 1969	July	aug.	sep.	oct.	nov.	dec.	Jan 1970	feb.	march	april	mai
total no of workers drivers	339	339	339	341	341	342	339	331	332	360	364	370
worker-day	10170	10509	10509	10230	10571	10260	10509	10261	9296	11150	10920	11470
without payment	460	377	539	470	437	386	439	261	178	230	249	219
without permission	540	476	657	179	541	1054	1209	953	766	770	734	903
illness	270	256	209	238	274	318	210	191	208	110	223	298
injury during work	30	2	—	26	51	29	52	22	6	20	—	95
lost work	—	—	—	—	—	—	—	—	—	—	—	—
total for all	1300	1111	1405	1413	1511	1787	1910	1427	1158	1200	1206	1515
total/worker	3.7	3.3	4.1	4.1	4.7	5.2	5.6	4.3	3.5	3.3	3.3	4.1
% total worker-day	12.7	10.6%	13.4	13.8	15.2	17.4	18.2	13.9%	12.5%	11.[illegible]	11.0%	13.2

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

Subject ..... Sheet No. ..... of .....
Job No. .....
Computed by ..... Checked by ..... Date .....

APPENDIX VII ITEM C

June 1978 — March 1979 Workers absence Collectors -2- other-el-mech

	June 1978	July	aug.	sep	oct.	nov.	dec.	Jan 1979	feb	mar	april	may
no. of workers Collectors	360	363	365	361	361	360	364	360	365	363	362	359
worker-day	10800	11253	11315	10830	11191	10800	11284	11160	10220	11253	10860	11129
absence: without payment	560	613	713	595	427	536	607	397	320	350	345	390
absence: without permission	940	873	941	962	1043	1151	1188	885	788	450	545	480
illness	250	338	271	287	[illegible]	297	250	170	176	240	218	182
injury during work	96	27	42	84	[illegible]	29	23	38	23	40	1	27
night work	—	—	—	—	—	—	—	—	—	—	—	—
total for all	1840	1851	1967	1958	[illegible]	2013	2068	1490	1307	1030	1109	1079
[illegible] / worker	5.1	5.0	5.4	5.3	5.3	5.6	5.7	4.1	3.6	3.0	3.1	3.0
% to total worker-day	16.2%	15.1%	17.4	17.6%	17.2	18.6	18.3	13.4%	12.8	9.6%	10.2	9.7

381

Page 17

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

Subject _____ Sheet No. ____ of ____
Job No. _____
Computed by _____ Checked by _____ Date _____

APPENDIX VII ITEM C

juin 1978 — mai 1979 Workers absence Technicians -3- omni-el metz jauge

	juin 1978	juillet	aug.	sept.	oct.	nov.	déc.	janv. 1979	fév.	mars	avril	mai
total no. of workers from [illegible]	321	321	327	326	329	321	325	320	323	321	318	314
worker days	9630	9951	10137	9780	10191	9630	10075	9920	9044	9951	9480	9734
without pay [illegible]	280	241	430	406	424	279	392	203	147	240	170	188
without provision	320	309	297	246	371	453	248	358	341	235	246	277
illness	300	278	205	173	205	157	225	186	133	225	256	192
injury [illegible]	40	54	51	80	76	43	48	15	60	50	24	89
[illegible]	—	—	—	—	—	—	—	—	—	—	—	—
total for all	940	882	993	955	1071	942	913	762	681	750	696	746
total / worker	2.9	2.7	3.0	2.9	3.3	2.9	2.8	2.4	2.1	2.4	2.2	2.4
% age to total worker days	9.8%	8.9%	9.8%	9.8%	10.6	9.8	9.1	7.7%	7.5%	7.7%	7.3	7.7

382

APPENDIX VII
ITEM C

Rate of engine failure
min. by and average km
in Ather-elinebi gauge

mercedes

all engines are overhauled in south unit shop

	Qua	average Km's	
78	13	56400	
	6	71500	
	16	46250	
	5	46000	
	11	73800	
	11	40400	
	8	71600	
	13	66900	
79	9	37000	
	7	106000	
ch	9	62000	
1	5	41000	
	114	59900 Km's	

Best Available Document

APPENDIX VII
ITEM C

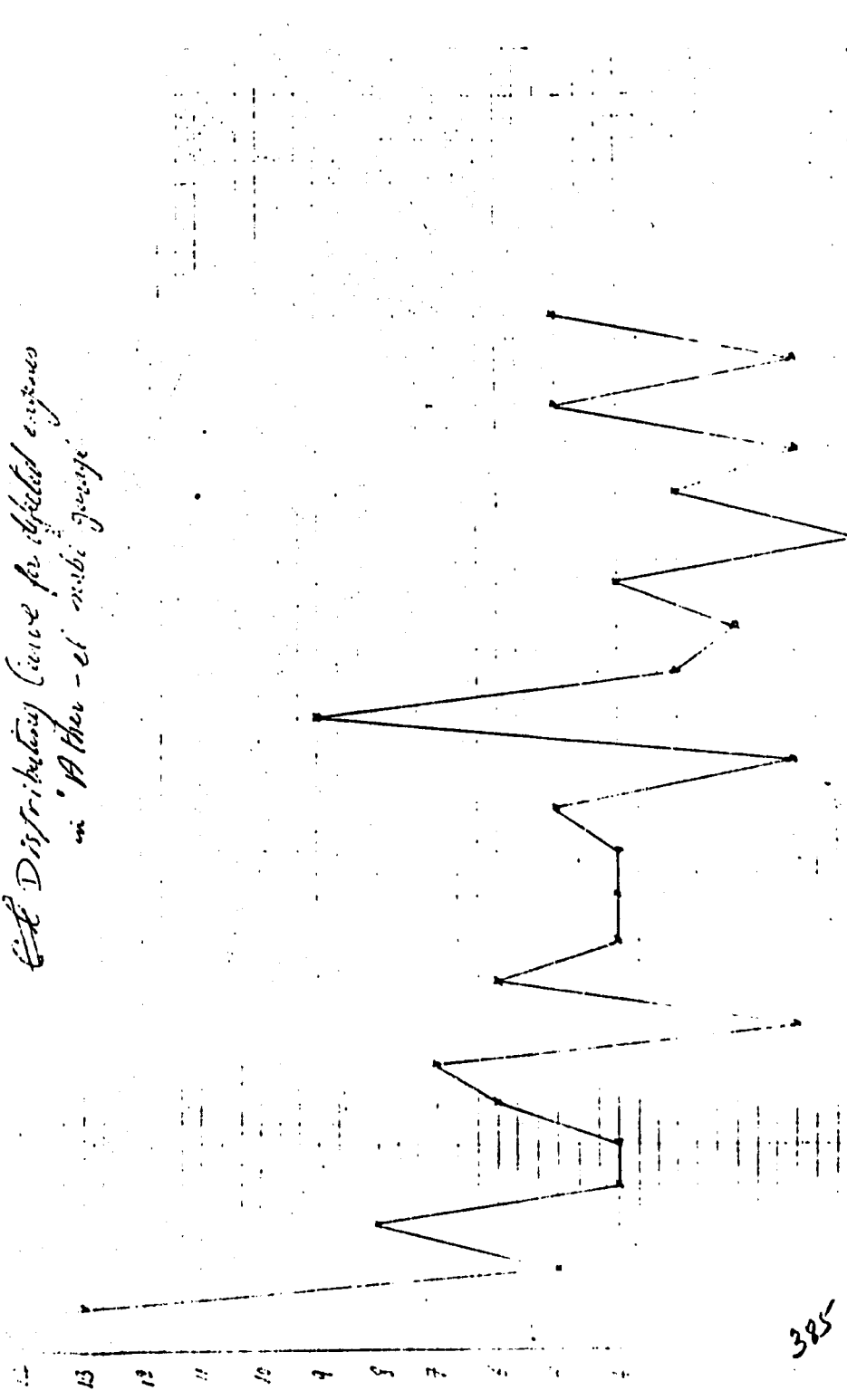
Classification of defected engines according to running Km's monthly in Ethio-el nabi garage

mercedes buses

	0/10	11 – 14	15 – 19	20 – 24	25 – 29	30 – 34	35 – 39	40 – 44	45 – 49	50 – 54	55 – 59	60 – 64	65 – 69	70 – 74	75 – 79	80 – 84	85 – 89	90 – 94	95 – 99	100 – 104	105 – 109	110 – 114	115 – 119	120 – 124	more than 124000 km
[illegible]	–	–	–	1	–	2	–	–	3	–	1	2	2	–	4	–	–	–	–	–	–	1	–	–	1 160,000
[illegible]	–	1	1	–	–	1	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1 170,000
[illegible]	3	1	1	1	–	1	2	1	–	–	–	1	1	–	–	–	–	–	–	–	1	1	–	–	1 138000
[illegible]	–	–	–	–	–	1	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	–	–	–	
[illegible]	1	–	1	–	1	–	–	–	–	–	–	–	–	–	3	–	–	–	–	2	–	2	–	1	1 156 000
[illegible]	2	1	2	2	–	1	2	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	–	1	
[illegible]	–	–	–	1	–	–	–	–	2	1	–	–	–	–	–	–	1	1	–	–	–	1	–	1	
[illegible]	1	–	1	–	–	–	–	–	1	2	2	–	2	–	2	–	–	–	–	–	–	–	–	1	1 17400
[illegible]	1	1	1	–	2	–	2	–	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	
	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	1	–	–	1	–	1 140 000 1 190 000
	2	–	–	1	–	–	–	–	–	–	–	–	–	1	2	1	–	1	–	–	–	–	–	1	
	2	1	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1 150 000
[illegible]	13	5	8	4	4	6	7	1	6	4	4	4	5	1	9	3	2	4	–	3	1	5	1	5	8 112

384

APPENDIX VII
ITEM C



FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

Subject ..... Sheet No. ..... of .....
Job No. .....
Computed by ..... Checked by ..... Date .....

APPENDIX VII ITEM C

June 77 — mai 78 — Various breakdowns monthly — Munich Garage

	Engine	alternator	starter	other elec parts	Gear box	clutch	steering	propeller shaft	rear axle	Leaf spring	brake	tyres	other mech	total, mech B.D	average / day	ave / 100,000 km	ave / breakdown	Downtime / min
June 77	24	1	7	34	2	12	6	—	—	—	27	86	—	209	7	22	0.1	94
July	15	2	3	18	3	4	1	—	—	—	11	73	4	140	5	14	0.1	80
aug.	16	2	5	19	6	12	5	—	—	—	29	80	—	178	6	18	0.1	84
Sep.	10	2	4	17	7	10	3	—	—	—	40	94	—	187	6	20	0.1	94
oct.	14	6	4	24	4	13	—	—	—	—	43	113	—	223	7	23	0.1	90
nov.	8	9	5	38	2	12	2	—	—	—	23	160	—	273	7	22	0.1	83
dec.	23	2	6	34	2	13	5	—	—	—	25	88	—	208	7	22	0.1	94
Jan 78	15	—	—	51	3	15	2	—	2	—	13	120	—	276	9	27	0.1	108
Feb.	23	—	—	12	1	9	—	—	—	—	8	89	—	208	7	23	0.1	83
march	63	—	—	44	1	18	—	—	1	—	17	114	—	261	8	25	0.1	77
april	16	—	—	92	1	5	—	—	2	—	11	156	23	255	9	25	0.1	78
mai	15	—	—	16	3	20	—	—	—	—	14	98	27	193	6	18	0.1	76

386

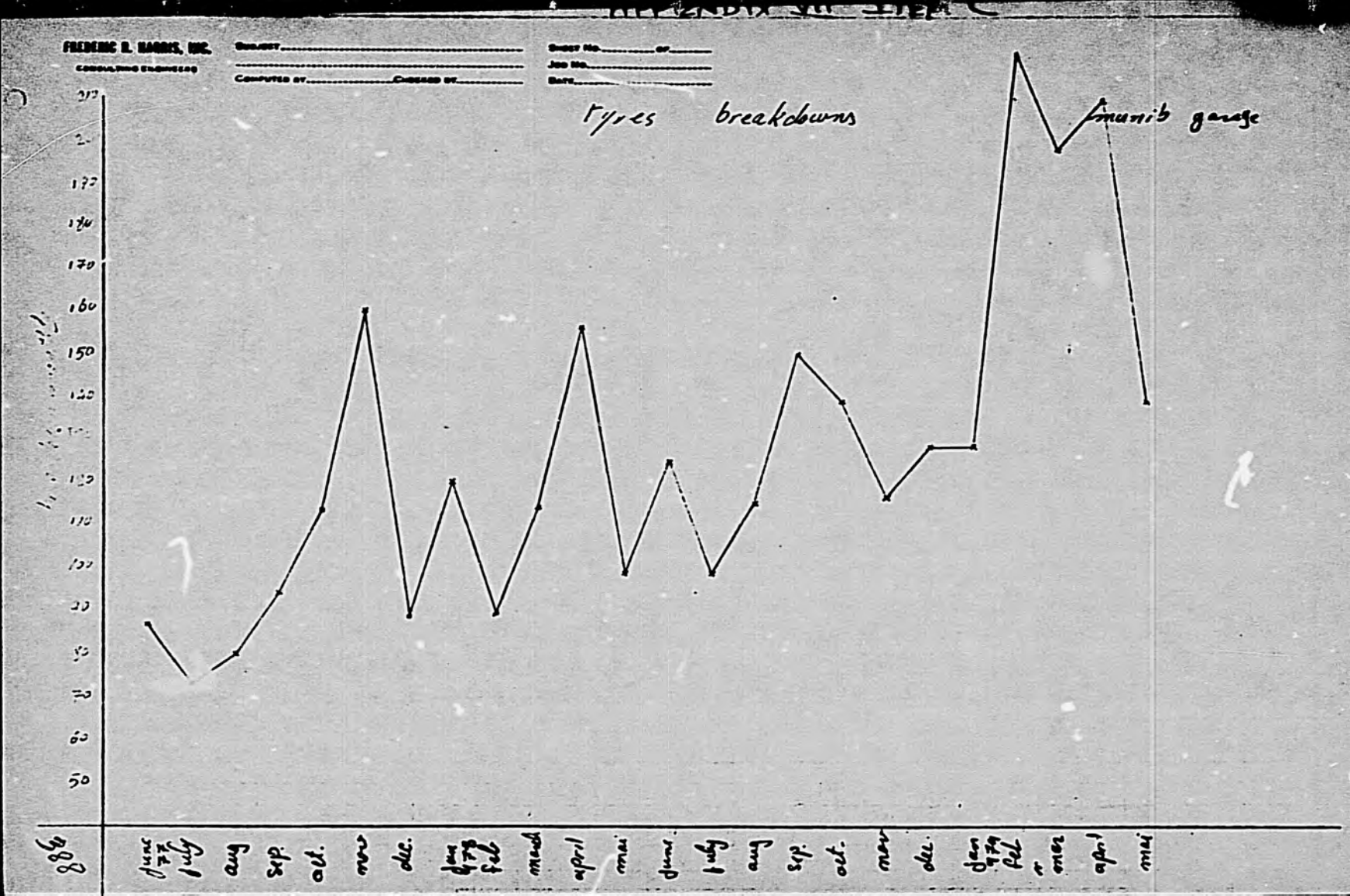
FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT: ..... SHEET NO. ..... OF .....
JOB NO. .....
COMPUTED BY ..... CHECKED BY ..... DATE .....

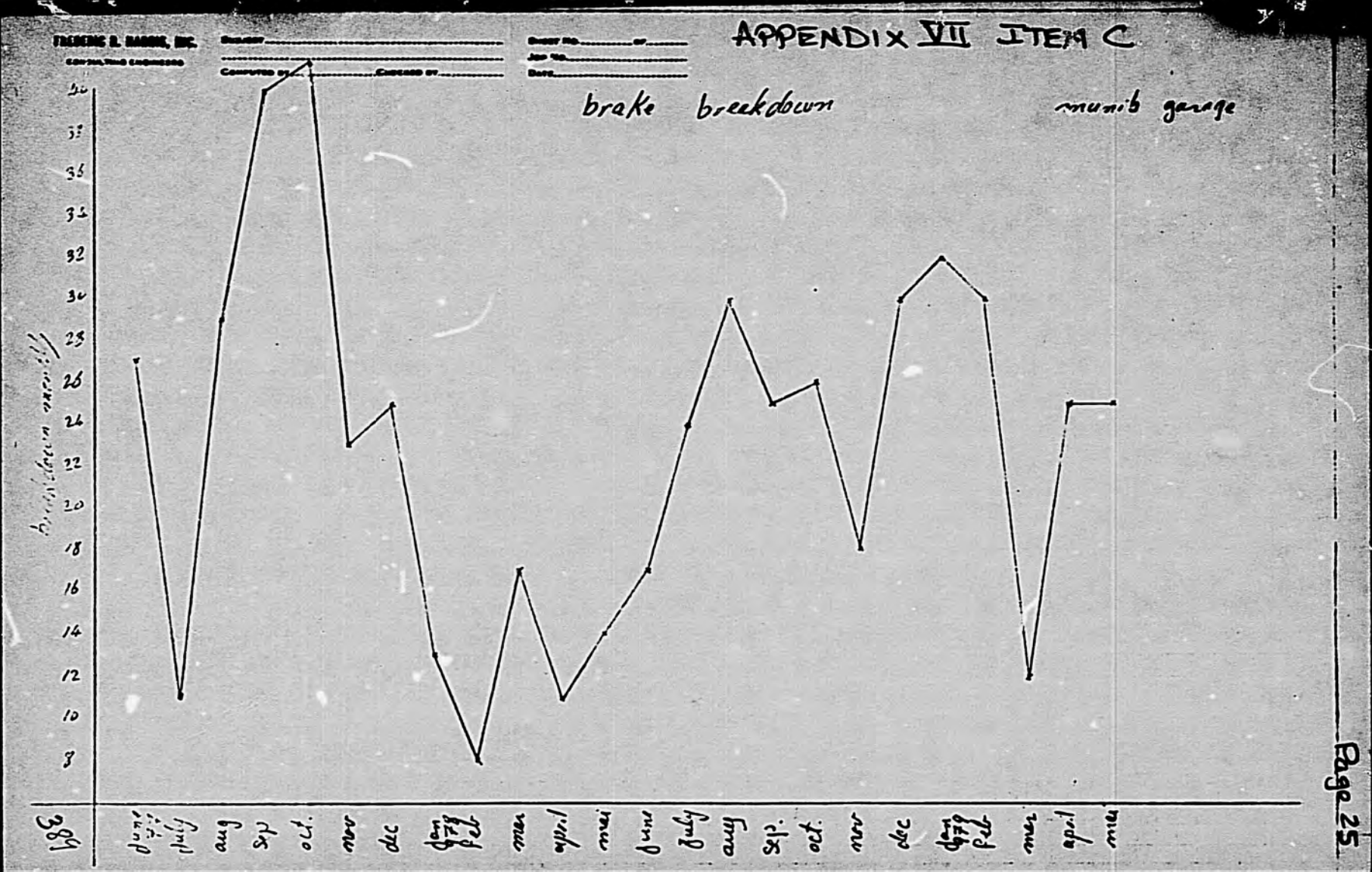
APPENDIX VII ITEM C

June 78 → mai 79 — Various breakdowns monthly — Alineeb GARAGE.

	Engine	Electrical etc	Steering	Other [illegible]	Gear box	Clutch	Steering	Propeller shaft	Reverse	Leaf spring	Brake	tyres	Other [illegible]	total man b.D	average / day	average / [illegible]	average / [illegible] day	Downtime per month
June 78	19	4	—	8	4	8	—	—	1	—	17	125	—	228	8	23	0.1	76
July	15	3	—	18	2	12	—	—	2	—	24	98	—	217	7	20	0.1	75
Aug	27	2	—	12	2	21	—	—	1	—	30	115	—	253	8	25	0.1	87
Sep	18	4	—	23	1	8	—	—	—	—	25	150	—	275	9	28	0.1	79
[illegible]	6	4	—	19	2	15	—	—	—	—	26	137	—	270	9	27	0.1	84
[illegible]	13	4	—	28	—	18	—	—	3	—	18	115	—	279	9	28	0.1	81
Dec	25	4	1	25	1	18	—	—	—	—	30	128	—	325	10	31	0.1	83
Jan 79	38	7	—	11	3	20	—	—	4	—	32	128	82	269	11	31	0.1	82
Feb	39	13	—	17	2	18	—	—	5	—	30	222	70	347	16	46	0.1	86
March	34	20	—	33	3	27	—	—	6	—	12	196	82	326	15	41	0.1	81
[illegible]	27	19	—	30	6	29	—	—	2	—	25	200	[illegible]	347	16	39	0.1	81
	23	18	—	37	7	41	—	—	3	—	25	138	—	408	13	32	0.1	72


FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS
Tyres breakdowns
Munib gauge
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
June 77
July
aug
sep.
oct.
nov
dec.
jan 1979
feb
march
april
mai
June
July
aug
sep.
oct.
nov
dec.
jan 1979
feb
mar
april
mai

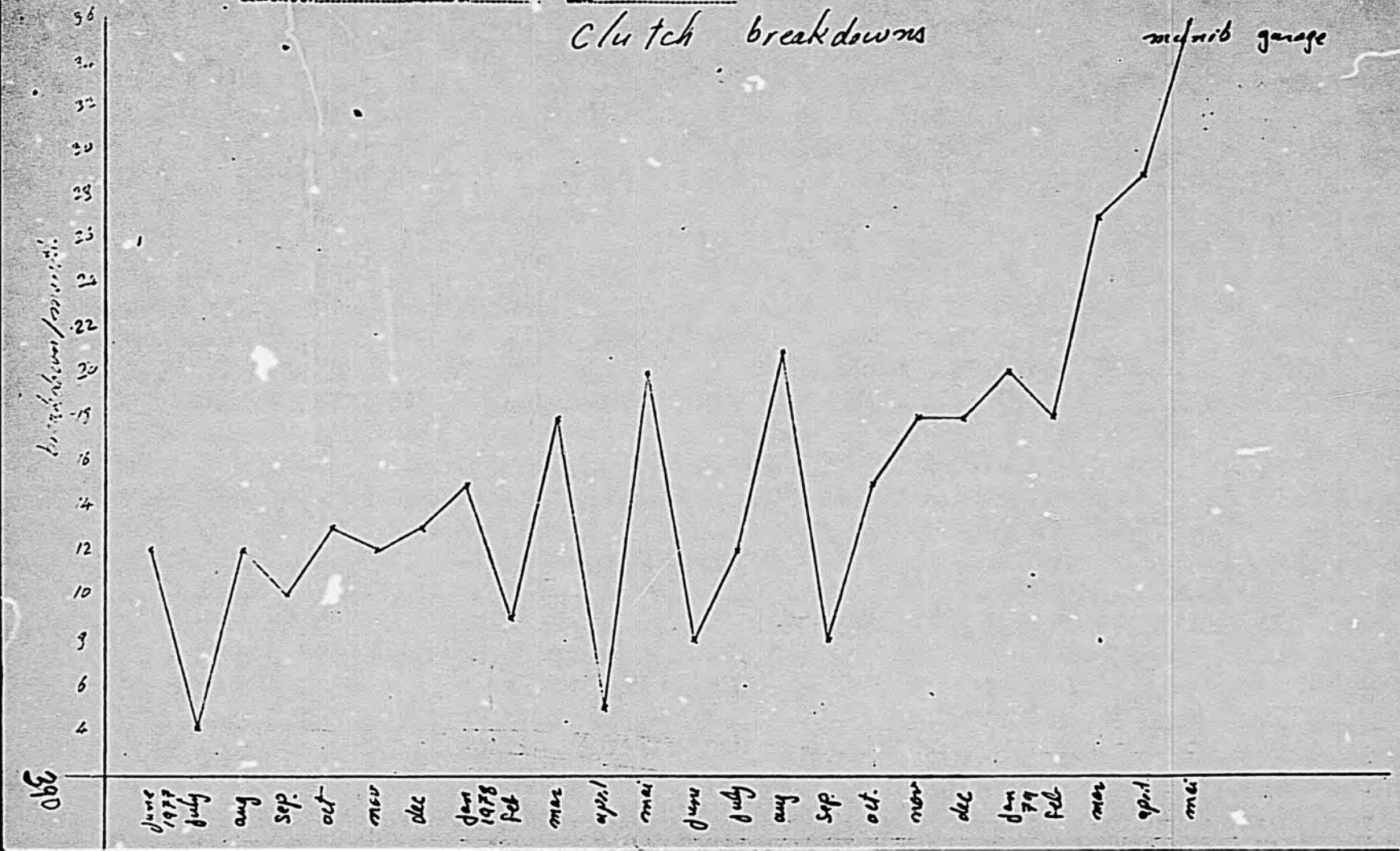
APPENDIX VII ITEM C



FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

Subject _____ Sheet No. ____ of ____
Computed by _____ Checked by _____ Job No. _____ Date _____

APPENDIX VII ITEM C



FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

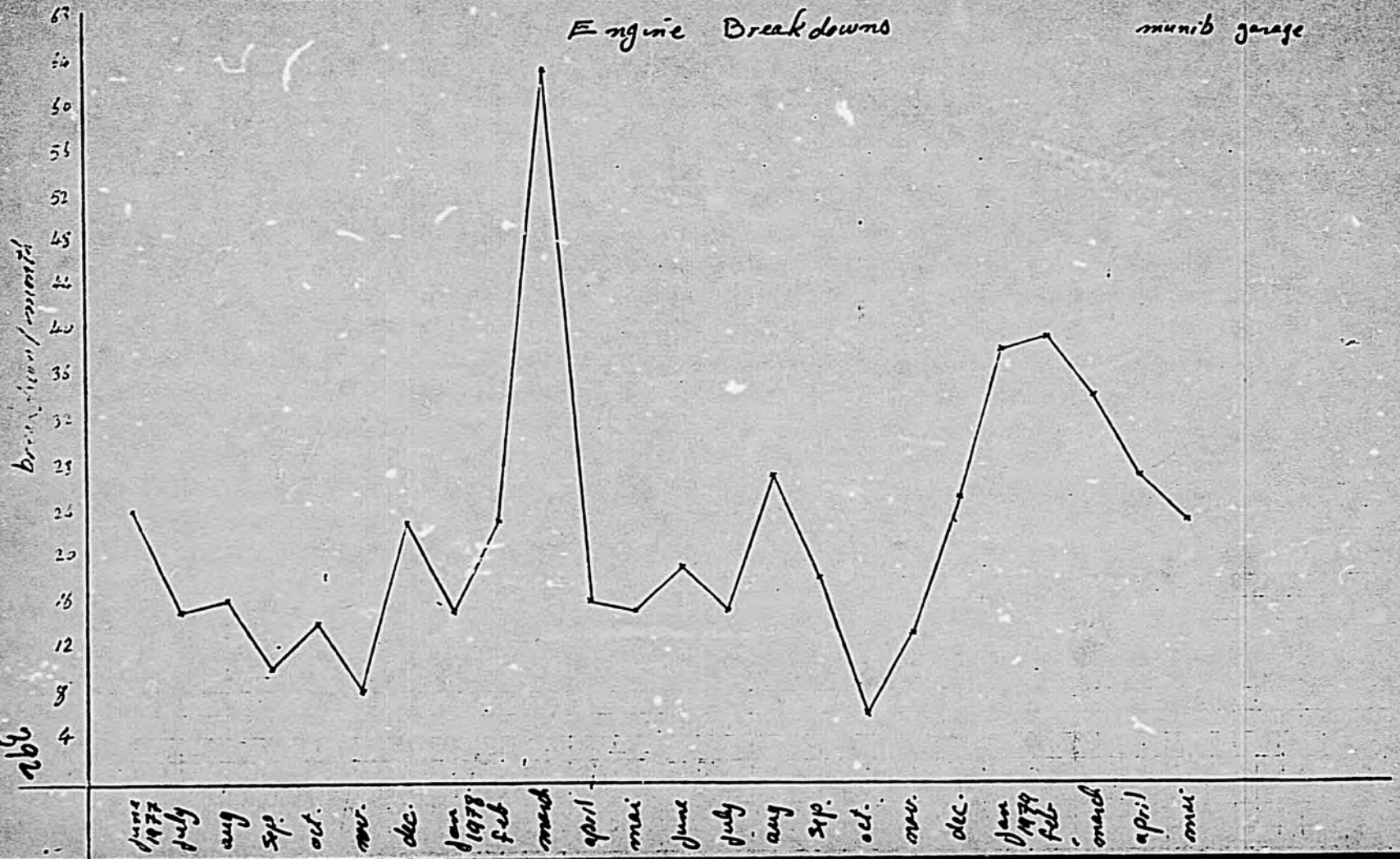
SUBJECT _____ SHEET NO. ____ OF ____
JOB NO. _____
COMP. BY _____ CHECKED BY _____ DATE _____

APPENDIX VII ITEM C

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT _____ SHEET No. ____ OF ____
JOB No. _____
COMPUTED BY _____ CHECKED BY _____ DATE _____

APPENDIX VII ITEM C



FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT ..... SHEET No. ..... OF .....
JOB No. .....
COMPUTED BY ..... CHECKED BY ..... DATE .....

APPENDIX VII ITEM C

June 1977 — mai 78 Technicall efficiency minneeb gange

	service effic			maintenance effic			operation effic			repair of busses in service	
	scheduled no. of busses / month	short of busses in service	effic	scheduled bus operating hours	Lost hours due to tech Causes	effic	scheduled K-m's	running K-m's	effic	total down-time min	D.T / bus min
June 1977	3292	4	99.9%	58126	327	99.4%	1000044	900603	90.1	19620	6
July	3596	96	97.3%	63546	186	99.7%	1080621	944534	87.4	11160	3
aug	3596	177	95.1%	61648	250	99.6%	1050131	931504	88.7	15000	4
Sep	3480	190	94.5%	59750	293	99.5%	1019615	885500	86.8	17580	5
oct.	3802	410	89.2%	65753	338	99.5%	1089914	900094	82.6	20280	6
nov.	3840	381	90.1%	62425	297	99.5%	1064124	908807	85.4	17820	5
dec.	3980	380	91.4	62730	301	99.5%	1114100	961896	85.2	13310	7
jan	3984	315	92.1	66123	480	99.3%	1114126	961920	85.2	13440	8
feb	3587	222	93.8	59549	291	99.5%	1007162	858482	85.2	17460	5
march	3969	252	93.6	65881	336	99.5%	1114004	963136	86.5	20160	5
april	3850	213	94.5	63884	332	99.5%	1080259	964791	89.3	19920	6
mai	3979	98	97.5	65888	244	99.6%	1101662	989189	89.8	14640	4

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT ..... SHEET No. ..... OF .....
JOB No. .....
COMPUTED BY ..... CHECKED BY ..... DATE .....

APPENDIX VII ITEM C

June 77 — mai 78 — Passangers (Riders), Income — munit garage

	Passangers (thousands)						Income						
	Kind of classe		total	%ge to total of C.T.U.	average		Kind of classe		total	%ge to total of C.T.U.	average		
	1 nt	2 nd			1 day	1 running Km's	1 nt	2 nd			1 day	1 Km's million	1 bus in service
June 1977	2592	4687	7279	9.3%	243	8	66029	58073	124102	10.0%	4137	138	38.0
July	2761	4921	7682	9.5%	248	8.1	71003	61388	132391	10.1%	4271	140	38.385
aug.	2717	4725	7442	9.7%	240	7.9	70483	58957	129440	10.3%	4175	139	38.170
Sep.	2558	4373	6931	9.5%	231	7.8	66863	54683	121546	10.1%	405	137	37.670
oct.	2891	2725	5616	7.0%	179	7.9	75623	58336	133959	10.3%	4321	149	39.800
nov.	2775	4454	7229	9.9%	241	7.9	71957	54727	126684	10.4%	4223	139	38.290
dec.	2712	4730	7442	9.7%	239	7.9	66863	54683	121546	10.1%	4050	137	37.668
Jan. 1978	3024	4264	7288	9.6%	235	7.7	77492	50847	128339	10.0%	4140	136	36.950
feb.	2668	4207	6875	9.7%	246	8.0	69187	51750	120937	10.0%	4319	141	38.316
march	3073	4813	7886	9.8%	254	8.2	78886	58991	137877	10.2%	4448	143	38.960
april	2986	4762	7748	9.8%	258	8.0	76326	58382	134702	10.2%	4490	140	37.940
mai	2997	4880	7877	9.9%	254	8.0	75544	59093	134637	10.1%	4343	136	36.554

394

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT ..... SHEET NO ..... OF .....
JOB NO. .....
COMPUTED BY ..... CHECKED BY ..... DATE .....

APPENDIX VII ITEM C

from june 977 — mai 79 Technical Condition of busses monthly mamaeh garage

Mercedes type (Iran)

Condition \ month		june 977	july	aug.	sep.	oct.	nov.	dec.	jan 978	feb.	march	april	mai	june	july	aug.	sep.	oct.	nov.	dec.	jan 979	feb.	march	april	mai
	in service	110	114	115	107	110	117	120	121	123	120	118	125	124	126	128	129	128	127	131	142	148	155	155	155
	maintenance	9	12	12	14	12	19	23	26	22	24	26	21	22	18	19	17	14	19	17	15	15	21	21	22
under repair	in garage	4	11	10	16	19	17	10	6	8	9	8	7	7	9	6	7	11	7	10	11	9	9	9	9
	in general w.shop	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	4	6	7	7	6
	waiting	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	stand-by.	–	–	–	34	16	–	–	–	–	–	–	–	–	–	–	–	–	–	5	1	–	–	–	–
	total	123	137	137	171	157	153	153	153	153	153	153	153	153	153	153	153	153	153	163	173	178	192	192	192

Year	No. of Buses
1976	131
1977	62
	193

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT _____ SHEET No. ___ OF ___
JOB No. _____
COMPUTED BY _____ CHECKED BY _____ DATE _____

APPENDIX VII ITEM C

June 1974 — mai 1979 Workers absence "Drivers" monthly [illegible]

	June 1974	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan. 1975	Feb.	Mar.	April	May
total no. of workers drivers	434	437	433	434	434	436	439	433	438	437	486	481
workers-day	13020	13547	13423	13020	13[illegible]	13080	13609	13423	12264	13547	14530	14911
absence: accident [illegible]	106	107	113	114	158	248	142	53	31	100	10	10
[illegible]	520	305	431	530	734	960	916	644	315	312	267	280
sickness	670	556	637	672	540	569	607	674	680	550	709	832
injury during work	48	28	7	20	35	50	113	89	51	34	114	12
light work	—	—	—	—	—	—	—	—	—	—	—	—
total [illegible]	1336	996	1190	1336	1767	1827	1778	1460	1077	996	1100	1134
[illegible]	3.1	2.8	2.7	3.1	4.1	4.2	4.1	3.4	2.5	2.8	2.3	2.4
[illegible] (workers-day)	10.3	7.3	8.9	10.3	13.1	14.0	13.1	10.9%	8.8%	3.7	7.5	7.6

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT ..... SHEET NO. ..... OF .....
JOB NO. .....
COMPUTED BY ..... CHECKED BY ..... DATE .....

APPENDIX VII ITEM C

[illegible] 1978 — [illegible] 1979 [illegible] Kerr [illegible] Collector [illegible] gauge

	June 1978	July	Aug.	Sept.	[illegible]	[illegible]	[illegible]	[illegible]	Feb.	[illegible]	[illegible]	[illegible]
[illegible]	415	416	468	415	421	432	458	477	498	500	520	502
[illegible]	12450	12896	12648	12450	[illegible]	12960	14198	14787	13944	15500	15600	15582
[illegible]	102	145	102	107	[illegible]	105	135	78	82	80	25	58
[illegible]	740	705	866	749	[illegible]	768	698	518	519	515	563	587
[illegible]	705	703	683	695	[illegible]	728	813	689	597	593	616	337
[illegible]	36	—	12	32	[illegible]	—	36	67	30	40	5	3
[illegible]	—	—	—	—	[illegible]	—	—	—	—	—	—	—
[illegible]	1583	1553	1663	1583	[illegible]	1601	1692	1352	1228	1228	1209	1585
[illegible]	3.8	3.7	4.1	[illegible]	[illegible]	3.7	[illegible]	2.8	2.0	2.1	2.3	3.2
[illegible]	12.7	12.0%	13.1%	[illegible]	12.3	12.3	[illegible]	9.1%	9.0%	8.1%	7.8	10.2

Page 33

397

Best Available Document

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT ..... SHEET NO. ..... OF .....
JOB NO. .....
COMPUTED BY ..... CHECKED BY ..... DATE .....

APPENDIX VII ITEM C

3.

[illegible] 1979 worker absence [illegible] month gauge

	June 1978	July	aug.	sept	oct.	nov.	dec.	jan. 1979	feb.	[illegible]	april	[illegible]
[illegible]	373	374	373	373	371	368	364	361	360	360	360	356
[illegible]	11170	11594	11563	11190	11501	11040	11284	11191	10080	11160	10800	11036
[illegible]	159	60	147	164	229	250	304	282	1	30	2	38
[illegible]	180	232	171	175	155	278	276	242	142	125	135	74
[illegible]	250	478	331	254	443	334	347	406	369	375	436	524
[illegible]	19	14	8	15	13	21	5	6	18	25	14	45
[illegible]	—	—	—	—	—	—	—	—	—	—	—	—
[illegible]	608	784	657	608	855	883	932	882	530	530	587	701
[illegible]	1.6	2.1	1.8	1.6	2.3	2.1	2.6	2.4	1.5	1.5	1.6	2.0
[illegible]	5.3%	[illegible]	5.7%	5.4%	7.4	8.0	8.3	7.9%	5.3%	5.3%	5.4	6.4

Best Available Document

398

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT ..... SHEET NO. ..... OF .....
JOB NO. .....
COMPUTED BY ..... CHECKED BY ..... DATE .....

APPENDIX VII ITEM C

Mercedes - bus

June 77 — mai 78 Various breakdowns monthly Imbaba Garage

	Engine	alternat.	starter	others	Gear box	clutch	steering	propeller shaft	rear axle	leaf spring	brake	tyres	others	total mech.	ave/day	ave/100.000 kms	ave/burday	Downtime/mm
June 77	164	—	—	149	3	x 73	39	—	—	—	x 61	x 210	—	626	21	82	0.2	59
July	185	—	—	146	18	72	58	—	—	—	77	119	—	789	5	31	0.1	66
Aug.	174	—	—	155	18	70	72	—	—	—	79	164	—	822	27	109	2.6	60
Sept	135	—	—	126	3	46	61	—	—	—	62	157	—	657	22	90	0.2	64
Oct.	139	—	—	182	13	50	51	—	—	—	63	121	—	682	22	87	0.2	60
Nov	79	—	—	130	11	58	25	—	—	—	95	123	—	635	21	83	0.2	62
Dec.	150	—	—	120	12	65	20	—	—	—	90	121	—	798	26	97	0.2	64
Jan 78	203	—	—	227	11	77	28	—	—	—	76	187	—	902	29	114	0.3	61
Feb.	156	—	—	118	7	56	11	—	—	—	74	180	—	628	22	88	0.2	61
March	151	—	—	138	10	108	34	—	—	—	94	163	48	800	26	97	0.2	64
April	191	—	—	125	19	83	32	—	—	—	51	131	22	657	23	82	0.2	63
May	250	—	—	106	19	63	30	—	3	—	43	126	30	708	23	78	0.2	58

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT _____ SHEET No. ____ OF ____
JOB No. _____
COMPUTED BY _____ CHECKED BY _____ DATE _____

APPENDIX VII ITEM C

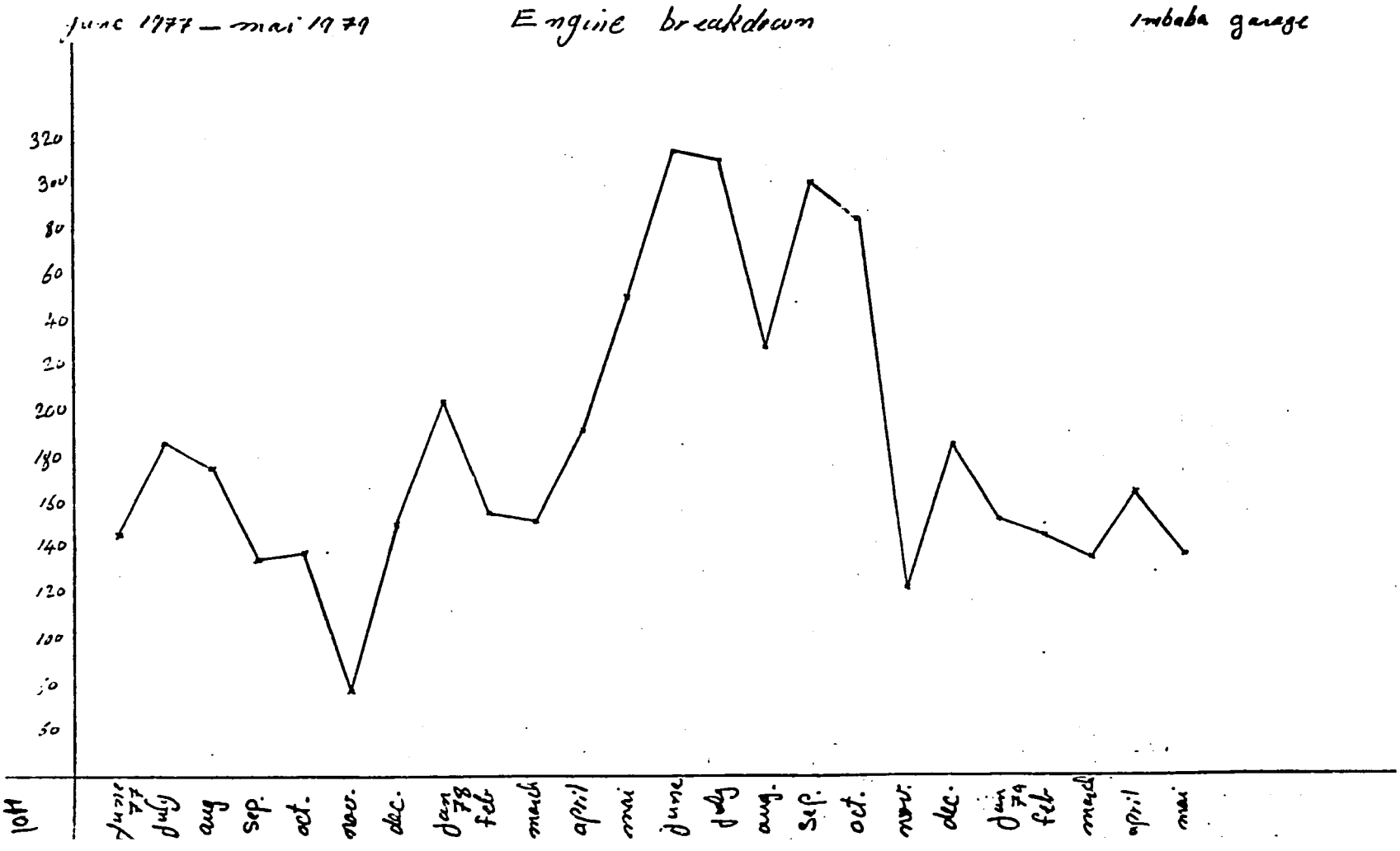
June 73 → mai 79 — Various breakdowns monthly — Imbaba Garage

	Engine	Alternator	Starter	other elec.	Gear box	Clutch	Steering	propeller shaft	Rear axle	leaf spring	brake	tyres	other mech B.D	total mech B.D	average / bus	average / veh, rec	average / bus day	Distance per ...
																		mi
June 78	314	—	—	84	10	77	40	—	—	6	72	117	40	806	27	92	0.2	61
July	311	—	—	137	12	69	71	—	—	—	69	180	51	954	31	109	0.3	61
aug.	228	—	—	114	27	105	55	—	—	—	92	199	34	936	31	106	0.3	61
Sep	302	—	—	168	21	81	54	—	—	—	59	246	65	1066	36	136	0.3	60
Oct	284	—	—	146	8	65	29	—	—	—	82	221	67	984	32	117	0.3	61
[illegible]	121	—	—	80	19	52	42	—	—	—	49	193	44	647	32	85	0.2	65
[illegible]	186	—	—	149	32	74	71	—	—	—	56	220	80	948	31	114	0.3	62
Jan 79	152	—	—	106	8	63	33	—	—	—	66	215	—	385	24	81	0.2	68
feb	145	—	—	162	13	71	56	—	—	—	38	209	—	387	29	93	0.2	73
march	137	—	—	106	5	62	56	—	4	—	91	241	—	459	25	79	0.2	73
[illegible]	154	—	—	52	7	56	47	—	—	—	42	136	—	338	20	62	0.2	73
[illegible] 79	136	—	—	102	6	52	64	—	—	—	54	160	59	645	21	62	0.2	69

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT ..... SHEET No. ..... OF .....
JOB No. .....
COMPUTED BY ..... CHECKED BY ..... DATE .....

APPENDIX VII ITEM C



FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT _____ SHEET NO. ____ OF ____
JOB NO. _____
COMPUTED BY _____ CHECKED BY _____ DATE _____

APPENDIX VII ITEM C

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

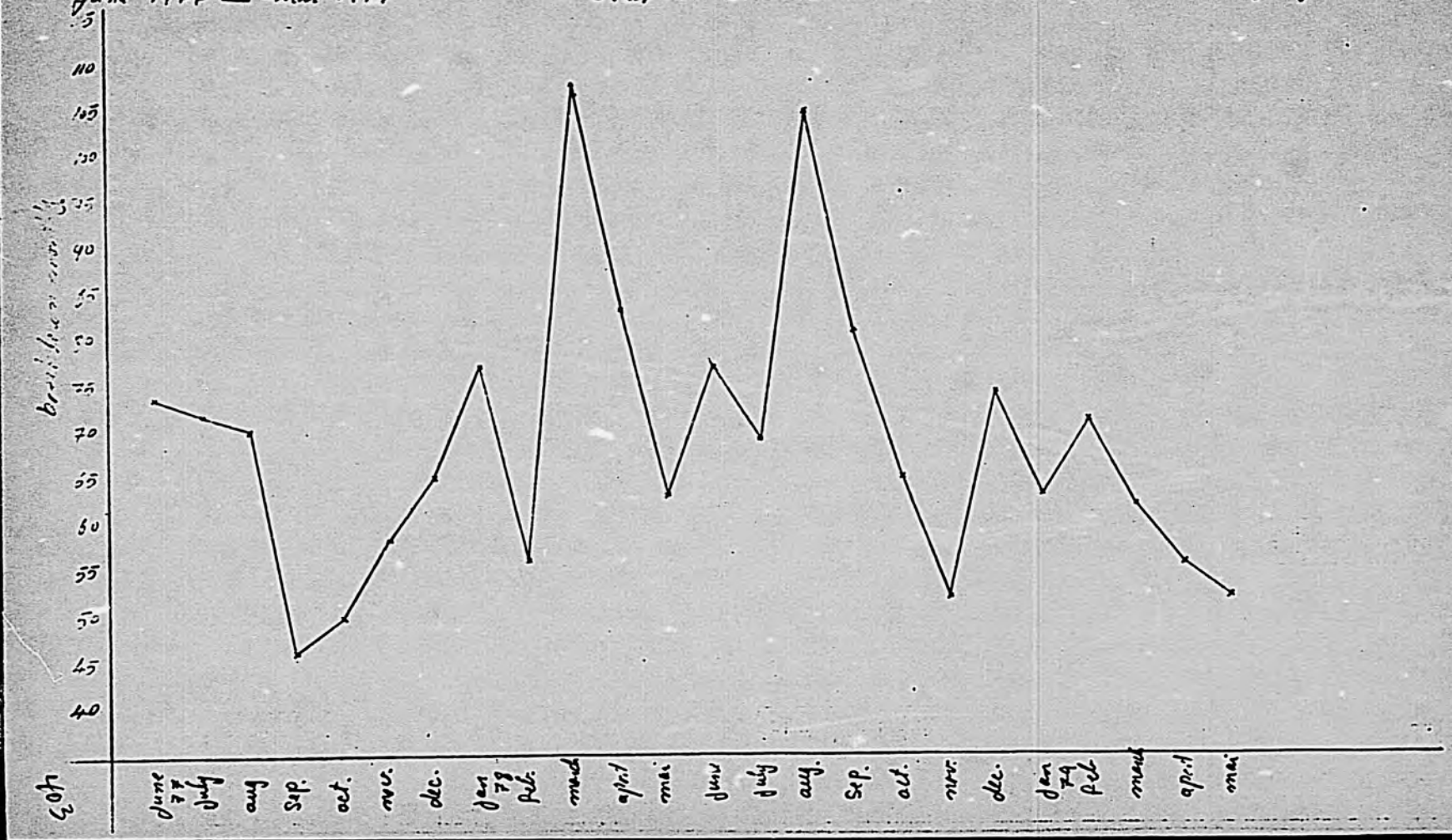
SUBJECT
COMPUTED BY CHECKED BY
SHEET NO. OF
JOB NO.
DATE

APPENDIX VII ITEM C

June 1977 — mai 1979

Clutch breakdown

Imbaba garage

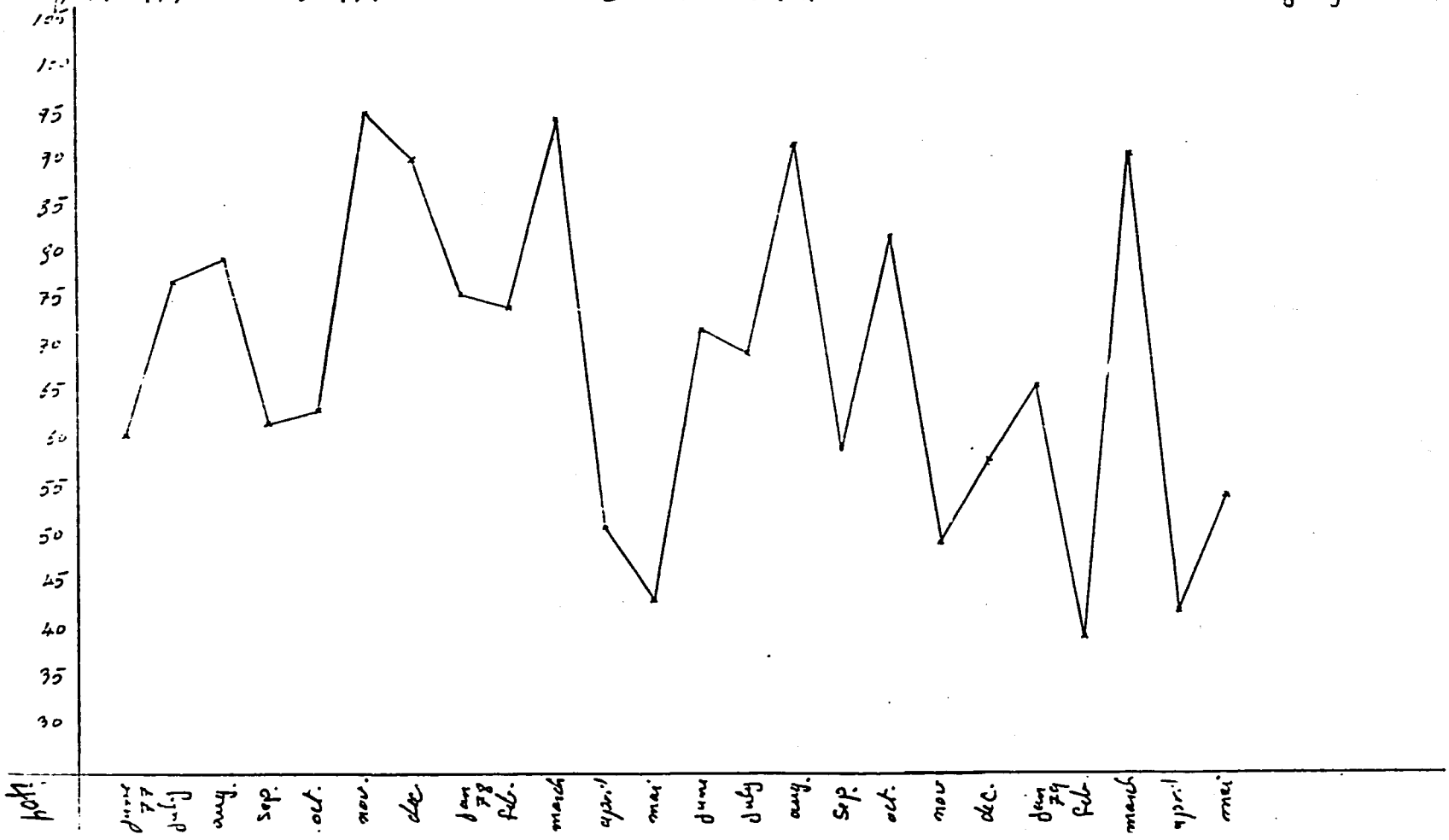


FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT ..... SHEET NO. ..... OF .....
JOB NO. .....
COMPUTED BY ..... CHECKED BY ..... DATE .....

APPENDIX VII ITEM C

June 1977 — mai 1979 Brake break down Embaba gauge



FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT _____ SHEET NO. ____ OF ____
JOB NO. _____
COMPUTED BY _____ CHECKED BY _____ DATE _____

APPENDIX VII ITEM C

June 1977 — mai 1979 Tyre breakdowns Imbaba garage

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT ____ SHEET No. ____ OF ____
JOB No. ____
COMPUTED BY ____ CHECKED BY ____ DATE ____

APPENDIX VII ITEM C

June 1977 — mai 78 Technical efficiency Imbaba Garage

	Service effi			maintenance effi			operation efficiency			repair of busses in service	
	scheduled no of busses / month	short of busses in service	effi	scheduled bus operating hours	Lost hours due to tech Causes	effi	scheduled K.m's	running K.m's	effi	total downtime in min	DT / bus min
June 1977	3210	116	96.4%	57609	612	98.9%	889026	820703	81.8	36720	12
July	3317	158	95.2%	59527	1273	97.8	918660	750057	81.6	48540	15
aug	3317	205	93.8%	58171	829	98.6	897934	706621	78.7	49740	15
Sep.	3110	189	94.1%	56447	704	98.8	870814	684000	78.5	42240	14
oct.	3469	114	96.7%	60578	688	98.9	1258108	964405	76.7	41280	12
nov.	3474	242	93.0	59522	659	98.9	919140	715676	77.9	39540	12
dec.	3470	114	96.7%	60580	690	98.8%	1258200	964450	76.8	41300	12
jan 1978	3603	259	92.8	61783	921	98.5	938840	740336	78.9%	55260	18
feb.	3246	120	96.3	55572	642	98.8	844565	670058	79.3	38520	12
march	3591	90	97.5	61452	847	97.0	934162	749676	80.3	50820	15
april	3486	78	97.8	59653	723	98.8	907149	786821	86.7	43380	13
mai	3603	31	99.1	61571	687	98.9	936628	851819	91.0%	41220	12

406

FREDERIC R. HARRIS, INC. CONSULTING ENGINEERS

SUBJECT ..... SHEET NO. ..... OF .....
JOB NO. .....
COMPUTED BY ..... CHECKED BY ..... DATE .....

APPENDIX VII ITEM C

June 1977 — mai 1978 Passangers (Riders), Income In-bach garage

	Passangers thousands						In Come						
	Kind of classe		total	%ge to total of C.T.A	average		Kind of classe		total	%ge to total of C.T.A.	average		
	1st	2nd			/ day	/ running Km's	1st	2nd			/ day	/ Km's million	/ business service.
June 1977	1733	5817	7550	9.7%	251	10.4	34528	69040	103568	8.3%	3452	144	34.8
July	2543	5258	7801	9.7%	251	10.4	51045	56745	107790	8.2%	3477	144	35.457
aug.	2307	5097	7404	9.6%	239	10.4	46366	56059	102425	8.1%	3304	145	35.790
Sep.	2410	4581	6991	9.7%	233	10.2	47307	49896	97203	8.1%	3240	142	35.180
oct.	2541	5027	7568	9.6%	244	7.8	51584	54594	106178	8.2%	3425	140	36.610
nov.	1776	5238	7014	9.6%	234	9.8	36533	62985	99518	8.2%	3317	139	34.58.
dec.	2306	5114	7410	9.6%	239	10.4	46366	56058	102424	8.1%	3304	145	35.690
jan 1978	2387	4801	7188	9.4%	232	9.7	48541	53033	101574	8.1%	3277	137	33.390
feb.	2302	4370	6672	9.4%	238	9.8	47017	47796	94813	7.9%	3386	141	34.440
march	2668	5009	7677	9.6%	248	10.2	54542	54941	109483	8.1%	3531	146	35.530
april	2429	5405	7834	9.9%	261	9.9	49040	62364	111404	8.4%	3703	142	34.460
mai	2889	5477	8366	10.4%	270	9.8	59095	59741	118836	8.9%	3834	140	33.950

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

Subject ..... Sheet No. ..... By .....
Job No. .....
Computed by ..... Checked by ..... Date .....

APPENDIX VII ITEM C

from june 977 — mai 979 Technical Condition of busses monthly Imibaba garage

Mercedes type (Iran)

Condition \ month		june 977	july	aug.	sep.	oct.	nov.	dec.	jan 978	feb.	march	april	mai	june	july	aug.	sep.	oct.	nov.	dec.	jan 979	feb.	march	april	mai
	in service	103	101	99	102	108	108	110	117	105	109	112	115	112	115	113	114	116	114	117	124	128	134	134	134
	maintenance	13	12	18	15	19	20	18	11	20	15	13	13	15	11	15	16	13	15	18	19	14	21	21	21
under repair	in garage	11	16	12	12	9	13	13	9	11	12	10	7	9	10	9	5	5	6	6	7	7	7	7	7
	in general w.shop	–	–	–	–	–	–	–	4	5	5	6	6	5	5	4	6	7	6	6	6	6	9	9	9
	waiting	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	stand-by	–	–	–	–	–	–		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	total	127	129	129	129	141	141	141	141	141	141	141	141	141	141	141	141	141	141	147	156	160	171	171	171

408

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

Subject: ..... Sheet No. ..... of .....
Job No. .....
Computed by ..... Checked by ..... Date .....

APPENDIX VII ITEM C

June 1978 — mai 1979 Workers absence Arsenal Imbaba garage

	June	July	aug	sep	oct	nov	dec	Jan 1979	Feb	March	April	May
Total no of workers days	397	400	401	394	400	393	395	397	395	420	423	428
worker-day	11910	12400	12431	11826	12400	11793	12245	12307	11060	13020	12690	13268
without payment	150	159	228	223	255	313	198	17	9	7	26	8
without permission	280	284	405	317	351	391	512	579	681	360	371	342
illness	687	669	515	280	375	458	532	511	382	520	504	591
injury during work	80	85	32	89	18	48	75	95	64	140	43	87
[illegible]	—	—	—	60	31	—	—	—	—	—	—	—
total [illegible]	1197	1197	1180	949	1030	1207	1317	1202	1164	1027	987	1028
total [illegible]	3.0	3.0	2.9	2.4	2.6	3.1	3.3	3.0	3.0	2.4	2.3	2.4
% age of total absenteeism	9.3%	9.6%	9.5	8.0%	8.3	10.2	10.8	9.3%	10.5%	7.7	7.8	7.7

Best Available Document

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT ..... SHEET NO. ..... OF .....
JOB NO. .....
COMPUTED BY ..... CHECKED BY ..... DATE .....

APPENDIX VII ITEM C

-2-

June 1978 — mai 1979 Workers rosaire Collectors Imibaba garage

	June 1978	July	aug.	sep.	oct.	nov.	dec.	jan 1979	fev.	mars	april	mai
total no of workers collectors	400	402	412	400	410	405	420	440	440	460	461	462
worker-day	12000	12462	12462	12000	12410	12150	13020	13640	12320	14260	13836	14322
without payment	220	200	191	224	251	235	372	102	102	145	130	159
without permission	450	455	451	400	378	392	477	460	318	450	415	405
illness	800	808	874	868	505	120	674	624	438	670	594	760
injury during work	30	55	53	226	103	539	96	64	44	115	53	49
light work	70	62	—	30	—	57	31	—	—	—	—	—
total for all	1580	1580	1569	1748	1245	1343	1712	1250	928	1380	1192	1373
total / worker	3.8	4.0	3.9	4.4	3.0	3.3	4.1	2.8	2.1	3.0	2.6	3.0
% age to total worker-day	12.4	12.7	12.6%	14.6%	9.8	11.1	13.1	9.2%	7.5%	9.6	8.6	9.6

410

APPENDIX VII ITEM C

Workers absence technicians -3- Imbabah garage

	June 1979	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan. 1979	Feb.	March	April	May
Total [illegible] technicians	325	325	325	322	324	317	313	322	320	324	329	329
worker day	9750	10075	10075	9660	10044	9510	9703	9982	8960	10144	9870	10199
absence: without payment	230	279	324	228	133	297	260	197	171	250	186	243
absence: without permission	387	260	312	379	502	354	202	238	184	150	239	206
absence: illness	160	322	181	168	202	311	207	263	170	450	173	393
absence: injury during work	105	14	23	97	77	61	26	55	63	80	100	96
absence: [illegible] work	—	—	—	—	—	—	—	—	—	—	—	—
total absence	872	875	841	872	919	1023	695	753	602	930	726	932
[illegible] / worker	2.7	2.7	2.6	2.7	2.8	3.2	2.2	2.3	1.9	2.8	2.2	2.3
% total worker day	8.0	8.7%	8.3%	9.0	9.1%	10.8	7.2	7.5%	6.7%	9.1	7.4	9.1

APPENDIX VII
ITEM C

[illegible] of engine failure
and average Km's monthly
in Imbaba garage mercedes
units are overhauled in west-unit shop

	Qua	average Km's	
78	1	10 000	
	2	33500	
	3	10 000	
	1	80 000	
	–	–	
	–	–	
	3	58000	
	2	114000	
79	5	81000	
	–	–	
	9	38000	
	11	52000	
	37	54 000 Km's	

APPENDIX VII
ITEM C

Page 49

Classification of defected engines according to running Km's monthly for "Imbaba Garage"

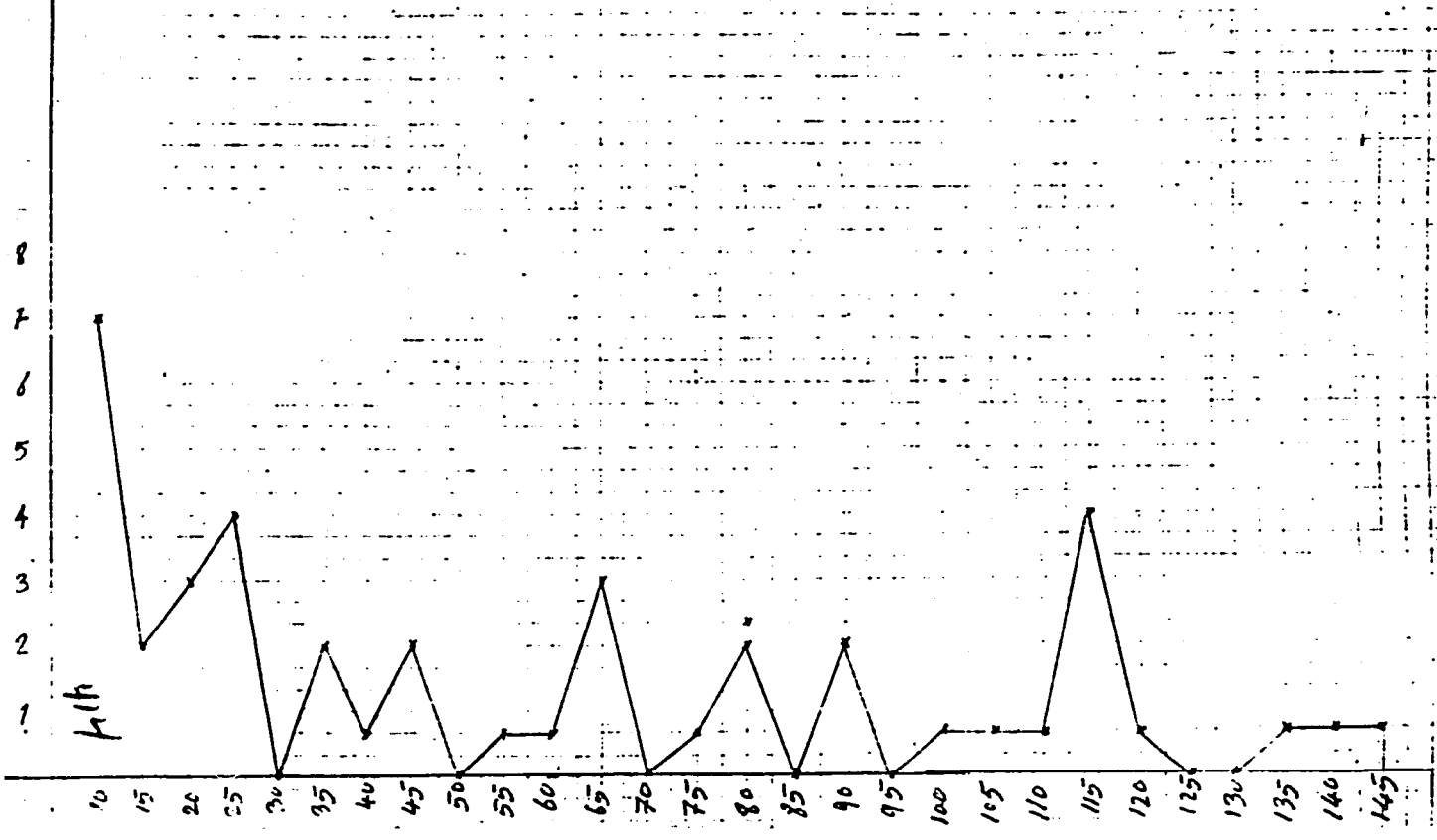
mercedes buses

running km's 1000 / month	upto 9	10—14	15—19	20—24	25—29	30—34	35—39	40—44	45—49	50—54	55—59	60—64	65—69	70—74	75—79	80—84	85—89	90—94	95—99	100—104	105—109	110—114	115—119	120—124	more than 124 000
may 78	–	1	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	
June	1	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	
July	2	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
aug.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	
sep.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
oct	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
nov.	–	–	–	–	–	–	1	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	1	–	
dec	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	1	
jan 79	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	1	–	–	–	–	–	–	1	–	1 136 000
feb	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	2	–	–	–	–	1	–	1 160 000
march	2	1	–	3	–	–	–	1	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1 190 000
april	2	–	1	1	–	1	–	–	–	–	1	–	2	–	1	–	–	–	–	–	–	1	1	–	1 145 000
total	7	2	3	4	–	2	1	2	–	1	1	1	3	–	1	2	–	2	–	1	1	1	4	1	4 — 44

413

APPENDIX VII
ITEM C

Distributing Curve for defected engines
"in Imbaba garage"



APPENDIX XII ITEM C

CONSULTING ENGINEERS — COMPUTED BY ..... CHECKED BY ..... JOB No. ..... DATE .....

NASR GARAGE.

June 78 → mai 79 — Various breakdowns monthly

	Engine	Alternator	Starter	other elect. parts	Gear box	clutch	steering	propeller shaft	Rear axle	Leaf spring	Brakes	tyres	other mech. part	Total mech. breakdown	average / day	average 100,000 km	average / bus day	Down time per month
																		min
June 78	929	—	100	130	430	188	50	149	132	90	615	264	79	4448	148	788	1,7	177
July	990	—	115	149	374	259	75	115	98	85	541	229	1008	4335	140	675	1,5	171
Aug.	731	—	100	110	279	239	50	112	116	70	415	183	916	3621	117	495	1,2	152
Sep.	729	—	85	95	235	153	35	81	73	54	368	184	1155	3457	115	478	1,2	143
oct.	769	—	95	125	282	283	50	50	87	70	415	227	653	3455	111	369	0.9	158
nov.	701	—	85	109	262	263	55	80	62	70	397	171	399	2914	97	302	0.8	153
dec.	802	—	110	145	314	288	70	86	24	85	429	222	413	3345	108	350	0.9	150
Jan 79	556	—	12	174	282	207	60	113	36	80	320	355	187	1640	102	330	0.8	136
feb.	515	118	—	170	214	130	50	121	41	79	217	443	200	1395	102	330	0.8	148
march	568	—	121	130	240	175	50	135	44	76	293	495	200	1702	104	336	0.8	157
april	521	—	120	130	206	144	80	164	30	81	229	526	200	1660	100	301	0.8	149
mai	473	72	—	90	229	142	80	86	30	50	330	489	424	2922	94	280	0.7	157

CONSULTING ENGINEERS

COMPUTED BY ..... CHECKED BY .....

JOB No. .....

DATE .....

APPENDIX VII ITEM C.

June 77 — mai 78 Various breakdowns monthly NASR Garage

	Engine x	alternat	starter	other elect parts	Gearbox x	Clutch x	steering	propeller shaft	rear axle	leaf spring	brake x	tyres x	other mech.	total mech. D.P	avg / day	avg / 100,000 km	avg / month	Downtime / km
June 77	1535	250	—	152	696	348	163	174	240	170	703	421	666	5993	199	804	1,7	189
July	1398	231	—	149	708	486	152	112	132	180	630	562	752	6004	194	764	1,6	199
aug.	1331	141	—	106	666	446	165	101	113	180	631	476	1012	5629	191	858	1,7	186
Sep.	1479	186	—	130	621	402	150	114	130	155	550	266	917	5551	185	841	1.8	186
oct.	1333	167	—	115	654	433	165	115	148	160	603	295	728	5362	173	763	1.5	200
nov.	1331	160	—	120	678	505	170	150	153	184	600	177	760	5676	189	843	1.7	174
dec.	1080	114	—	195	560	370	130	120	101	174	690	150	616	4735	152	667	1.4	169
jan 78	1284	220	—	190	646	450	196	104	120	190	668	147	735	5552	179	798	1.7	158
feb.	1114	115	—	121	542	327	130	101	92	150	639	150	447	4363	156	653	1.4	184
march	1298	—	119	195	570	374	135	110	102	170	674	154	612	4725	152	667	1.4	169
april	994.	—	85	135	418	260	87	94	90	145	446	206	824	4104	137	663	1.4	169
mai 78	975	—	105	122	424	239	80	114	51	130	552	205	1313	4725	152	833	1.8	165

416

CONSULTING ENGINEERS

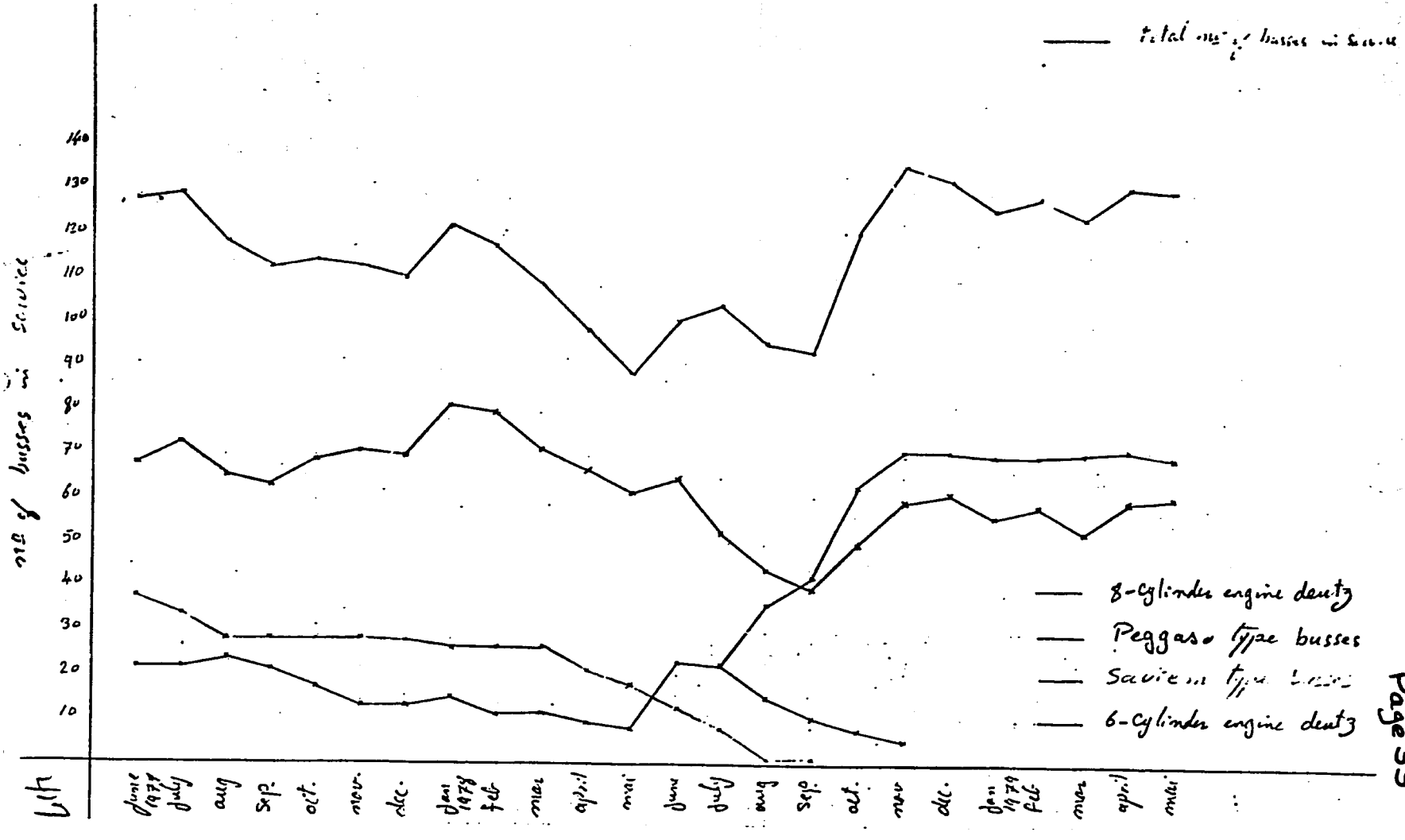
COMPUTED BY _____ CHECKED BY _____

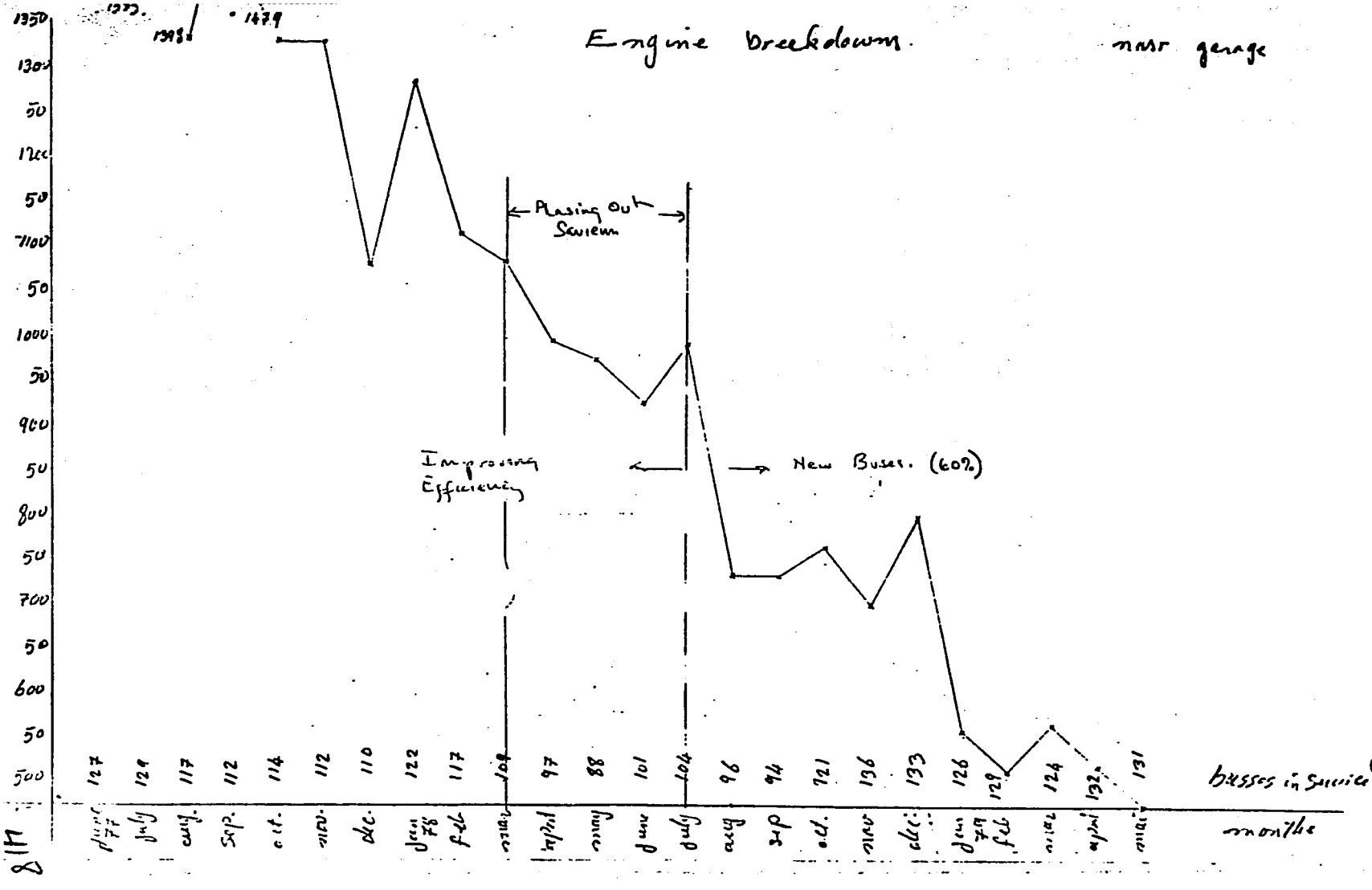
SHEET NO. _____ OF _____

JOB NO. _____

DATE _____

APPENDIX VII ITEM C




Engine breakdown.
miles gauge
1350
1300
1250
1200
1150
1100
1050
1000
950
900
850
800
750
700
650
600
550
500
1479
Phasing out Saviem
Improving Efficiency
New Buses. (60%)
127
129
117
112
114
112
110
122
117
108
97
88
101
104
96
94
121
136
133
126
129
124
132
131
busses in service
months

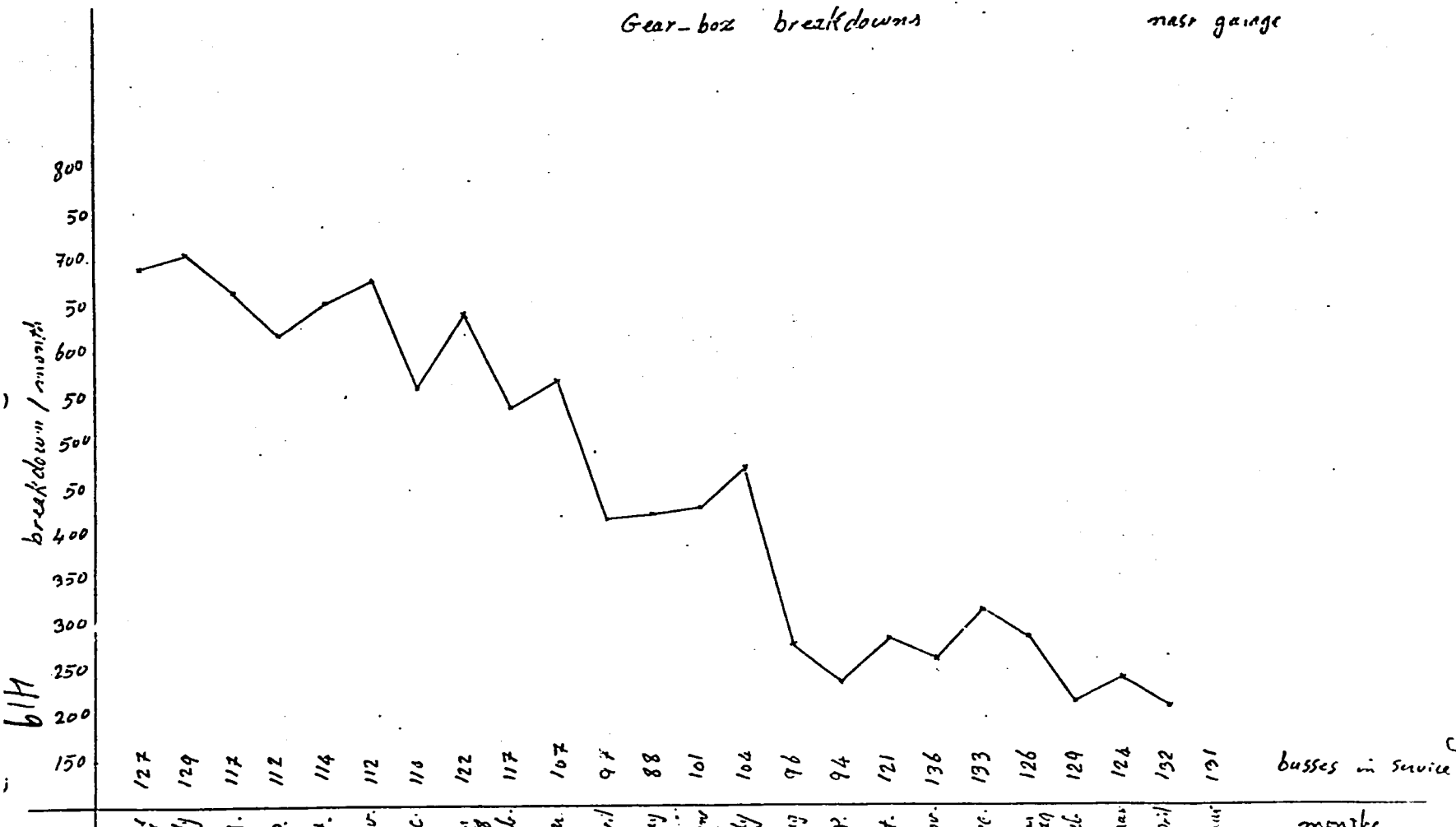
FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT _____ SHEET No. ____ OF ____
JOB No. _____
COMPUTED BY _____ CHECKED BY _____ DATE _____

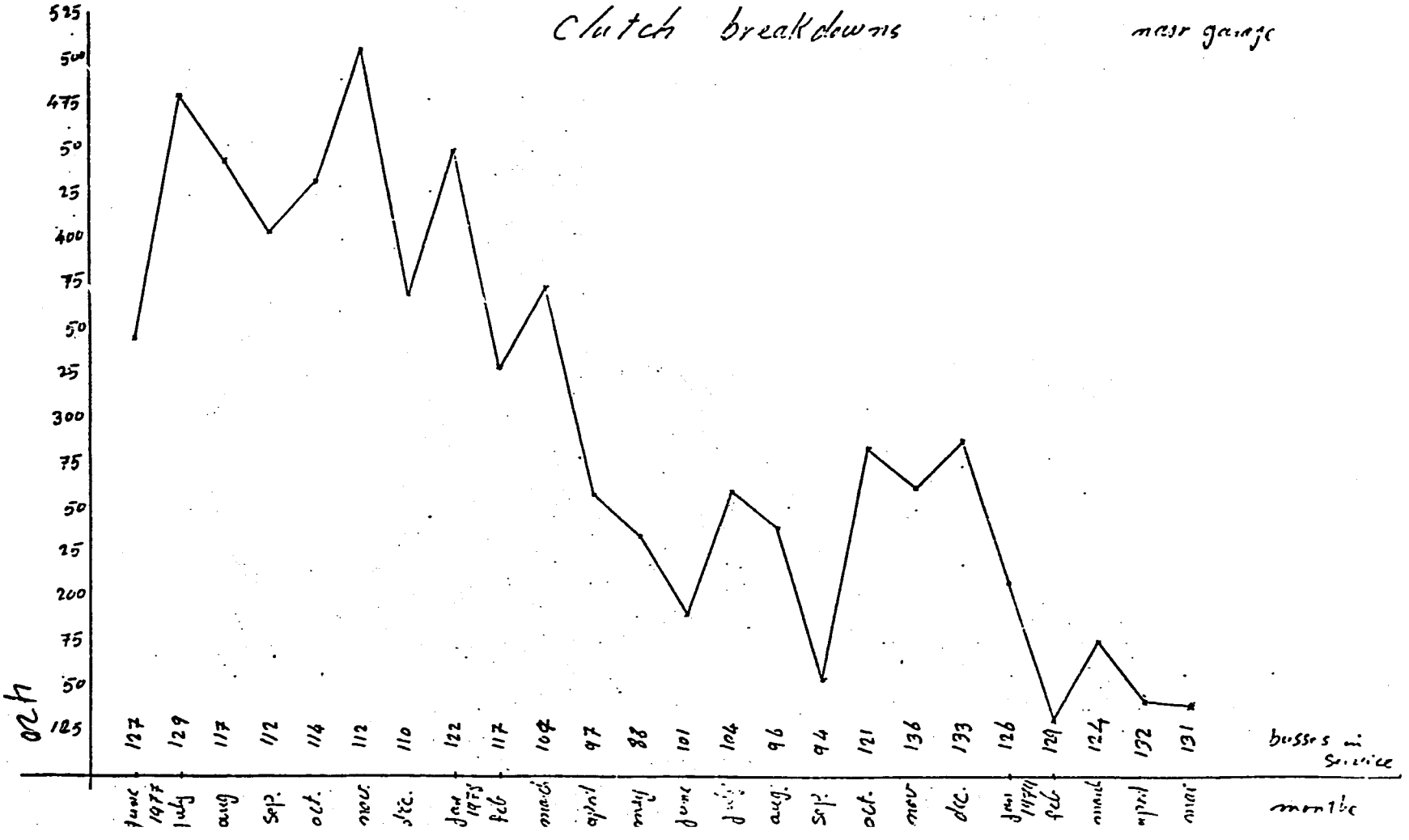
APPENDIX VII ITEM C

Gear-box breakdowns

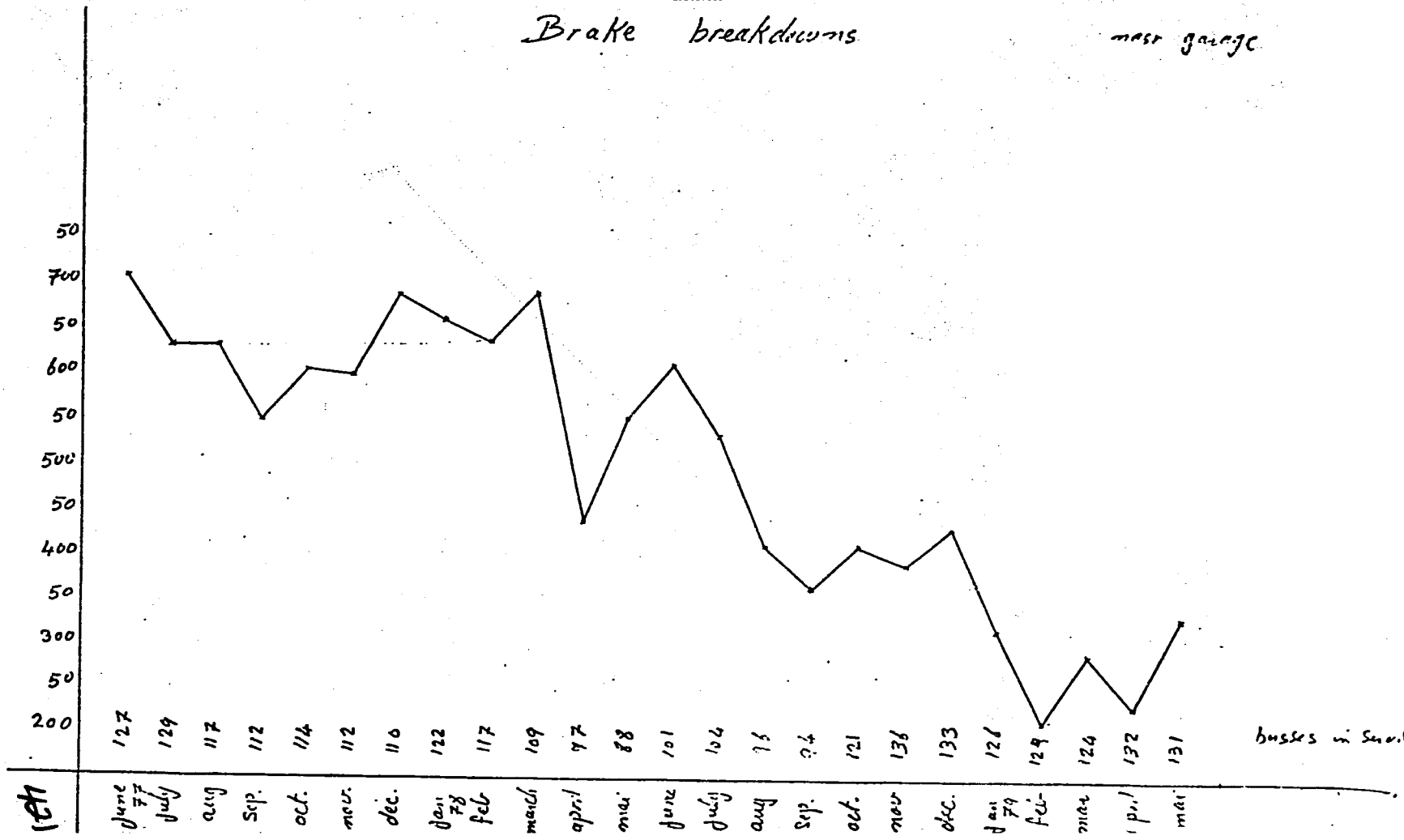
nasr gauge



APPENDIX VII ITEM C



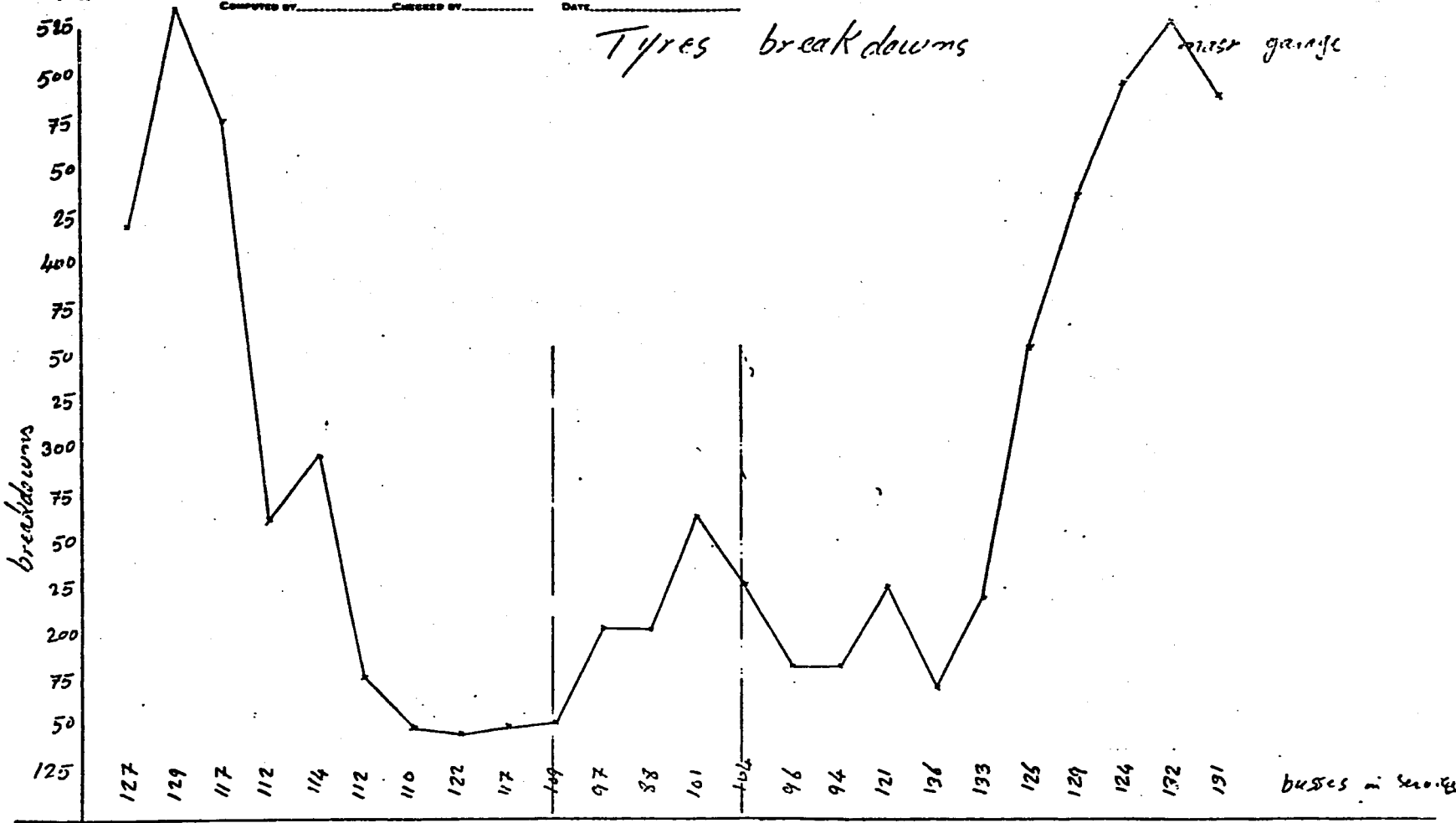
APPENDIX VII ITEM C



FRANCIS R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT _____
COMPUTED BY _____ CHECKED BY _____
SHEET No. ____ OF ____
JOB No. _____
DATE _____

APPENDIX VII ITEM C



FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT _____ SHEET NO. ____ OF ____
JOB NO. _____
COMPUTED BY _____ CHECKED BY _____ DATE _____

APPENDIX VII ITEM C

June 1977 — mai 1978 Technical efficiency NASA Garage

	service effic.			maintenance effic.			operation effic.			Repair of busses in service	
	scheduled nr of busses / month	short of busses in service	effic.	scheduled bus operating hours	Lost hours due to Tech. Causes	effi	scheduled K.m's	running K.m's	effic	total down time in min	D.T per bus min
June 1977	4260	722	83.1%	72016	30979	57%	1285120	690844	53.8	1133700	320
July	4402	661	85%	74475	31222	58.1	1330338	729966	54.9	1193040	319
aug	4254	942	77.9	70261	33058	52.9	1265385	641204	50.7	1103460	333
Sep.	3930	803	79.6	65603	29454	55.1	1179986	613243	52%	1030260	329
oct.	4061	639	84.3	67506	28649	57.8	1216945	651283	53.5	1075380	314
nov.	3930	670	82.6	64323	27162	57.8	1158273	624504	53.9	989940	303
dec.	3730	765	81.2	66209	30054	55%	1178980	613053	52%	1020260	315
Jan 1978	3925	651	83.9	63392	24353	61.6	1138620	646574	56.8	876600	268
feb.	3444	327	90.5	55361	18312	66.9	989209	611298	61.8	806040	259
march.	3813	526	86.2	61294	21886	64.3	1095173	659578	66.2	800220	243
april	3690	739	80	59300	22774	61.6	1059509	615714	58.1	691980	234
mai	3813	1239	67.5	61266	29951	51.1	1094639	528466	48.3	779700	303

423

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT _____ SHEET NO. ____ OF ____
JOB NO. _____
COMPUTED BY _____ CHECKED BY _____ DATE _____

APPENDIX VII ITEM C

June 77 — mai 78 | Passangers, income | Nasr garage

	Passangers (thousands)						in come						
	Kind of classe		total	%age to total for C.T.-77	avarage		Kind of classe		total	%ge to total for C.T.-77	avarage		
	1st	2nd			1 day	1 running Km's	1st	2nd			1 day	1 Km's million	1 busin service pounds
June 1977	2386	2440	4826	6.2%	160	6.9	77603	25669	103272	8.3%	3443	149	41.780
July	2592	2671	5263	6.5%	170	7.2	84516	28191	112707	8.6%	3636	154	43.416
aug	2365	2391	4755	6.1%	154	7.4	77598	25361	102959	8.2%	3321	161	45.640
sep.	2243	2026	4269	5.9%	142	7.0	76358	21593	97951	8.2%	3265	160	45.350
oct.	2477	2273	4750	6.0%	153	7.2	83934	24259	108193	8.3%	3490	166	47.160
nov	2279	2051	4330	5.9%	144	6.9	77595	21908	99503	8.2%	3317	159	45.354
dec.	2427	2273	4700	6.0%	152	7.3	83928	24259	108187	8.3%	3490	166	46.850
Jan. 1978	2377	2185	4562	6.0%	147	7.0	82413	23435	105848	8.3%	3415	164	46.460
feb.	2228	2067	4295	6.0%	153	7.0	76855	22153	99008	8.2%	3536	162	45.920
march	2365	2222	4587	5.7	148	7	81407	24000	105407	7.8	3400	160	45.490
april	2219	2086	4305	5.5	144	6.9	75568	22562	98130	7.4	3271	159	45.260
mai	2050	1984	4034	5.1%	130	7.6	68294	21398	89692	6.7	2893	170	47.990

hth

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT _____ SHEET NO. ____ OF ____
JOB NO. _____
COMPUTED BY _____ CHECKED BY _____ DATE _____

APPENDIX VII ITEM C

from June 1977 — Jan 1978 Technical Condition of busses monthly -1- Nasr garage

	June 1977				July				aug.				sep.				oct.				nov.				dec.				jan 1978			
	old deutze	Saviem	Peugeot	Total	O.D.	S.	P.	Total	O.D.	S.	Peg	Total	O.D.	S.	Peg	Total	O.D.	S.	Peg	total	O.D.	S.	Peg	Total	O.D.	S.	Peg.	Total	O.D.	S.	Peg.	Total
In Service	22	37	68	127	22	34	73	129	24	28	65	117	21	28	63	112	17	28	69	114	13	28	71	112	13	27	70	110	15	26	81	122
maintenance	4	2	4	10	4	1	4	9	4	—	6	10	3	—	4	7	3	1	4	8	3	1	4	8	3	2	5	10	1	2	6	9
Under repair: in garage	3	6	11	20	4	6	10	20	3	2	9	14	2	4	11	17	3	3	10	16	3	4	10	17	3	4	10	17	2	4	8	14
in general shop	—	—	5	5	—	—	8	8	—	—	14	14	6	—	12	18	—	—	7	7	—	—	6	6	—	—	8	8	—	—	12	12
waiting	42	7	22	71	43	8	15	76	42	12	16	70	48	8	20	76	48	2	20	70	39	—	19	58	39	—	17	56	19	—	13	32
Scrape	2	14	1	17	3	17	1	21	3	24	1	28	3	26	1	36	3	32	1	36	3	32	1	36	3	32	1	36	3	31	1	35
Total	73	66	111	250	76	66	111	253	77	55	111	254	77	66	111	254	74	66	111	251	60	65	111	236	66	65	111	236	35	63	121	229

old deutze means 6-cylinder engine deutze

Saviem 1961
6-cyl deutz 1969 – 1972

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT _____ SHEET No. ____ OF ____
JOB No. _____
COMPUTED BY _____ CHECKED BY _____ DATE _____

APPENDIX VII ITEM C

from feb 1978 — Sep. 1978 Technical Condition of busses monthly -2- Nasr Garage

	feb-1978				march				april				mai				june				july				aug.				sep. 1978			
	6-Cyl diesel	Savirem	Peggau	Total	6-Cy D	Sav	Peg	Total	6-Cy D	Sav	Peg	Total	6-Cy D	Sav	Peg	Total	6-Cy D	Sav	Peg	Total	6-Cy D	Sav.	Peg	8-Cy diesel	6-Cy D	Sav.	Peg	8-Cy diesel	6CyD	Sav.	Peg.	8Cy diesel
In Service	11	26	80	117	11	26	72	109	9	21	67	97	8	18	62	88	23	13	65	101	22	7	53	22	15	1	44	36	10	1	40	43
																						total		104								
maintenance	3	2	6	11	—	—	5	5	1	1	6	8	7	1	4	12	2	—	—	2	3	—	3	2	3	—	4	3	3	—	4	3
																							total	9								
under repair: in garage	2	3	7	12	2	3	9	14	2	7	10	19	2	9	12	23	5	13	9	27	4	1	12	2	1	—	8	—	3	—	8	—
																								19								
in general w-shop	—	—	10	10	—	—	11	11	—	—	8	8	—	—	7	7	—	—	5	5	—	—	11	—	—	—	19	—	—	—	22	—
																								11								
waiting	16	—	17	33	17	—	23	40	18	—	29	47	21	1	35	57	25	—	41	66	26	8	39	—	30	—	45	—	39	—	45	1
Scrape	3	32	1	36	3	33	1	37	3	22	1	26	3	21	1	25	5	12	1	18	—	—	—	—	—	—	—	—	—	—	—	—
Total	35	63	121	219	33	62	121	216	33	51	121	205	41	50	121	~~212~~ 212	60	38	121	219	55	16	120	26	47	1	120	39	55	1	120	47
																						total		217	209				213			

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

Subject ..... Sheet No. ..... of .....
Computed by ..... Checked by ..... Job No. ..... Date .....

APPENDIX VII ITEM C

June 1973 – mid 1974 Workers [illegible] "Drivers" [illegible] gauge

	June 1973	July	Aug.	Sep	Oct.	[illegible]	Dec.	Jan 1974	Feb	[illegible]	Apr 1	[illegible]
[illegible] of workers (Drivers)	351	360	[illegible]	[illegible]	[illegible]	354	351	353	354	358	398	[illegible]
worker - day	10 500	11160	[illegible]	[illegible]	[illegible]	[illegible]	10881	10943	9912	[illegible]	[illegible]	[illegible]
without payment	160	75	57	135	[illegible]	[illegible]	175	125	119	105	152	169
without [illegible]	503	671	639	[illegible]	[illegible]	[illegible]	[illegible]	352	359	[illegible]	[illegible]	[illegible]
illness	420	743	520	475	[illegible]	421	427	553	474	410	[illegible]	[illegible]
injury during work	44	23	55	[illegible]	[illegible]	37	14	36	18	25	[illegible]	[illegible]
Light work	354	90	73	[illegible]	[illegible]	[illegible]	465	372	336	336	330	[illegible]
Total for all	1491	1602	1364	[illegible]	1551	1491	1491	1438	1325	1325	1277	[illegible]
[illegible] worker	4.2	4.5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4.1	3.7	3.9	[illegible]	[illegible]
[illegible] total worker-day	13.9%	14.3%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	13.1%	13.4%	13.5%	[illegible]	[illegible]

Best Available Document

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT ..... SHEET No. ..... OF .....
JOB No. .....
COMPUTED BY ..... CHECKED BY ..... DATE .....

APPENDIX VII ITEM C

June 1978 — mai 1979 Workers absence 'Collectors' 2 nasr garage

		june 1978	july	aug.	sep.	oct.	nov.	dec.	jan 1979	fev	march	april	mai
total nº of workers Collectors		390	393	393	391	431	431	436	431	438	435	428	423
work'er. day		11700	12183	12183	11730	12431	12930	13516	13361	12264	13485	12840	13113
absence	without payment	105	123	119	117	22	76	171	72	39	160	52	60
	without permission	625	614	336	631	5[illegible]	425	651	628	598	640	645	671
accident	illness	680	776	735	688	547	551	753	630	604	740	480	493
	injury during work	56	49	67	48	29	61	23	7	14	41	65	46
	Light work	617	434	420	600	–	510	531	620	560	611	600	620
total for all		2084	1996	1677	2084	1215	1773	2192	1909	1815	2172	1842	1[illegible]
total [illegible]		5.2	5	4.3	5.3	3.0	4.1	5.0	4.6	4.1	5.0	4.3	[illegible]
% age to total [illegible] day		17.7%	16.4%	13.8	17.8	9.8	13.7	14.2	14.7%	14.8%	16.1%	14.3	[illegible]

428

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT ..... SHEET No. ..... OF .....
JOB No. .....
COMPUTED BY ..... CHECKED BY ..... DATE .....

APPENDIX VII ITEM C

June 1979 — mai 1979 Workers absence "technicians" 3 [illegible]

		June 1978	July	aug.	sept.	oct.	[illegible]	dec.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	total nr of workers (technicians)	433	447	443	410	437	432	433	428	424	420	419	413
	worker-day	13423	13257	13733	12300	13547	12960	13423	13268	11872	13020	12570	12803
voluntary absence	without payment	410	184	75	157	305	297	415	51	56	100	196	235
	without permission	353	513	8	789	601	419	348	260	344	326	287	482
involuntary absence	illness	460	[illegible]	587	527	572	425	462	347	352	341	309	395
	injury during work	51	117	96	66	45	38	49	128	51	46	120	97
	legal work	186	[illegible]	101	180	[illegible]	150	186	132	112	118	83	—
	total for all	1460	1556	1717	1749	1722	1399	1460	949	956	925	1008	1149
	total / [illegible]	3.4	[illegible]	3.9	4.3	3.9	3.1	[illegible]	[illegible]	2.3	2.1	[illegible]	2.8
	% age of total (worker-day)	10.87%	[illegible]	12.5	14.2%	12.=	10.3	[illegible]	[illegible]	8.1%	7.2	[illegible]	[illegible]

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT _____ SHEET No. ____ OF ____
JOB No. _____
COMPUTED BY _____ CHECKED BY _____ DATE _____

APPENDIX VII ITEM C

oct 978 — mai 979 Technical Condition of busses in city -3- main garage

	oct. 978				nov.				dec.				jan 979				feb.				march				april				mai 79			
	6 cy diesels	8 cy diesels	Peggy	total	6 cy diesels	8 cy diesels	Peggy	total	6 cy diesels	8 cy diesels	Peggy	total	6 cy diesels	8 cy diesels	Peggy	total	6 cy diesel	8 cy diesel	Peggy	Totals	8 cy diesels	Peggy	Savium	total	8 cy diesels	Peggy	Savium	total	8 cy diesels	Peggy	Savium	total
in service	8	63	50	121	5	71	60	136	–	71	62	133	–	70	56	126	–	70	59	129	71	53	–	124	72	60	–	132	70	61	–	131
maintenance	4	4	4	12	3	5	4	12	3	5	4	12	5	6	6	17	7	5	5	17	7	4	–	11	7	11	–	18	7	10	–	17
under repair: in garage	1	2	7	16	–	1	8	9	–	1	10	11	–	1	15	16	–	2	17	18	3	20	1	24	2	15	1	18	4	9	1	14
under repair: in general shop	–	–	15	15	1	–	5	6	–	–	9	9	3	–	11	14	–	–	7	7	–	7	–	7	–	5	–	5	–	7	–	7
under repair: waiting	39	–	41	80	43	–	40	83	5	–	32	37	–	–	29	29	–	–	29	29	–	29	–	29	–	26	–	26	–	30	–	30
scrape	–		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
total	52	69	117	238	52	77	117	236	8	77	117	202	8	77	117	202	7	77	117	201	71	117	1	199	71	112	1	199	71	112	1	199

APPENDIX VII
ITEM C

Rate of engine failure in "Nasr Garage"

Peggeao

Period from mai 78 – apr. 79

	Nasr workshop		Ameria workshop		East unit shop		Total	
	Qua	average km	Qu.	ava km	Qua	aver km	Qua	aver km
Mai 78	13	41,000	2	13500	17	19 000	32	29000
june	11	31700	1	25000	6	25000	18	29000
july	6	41000	1	10 000	12	28500	19	31400
aug	10	34 000	2	16 500	15	20400	27	25000
sep.	18	33400	2	30 000	12	38750	32	35000
oct	8	28000	—	—	—	—	8	28000
nov.	11	23.800	8	27500	11	30800	30	27300
dec	7	17 000	—	—	11	13600	18	14900
Jan 79	8	34 000	—	—	17	16000	25	21750
feb	4	41 000	—	—	16	18000	20	23600
march	6	24 000	1	55 000	16	25000	23	26000
april	3	54000	—	—	9	25000	12	32000
431	average 33575 Km's		average 25357 Km's		average 23638 Km's		264	average running Km's 26900 Km's

N: west workshop
A: annex workshop
E: east unit shop

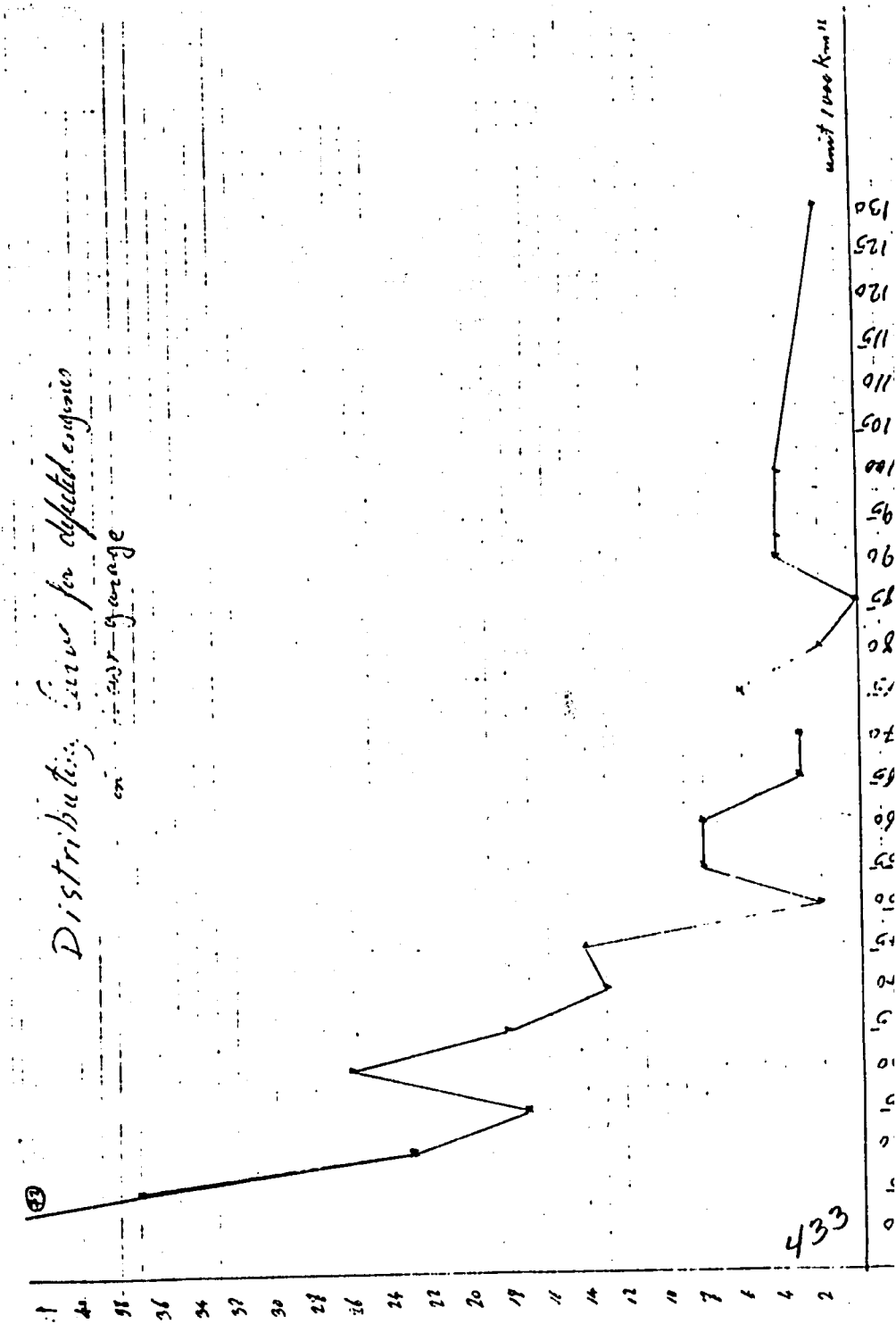
Classification of defected engines due to running K.ms monthly
— NASR GARAGE

unit 1000 km	up to 9			10–14			15–19			20–24			25–29			30–34			35–39			40–44			45–49			50–54			55–59			60–64			65–69			70–74			75–79			80–84		
	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E	N	A	E
Mai 78	4	–	5	2	5	3	1	–	–	–	–	–	–	–	2	1	–	2	–	–	2	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
june	3	–	2	–	–	1	2	–	–	–	1	–	–	–	1	–	–	1	3	–	–	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	1
july	1	1	2	–	–	–	1	–	2	–	–	–	–	–	1	1	–	4	–	–	1	–	–	–	1	–	–	–	–	–	1	–	–	–	–	1	–	–	–	–	–	1	–	–	–	–	–	–	–	1
aug	2	–	5	3	1	2	–	1	–	–	–	3	2	–	1	–	–	–	1	–	1	–	–	2	–	–	–	–	–	–	1	–	–	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–	1
sep.	10	1	3	–	–	1	–	–	1	–	–	–	1	–	–	–	–	1	1	–	–	1	–	2	–	–	–	2	1	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	1	–	–	–	3
oct.	–	–	–	1	–	–	2	–	–	–	–	–	3	–	–	–	–	–	1	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
nov.	2	1	2	–	1	2	2	1	1	4	–	1	–	2	–	2	–	–	–	–	–	–	–	2	–	–	–	–	1	1	–	–	–	–	1	–	1	–	–	1	–	2	–	–	–	–	–	–	–	–
dec.	3		5	2	3	1	–	1	3	–	–	2	–	–	–	2	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
jan 79	–	–	6	1	–	1	–	–	2	1	–	3	2	–	5	–	–	1	–	–	–	2	–	–	–	–	1	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
feb	1	–	3	–	–	6	–	–	1	–	1	–	–	–	2	–	–	3	–	–	1	1	–	–	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
march	–	–	8	3	–	1	1	–	–	–	–	–	1	–	3	–	–	–	–	–	–	–	–	2	–	–	–	–	–	1	1	1	–	–	–	–	–	–	–	1	–	1	–	–	–	–	–	–	–	–
april	–	–	2	–	–	–	–	–	1	–	–	1	–	–	2	–	–	–	1	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	1	–	–	1	–	1	–	–	–	–	–	–	–	–
	26	3	43	12	8	17	9	3	11	5	2	10	9	2	15	6	–	12	7	–	6	6	–	3	1	–	1	4	2	2	6	1	1	–	1	2	2	–	1	3	–	5	0	–	2	–	–	–	–
	72			37			29			17			26			18			13			14			2			8			8			3			3			6			2			–			

total 264 average 22 mg

APPENDIX VII
ITEM C

APPENDIX VII
ITEM C



APPENDIX VII - ITEM [illegible]

PHYSICAL FACILITIES

Total area of the garage	[illegible]044	60678	34153
Floor area of building	1[illegible]667	18955	15029
Working area	27377	41723	19124
/bus	142.98m^2	243.94m^2	141.65m^2

Date of buses in service

	1975	1976	1977	Total
Muneib	-	131	62	193
Imbaba	127	2	42	171
Ather El Nabi	105	-	30	135

BUS OPERATIONS

Average running kms /bus in service

	Muneib	Imbaba	Ather El Nabi
January	1,053,170/142 7416.69	879,314/124 7091.24	814,109/96 8480.30
February	920,195/148 6217.53	808,643/128 6317.52	722,678/99 7299.77
March	1,052,890/155 6792.83	879,610/134 6564.25	813,980/105 7752.19
April	1,128,468/155 7280.43	928,240/134 6927.16	818,673/106 7723.33
May	1,192,458/155 7693.27	978,198/134 7299.98	877,241/106 8275.93

The above shows that buses in the service of Ather El Nabi garage ran a total number of km/bus more than the other two garages.

If we take the running kms in May as an example -

	No. of buses in service	Running kms/bus
Muneib	155	7693
Imbaba	134	7300
Ather El Nabi	106	8276

If one were to equalize running kms per bus, then Ather El Nabi should have 114 buses - From that one can conclude that the garage is overloaded by 7.5%.

434

TECHNICAL WORKERS

Total No. of Technicians

	Muneib	Imbaba	Ather El Nabi
Mechanics	153	145	11[illegible]
Total No. of buses	192	171	135
Mech/bus	0.796	0.847	0.85[illegible]

Percentage of workers absent

	Muneib	Imbaba	Ather El Nabi
January	7.9	7.5	7.7
February	5.3	6.7	7.5
March	5.3	9.1	7.7
April	5.4	7.4	7.3
May	6.4	9.1	7.7
Mean value	6.06	7.96	7.58

Qualification of manpower/bus (all mechanics)

Garage	Foreman	Work Leader	Highly Skilled	Very Skilled	Skilled	Semi-Skilled
Muneib-total	4	6	12	30	56	35
Mechs/bus	0.0208	0.0312	0.0625	0.1562	0.2916	0.1822
Imbaba-total	4	3	7	8	62	61
Mechs/bus	0.0233	0.0175	0.0409	0.0467	0.3625	0.3567
Ather-El-Nabi-total	1	1	5	18	53	33
Mechs/bus	0.0074	0.0074	0.0370	0.1333	0.3925	0.2814

The leaders of the Ather-El-Nabi garage are fewer than the other two garages. (Those who have to control the work, inspect and give orders).

Supervising Workers/Bus

Garage	Foreman	Work Leader	Highly Skilled	Total	Total/Bus
Muneib	4	6	12	22	0.114
Imbaba	4	3	7	14	0.081
Ather-El Nabi	1	1	5	7	0.051

There are twice as many supervisory personnel at Muneib garage than at Athar-El-Nabi. It is recommended that for maintaining more than 100 buses in 3 shifts, the following is the minimum number of supervisory personnel required;

435

	Foreman	Work Leader	Highly Skilled
1st shift	2		
Periodic maintenance repair		3	4
2nd shift		1	1
3rd shift	1	2	2
Total	3	6	7

436

APPENDIX VIII

A BUS DESIGNED WITH EGYPT IN MIND

APPENDIX VIII

A BUS DESIGNED WITH EGYPT IN MIND

A look at any of the buses presently in operation on the heavier, multi-stop routes anywhere in Egypt is enough to convince that they are not sufficient to their task. For this reason, the attached designs (Figures 1 & 2) are submitted for consideration - some or all of the features might well be the basis for specifications of future buses.

A. City Bus: (Figure 1) The present city buses have two doors - one in the front, and the one in the rear. They normally have double forward facing seats on either side of a narrow aisle. A conductor sits near the rear door, collecting fares from passengers boarding through that door. Exit is probably supposed to occur at the front door, but as a matter of fact, both doors are used for this purpose.

The combination of narrow doors, narrow aisles, conductor near the loading door, and extremely heavy loads makes for a very slow boarding and alighting process and slows the overall service considerably. It also makes for a very uncomfortable ride, and it is very difficult for anyone to board or alight. This type of arrangement is all right on the lesser patronised routes found in most cities, but certainly not for Cairo and most Alexandria routes. The design suggested in Figure 1 is an attempt to alleviate some of the more obvious problems while maintaining the basic features of the service.

All public transport buses in the public sector in Egypt have conductors, so a conductor was 'designed in' to the proposed bus. However, his station has been moved to the center of the bus, facing a wide opening which is the only place passengers can board.

They can pass on either side of the conductor, through turnstiles, paying their fare as they enter. The turnstiles are for the purpose of registering the number of passengers thus ensuring that the conductor turns in all fares, and giving an accurate passenger count.

The steps in front of the conductor are quite wide, and can accomodate a large number of boarding passengers.

The bus interior (which is based on the standard 12 meter x 2.7 meter body) is equipped with 38 seats - all but four of which are longitudinal. This allows maximum room for circulation and accomodates very large loads with reasonable comfort. There is also a double row of stanchions to ensure every standee a good handhold. These stanchions would support grab rails a reasonable height above passenger heads.

The driver and conductor both sit in enclosed cubicles. The conductor has a standard ticket booth type glass partition on either side through which he conducts his business, while the driver is completely enclosed so that he can devote his full attention to safe driving - starting the bus on signal from the conductor.

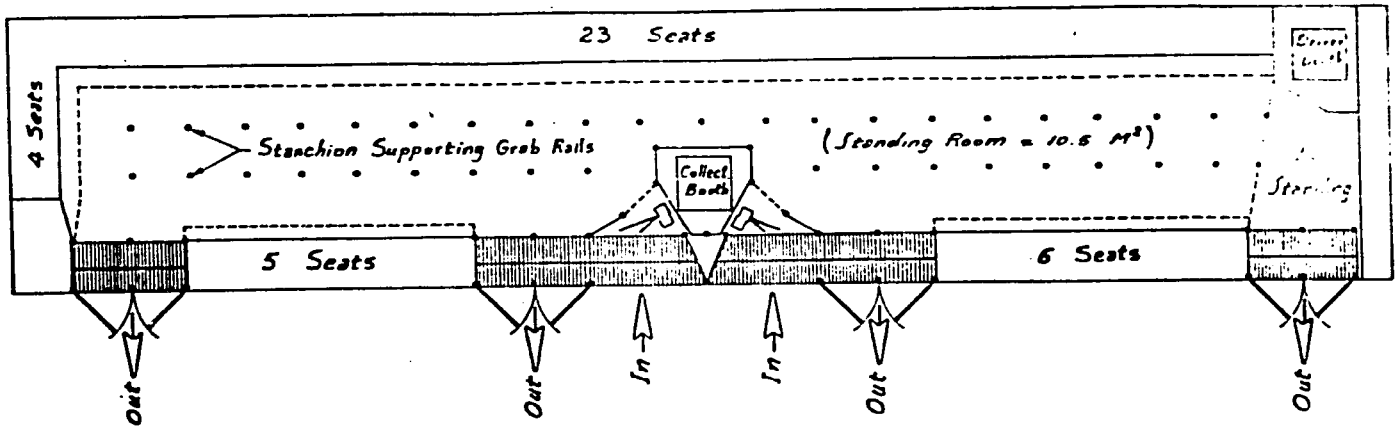
There are four double exit doors - one each in front and rear, and one on either side of the entrance platform. This multiplicity of exit allows for rapid discharging at heavy center city stops, and keeps passenger congestion to a minimum - there is a door convenient to all areas of the bus. Doors are of the "push" type. The conductor would control their operation with a switch in his compartment, unlocking them only after the bus had come to a complete stop. Once unlocked, passengers push them to open, and they slowly swing closed when released. In the U.S. this type of push door usually has a brake interlock as well, which makes it impossible to move the bus when doors are not locked. It was thoughtthat such an arrangement might not be practiced in Egypt.

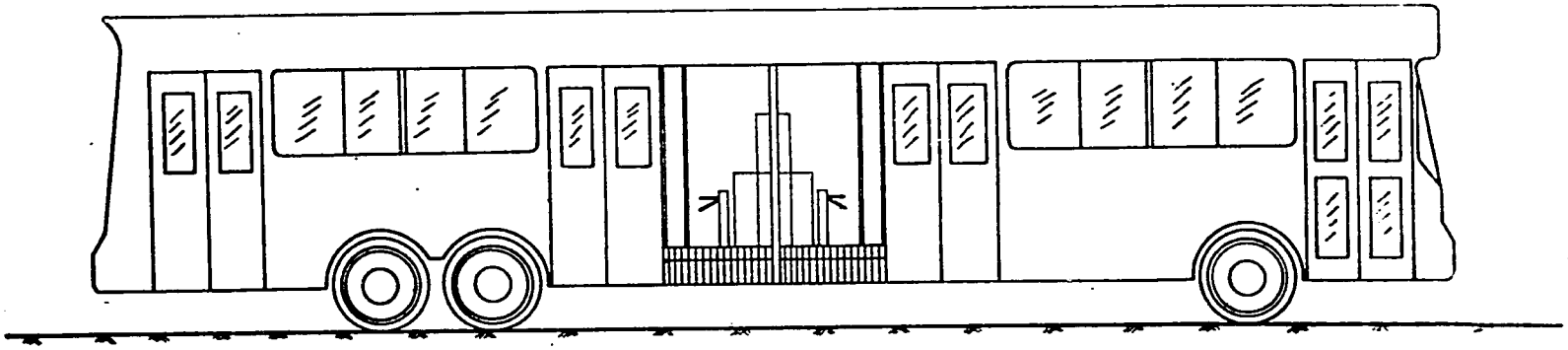
B. Country Bus (Figure 2). The present country bus is much like the city bus, except that it generally has slightly more comfortable seats, and has doors that are passenger operated.

The proposed bus has the same body and chassis as the city bus, with a few modifications. First, the seats are all forward facing to provide more comfort for longer trips, but the aisles are made wider than an existing basis through providing 2 and 1 seating, versus the present 2 and 2. Only two exit doors are provided (push doors) with the rear door being eliminated and the front door opening into a baggage

compartment alongside the driver. Passengers would not be permitted in this area.

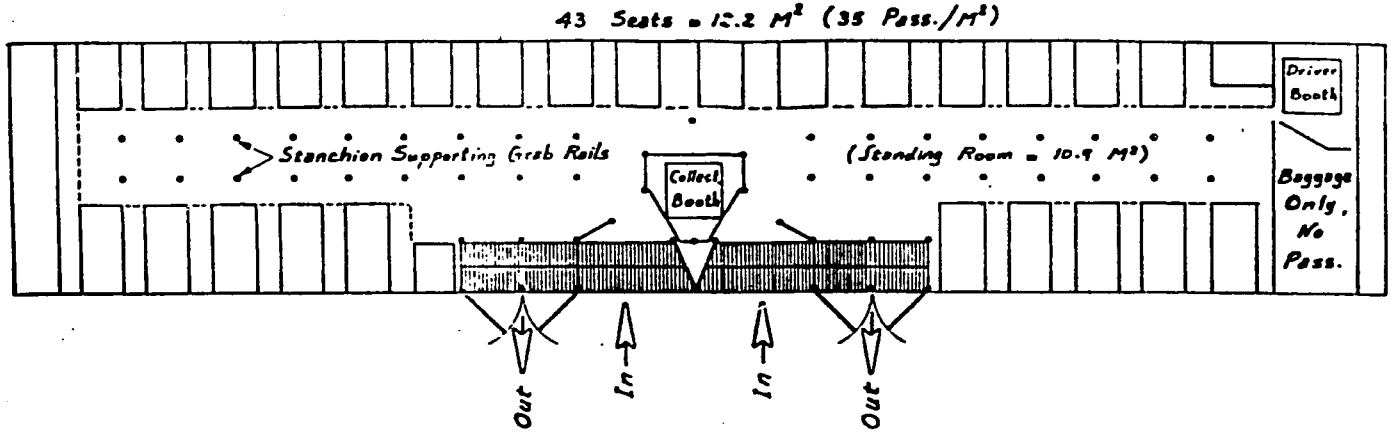
There is no reason, structurally or operationally, why buses such as these could not be built and operated. It is hoped that this design will be given serious thought when specifications for new buses are next issued.

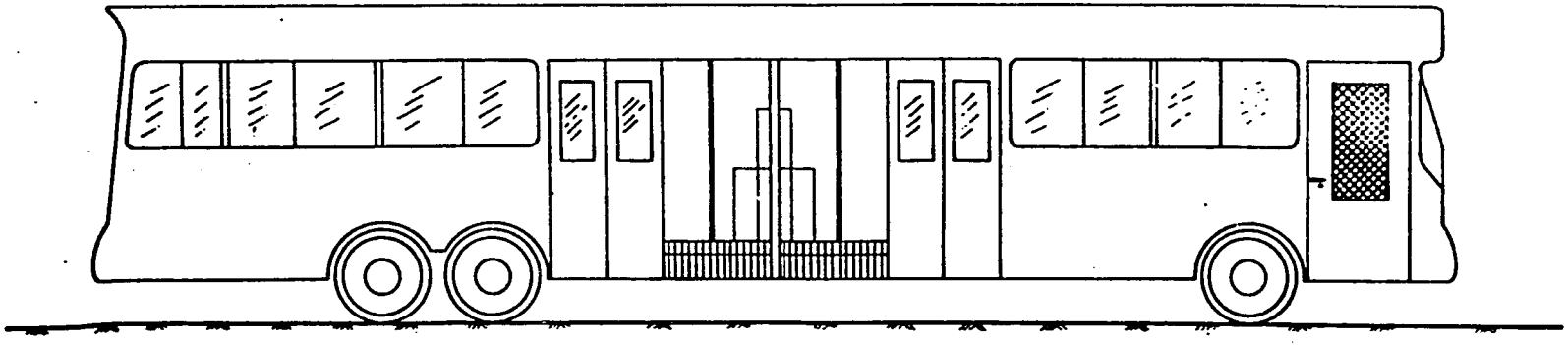




"Normal" Capcity: 38 seated + 40 standing = 78 passengers.
(10.45 M² seated room = 3.64 pass./M²)
(10.05 M² standing room = 3.98 pass./M²)
(20.50 M² total room = 3.80 pass/M²)

"Crush" Capacity: 38 seated + 71 standing = 109 passengers
(10.45 seated room = 3.64 pass./M²)
(10.05 standing room = 7.06 pass./M²)
(20.50 total room = 5.32 pass./M²)

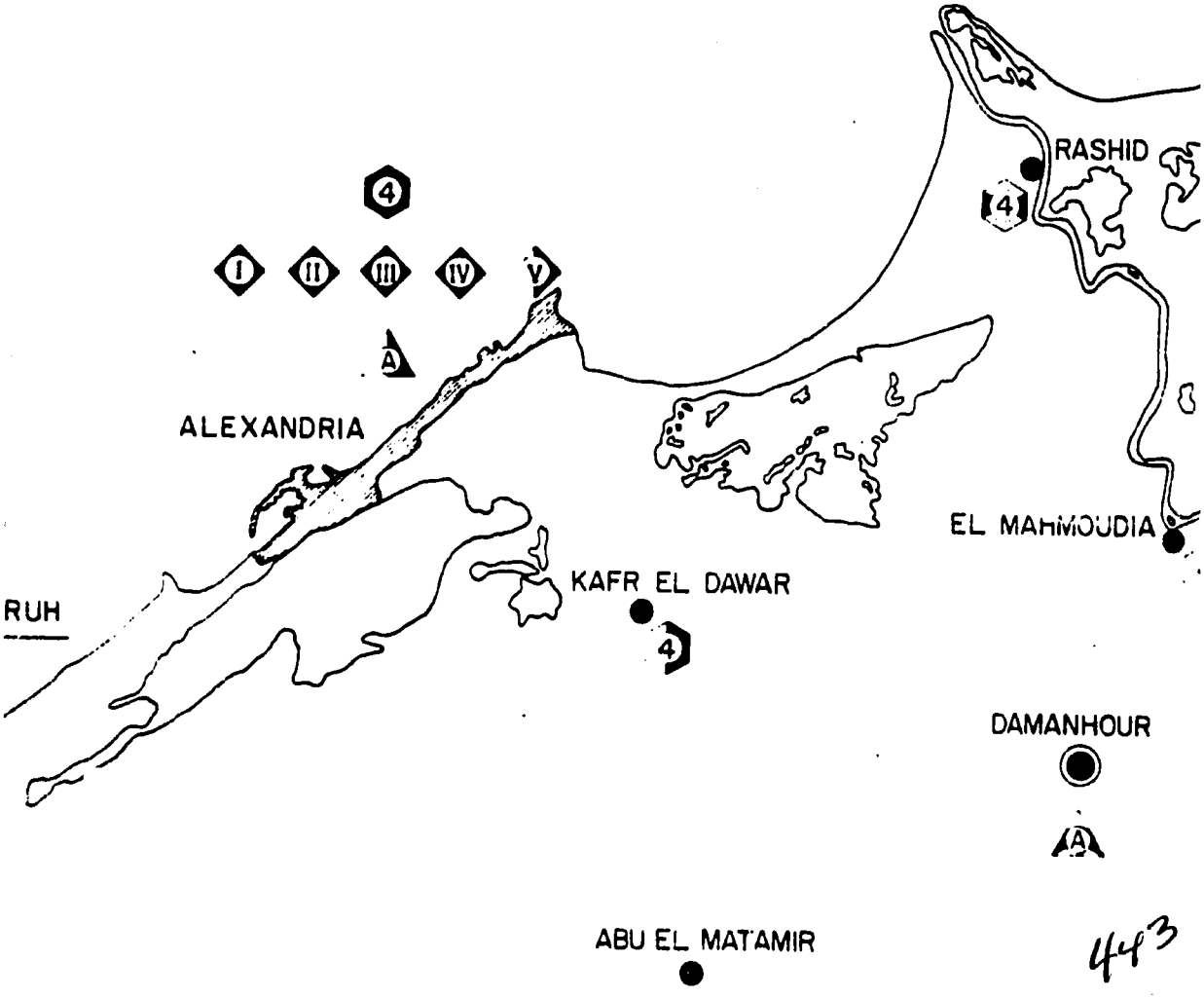




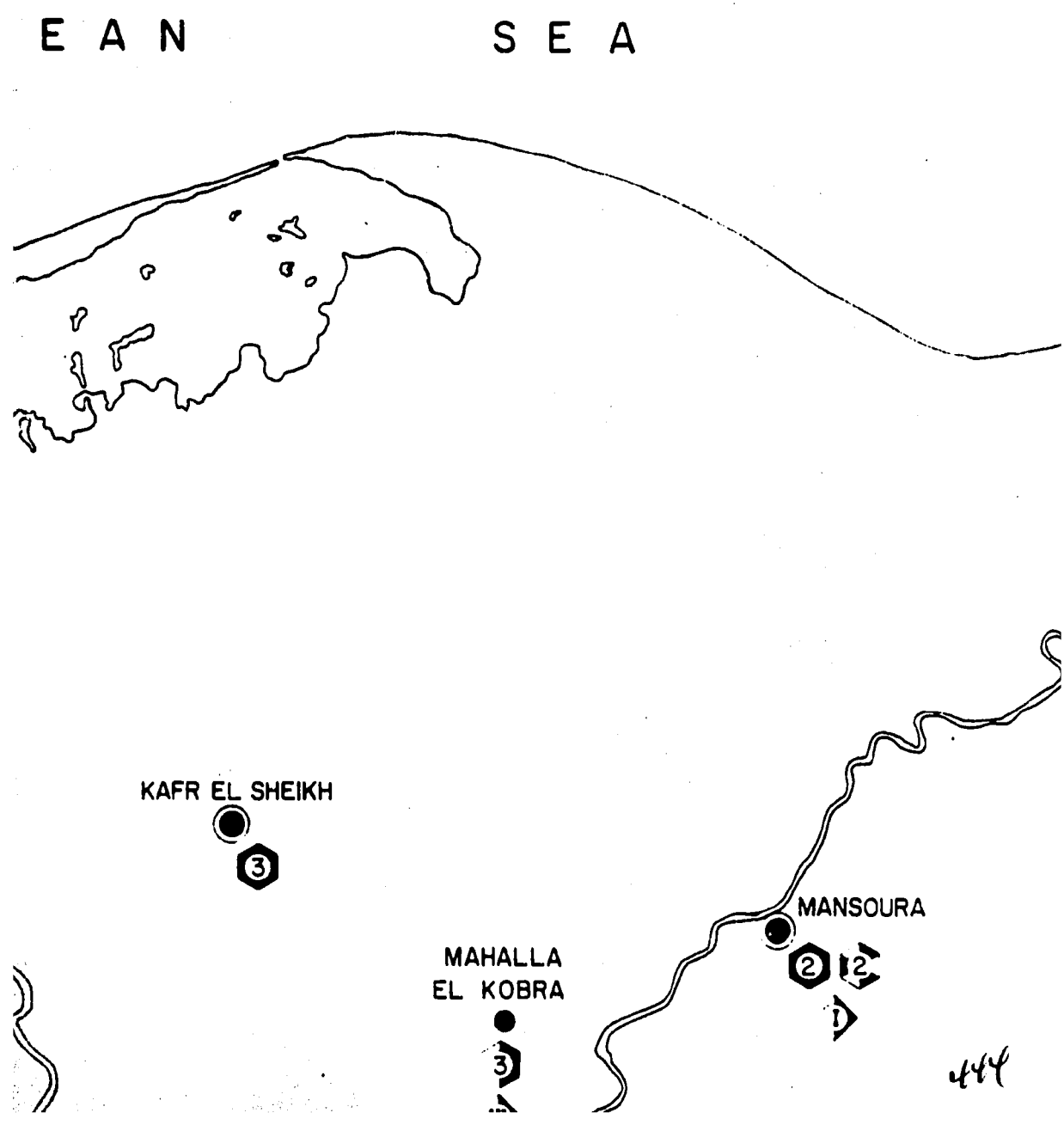
"Normal" Capacity: 43 seated + 44 standing = 87 passengers.
(12.20 M² seated room = 3.52 pass./M²)
(10.90 M² standing room = 4.04 pass./M²)
(23.10 M² total room = 3.77 pass./M²)

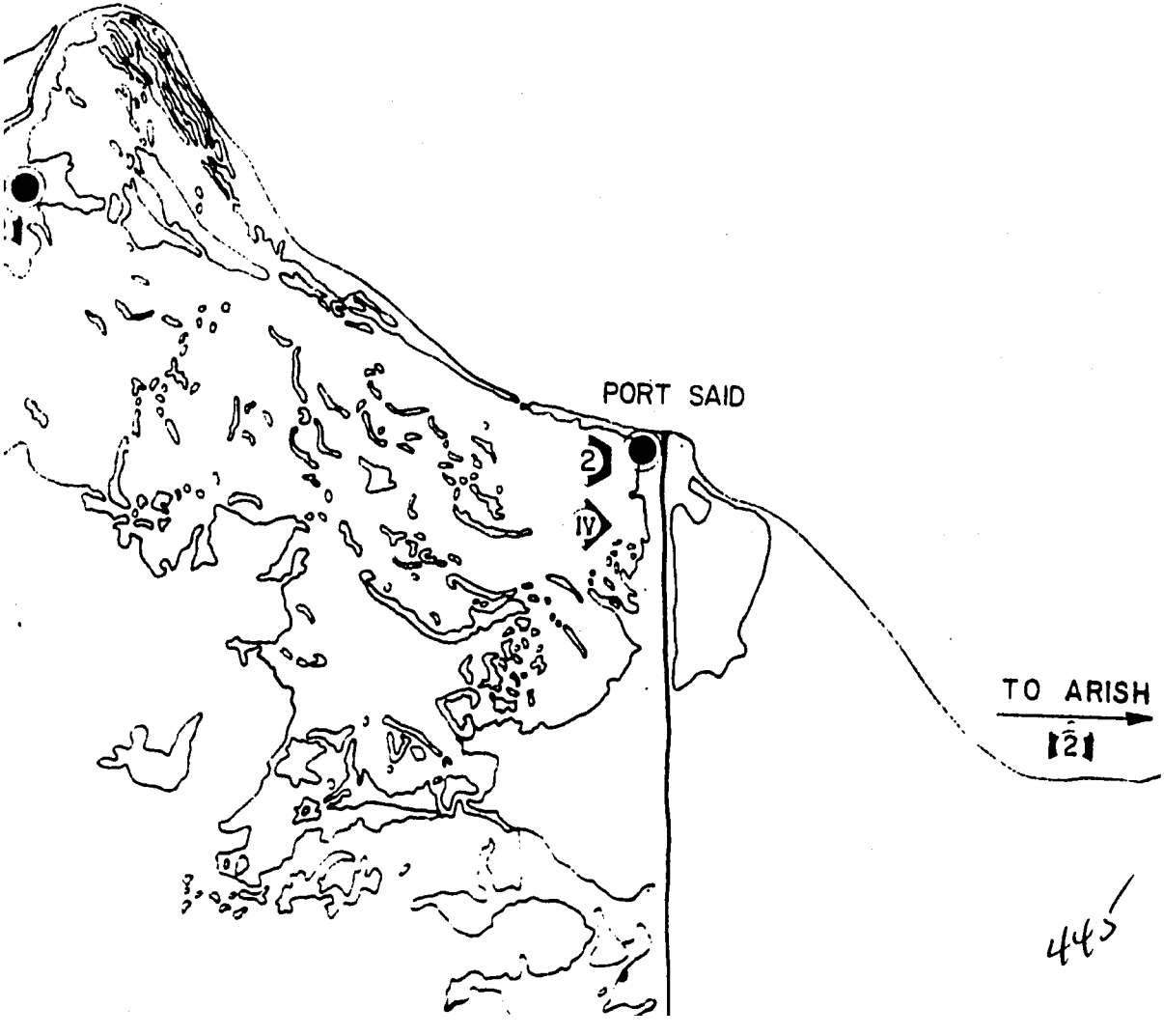
"Crush" Capacity: 43 seated + 77 standing = 120 passengers.
(12.20 M² seated room = 3.52 pass./M²)
(10.90 M² standing room = 7.06 pass./M²)
(23.10 M² total room = 5.19 pass./M²)

MEDITE


RASHID
4
4
I
II
III
IV
V
A
ALEXANDRIA
EL MAHMOUDIA
KAFR EL DAWAR
4
RUH
DAMANHOUR
A
ABU EL MATAMIR

443


E A N
S E A
KAFR EL SHEIKH
3
MANSOURA
2
2
1
MAHALLA
EL KOBRA
3


PORT SAID
2
IV
TO ARISH
2

EGEND

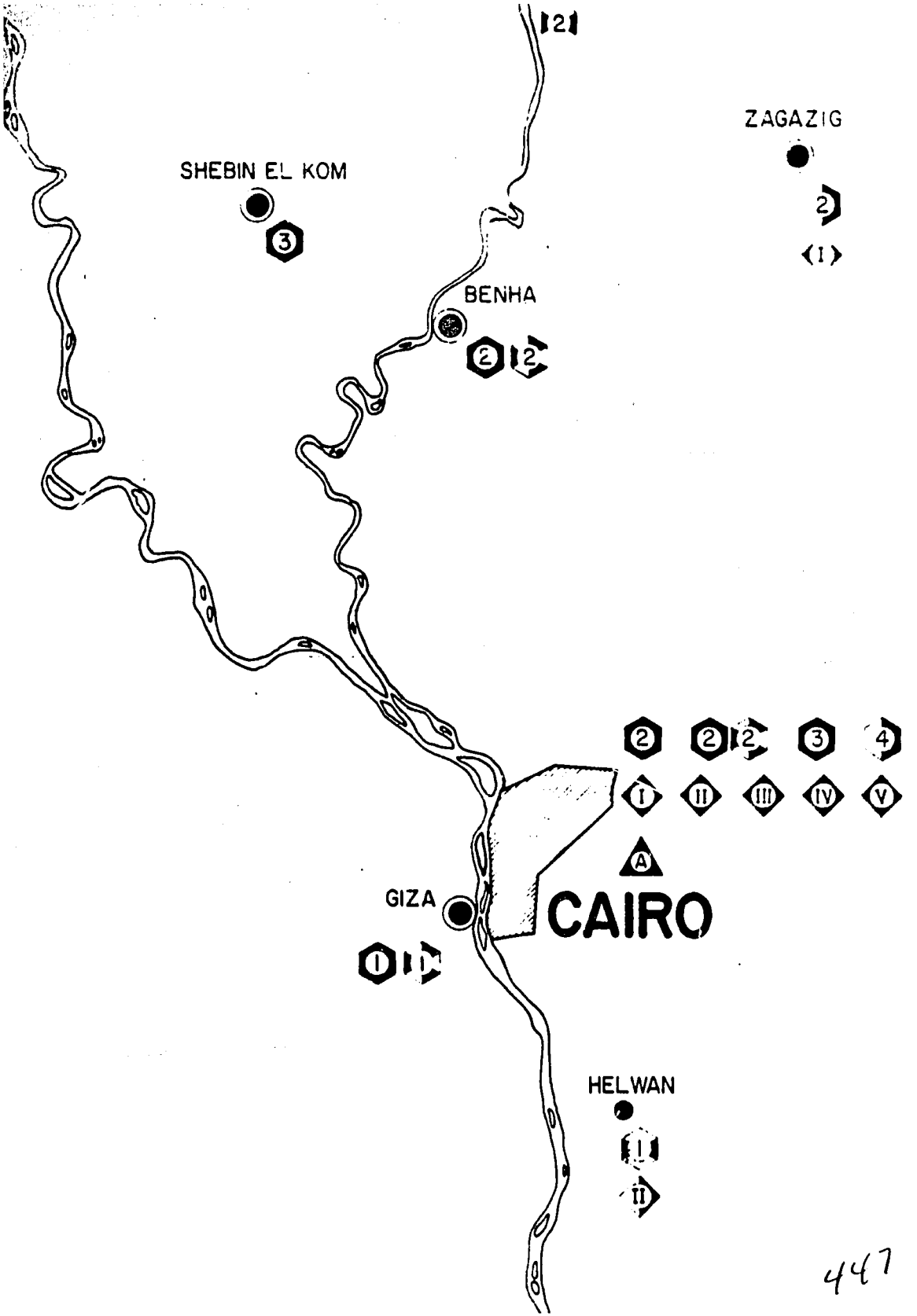
BUS COMPANIES	TRUCK COMPANIES	AUTOMOTIVE REPAIR CO.	
3	II	A	GARAGE WITH A WORKSHOP FOR LIGHT, MEDIUM & SOME MAJO
3	II	A	" " " " FOR LIGHT & MEDIUM REPAIRS.
31	II	A	" " " " FOR LIGHT REPAIRS.
3	II		WORKSHOP FOR REBUILDING.

KEY FOR COMPANIES

GENERAL NILE Co. FOR :

1	UPPER EGYPT BUS.	I	GOODS TRANSPORT.
2	EAST DELTA BUS.	II	DIRECT TRANSPORT.
3	MIDDLE DELTA BUS.	III	RURAL TRANSPORT.
4	WEST DELTA BUS.	IV	TRANSPORT WORKS.
A	AUTOMOTIVE REPAIR.	V	HEAVY TRANSPORT.

NOTE :
CTA FACILITIES, SEE MAP OF CAIRO, SCALE 1 : 20,000


2
ZAGAZIG
2
I
SHEBIN EL KOM
3
BENHA
2
2
2
2
2
3
4
I
II
III
IV
V
A
CAIRO
GIZA
1
1
HELWAN
1
II

EGEND

BUS COMPANIES	TRUCK COMPANIES	AUTOMOTIVE REPAIR CO.	
	(II)	(A)	GARAGE WITH A WORKSHOP FOR LIGHT, MEDIUM & SOME MAJO
	II	A	" " " " FOR LIGHT & MEDIUM REPAIRS.
	(II)	(A)	" " " " FOR LIGHT REPAIRS.
	II		WORKSHOP FOR REBUILDING.

KEY FOR COMPANIES

GENERAL NILE Co. FOR :

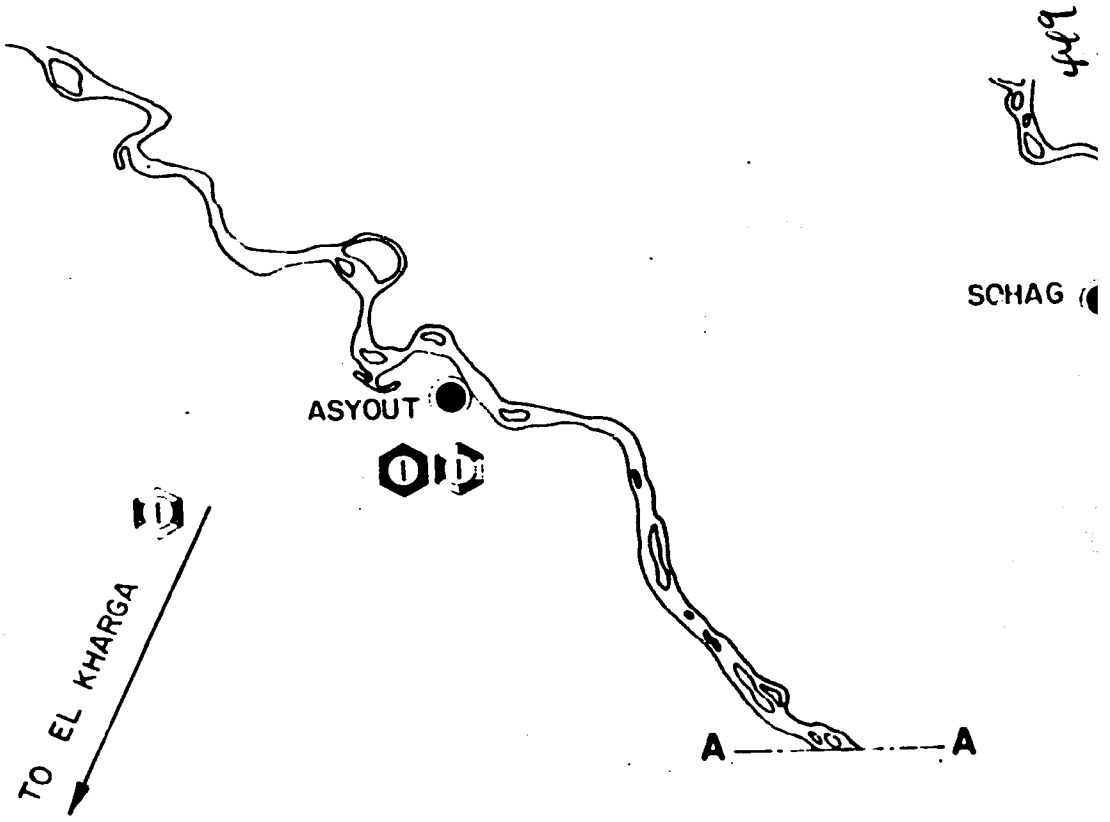
1	UPPER EGYPT BUS.	I	GOODS TRANSPORT.
2	EAST DELTA BUS.	II	DIRECT TRANSPORT.
3	MIDDLE DELTA BUS.	III	RURAL TRANSPORT.
4	WEST DELTA BUS.	IV	TRANSPORT WORKS.
A	AUTOMOTIVE REPAIR.	V	HEAVY TRANSPORT.

NOTE :
CTA FACILITIES, SEE MAP OF CAIRO, SCALE 1. 20,000

448

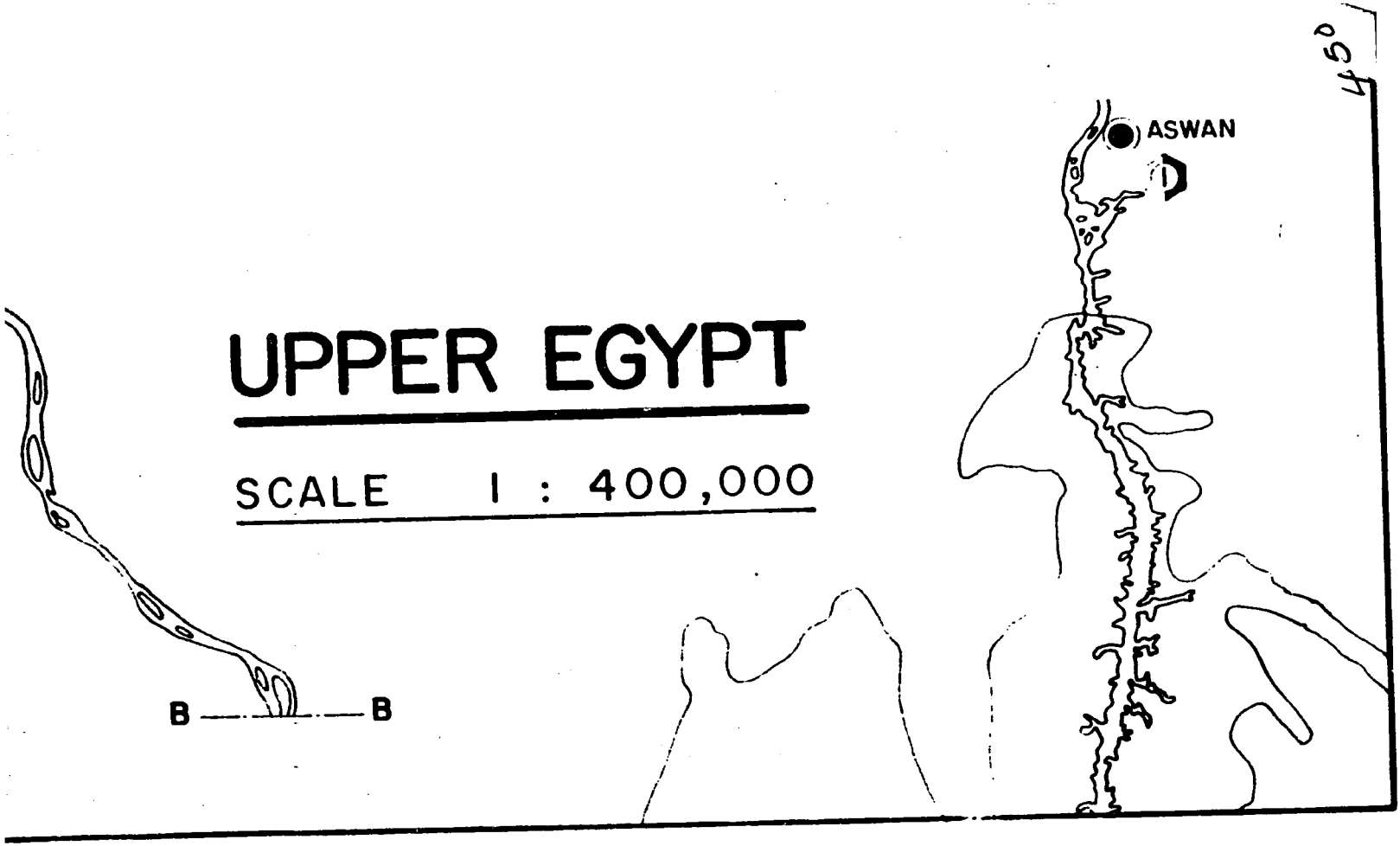
LEGEND

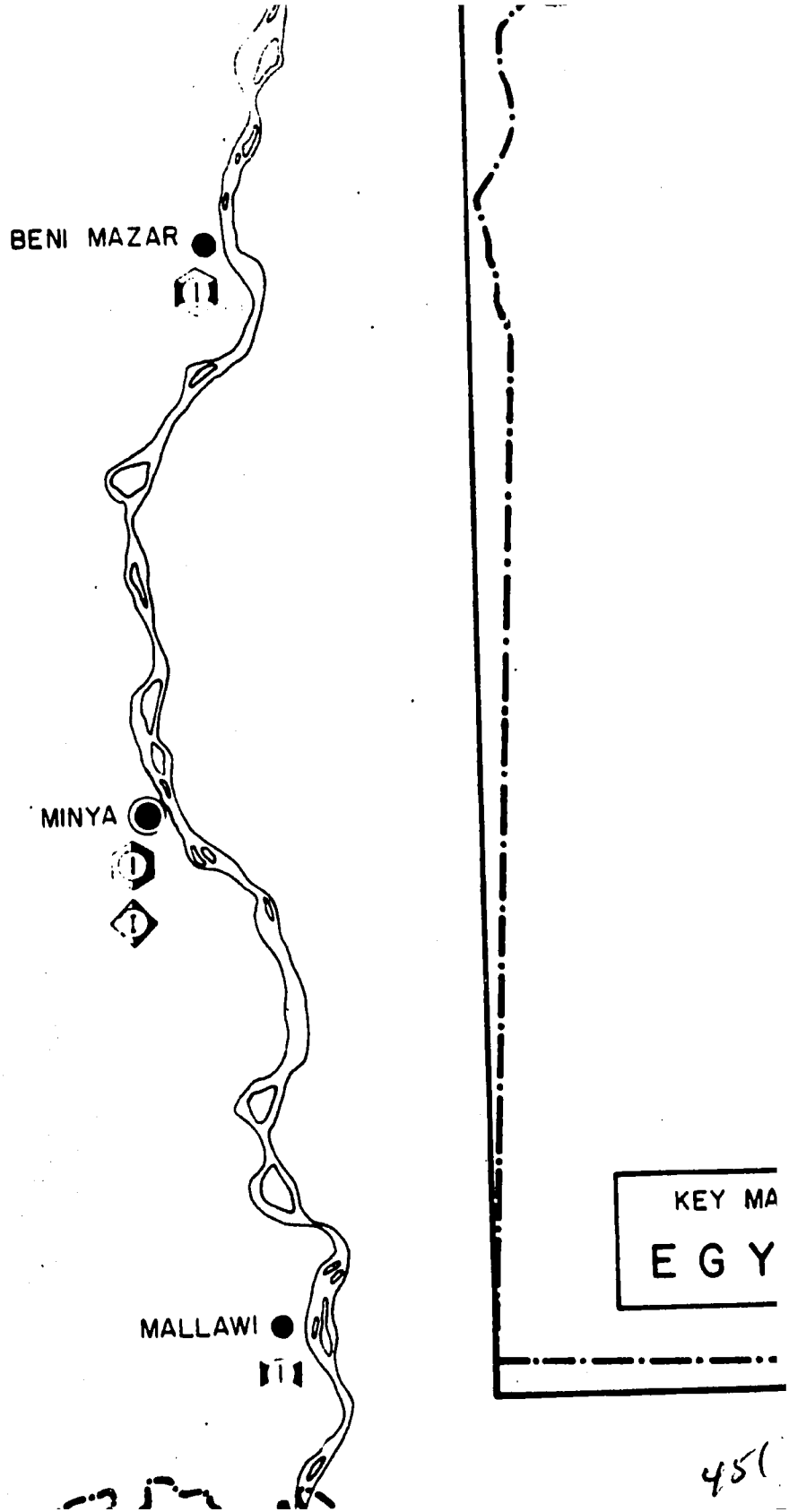
(SEE THE OTHER MAP OF
LOWER EGYPT, SAME SCALE)

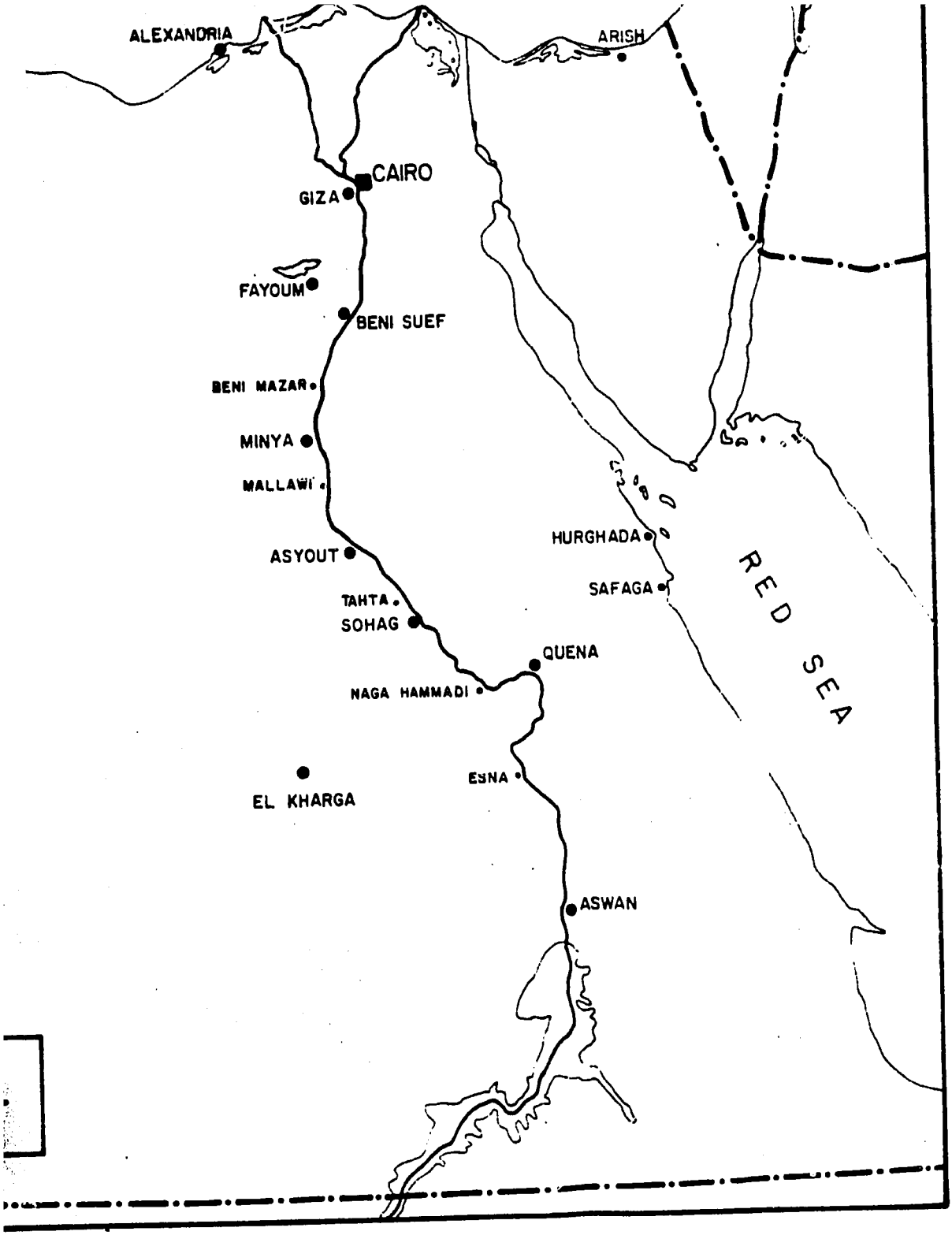


UPPER EGYPT

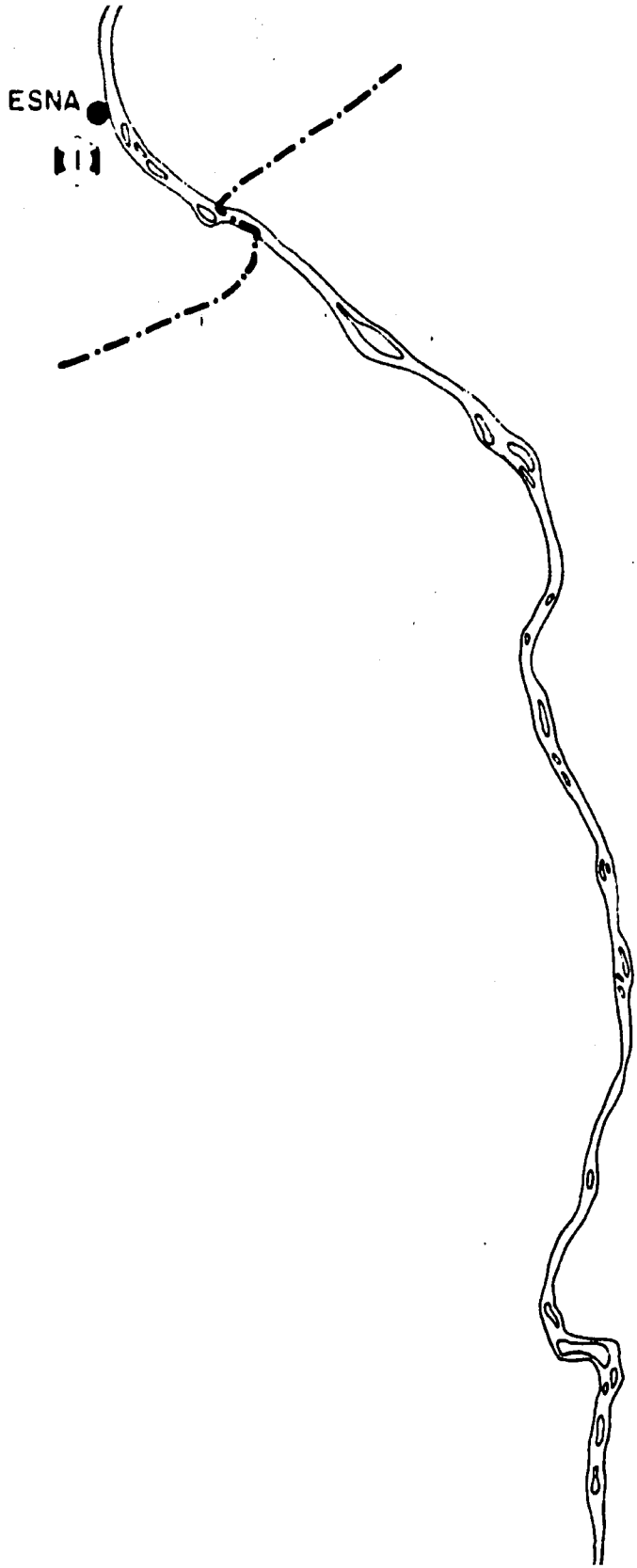
SCALE 1 : 400,000

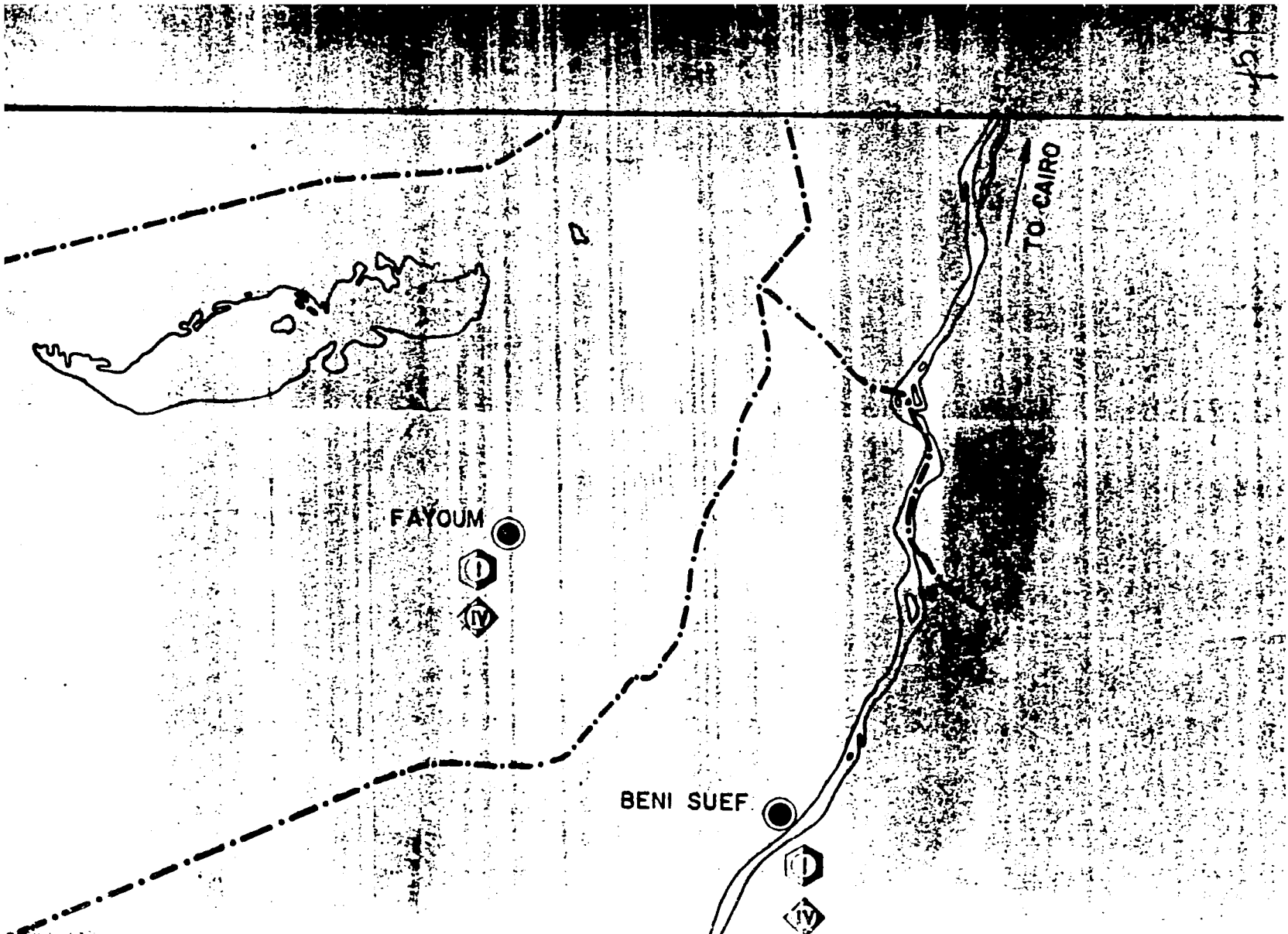


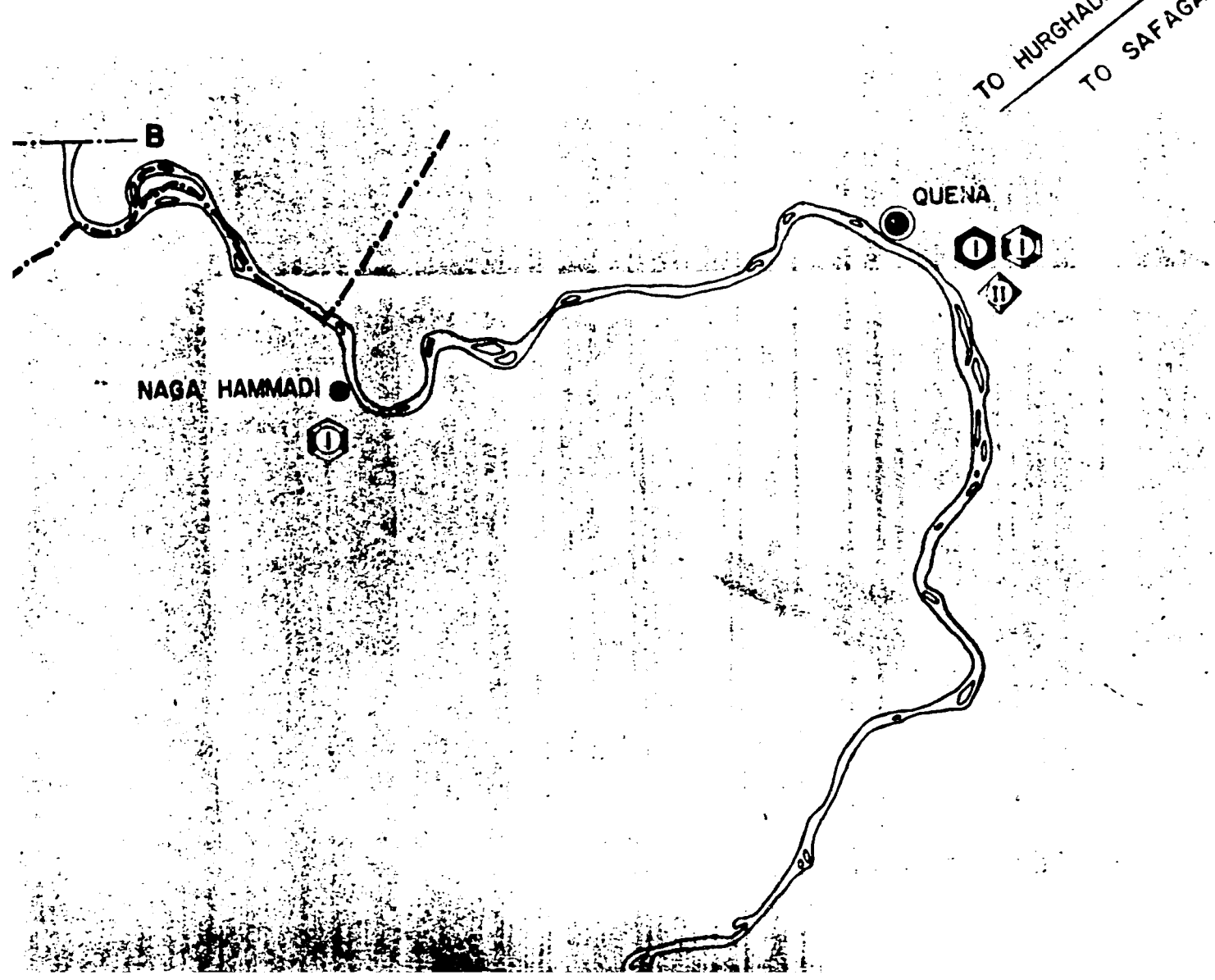

BENI MAZAR
MINYA
MALLAWI
KEY MA
E G Y

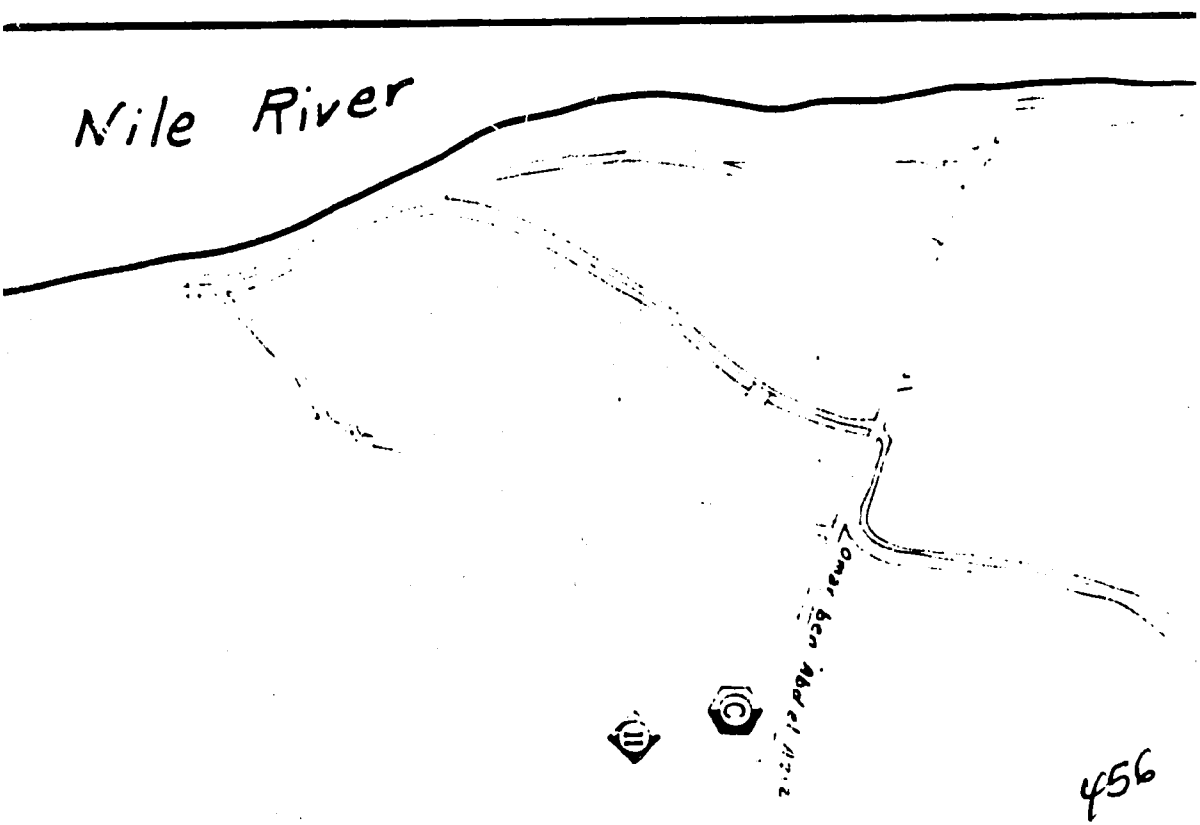

ALEXANDRIA
ARISH
CAIRO
GIZA
FAYOUM
BENI SUEF
BENI MAZAR
MINYA
MALLAWI
ASYOUT
TAHTA
SOHAG
QUENA
NAGA HAMMADI
ESNA
EL KHARGA
ASWAN
HURGHADA
SAFAGA
RED SEA

A

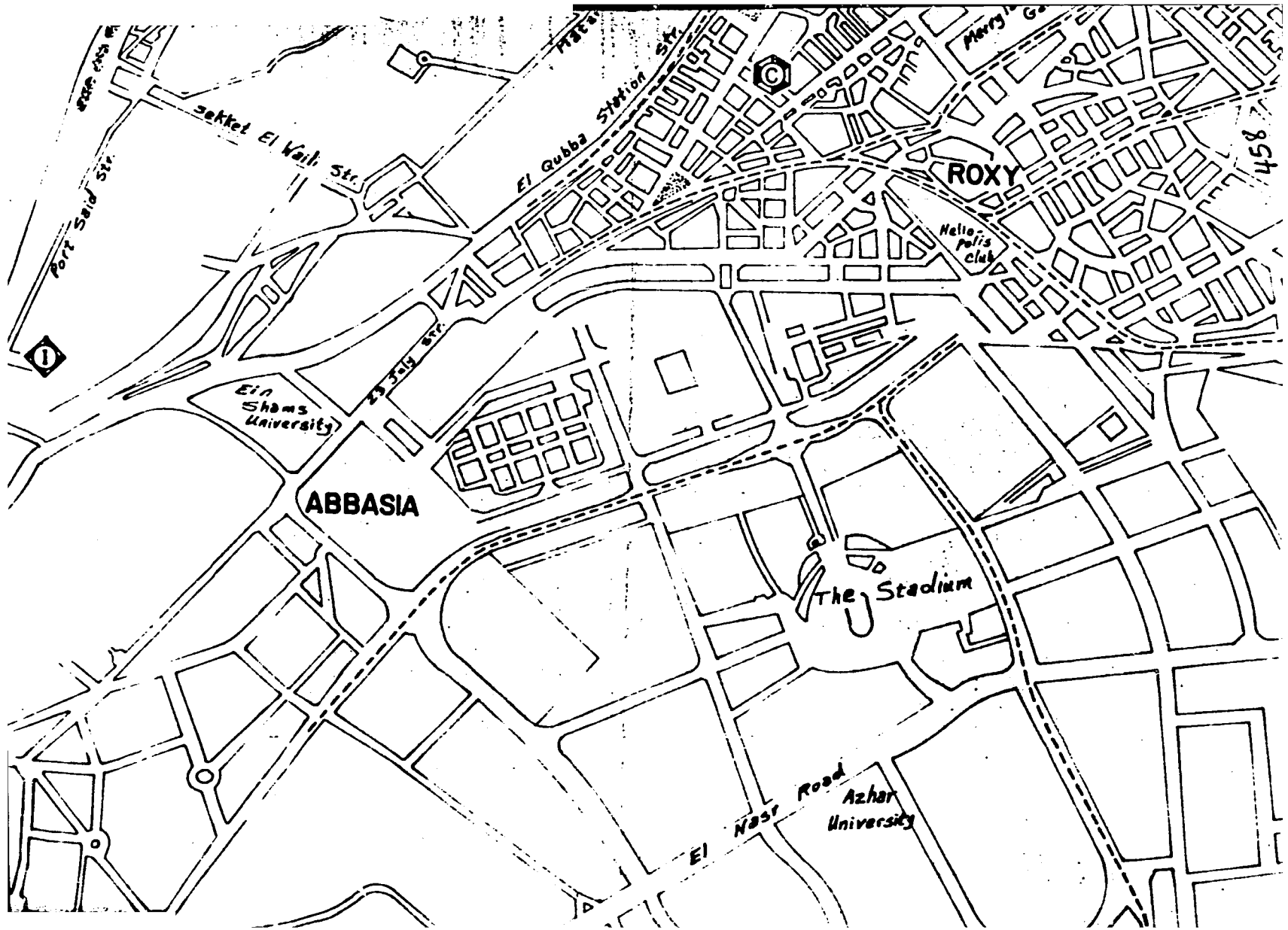

ESNA

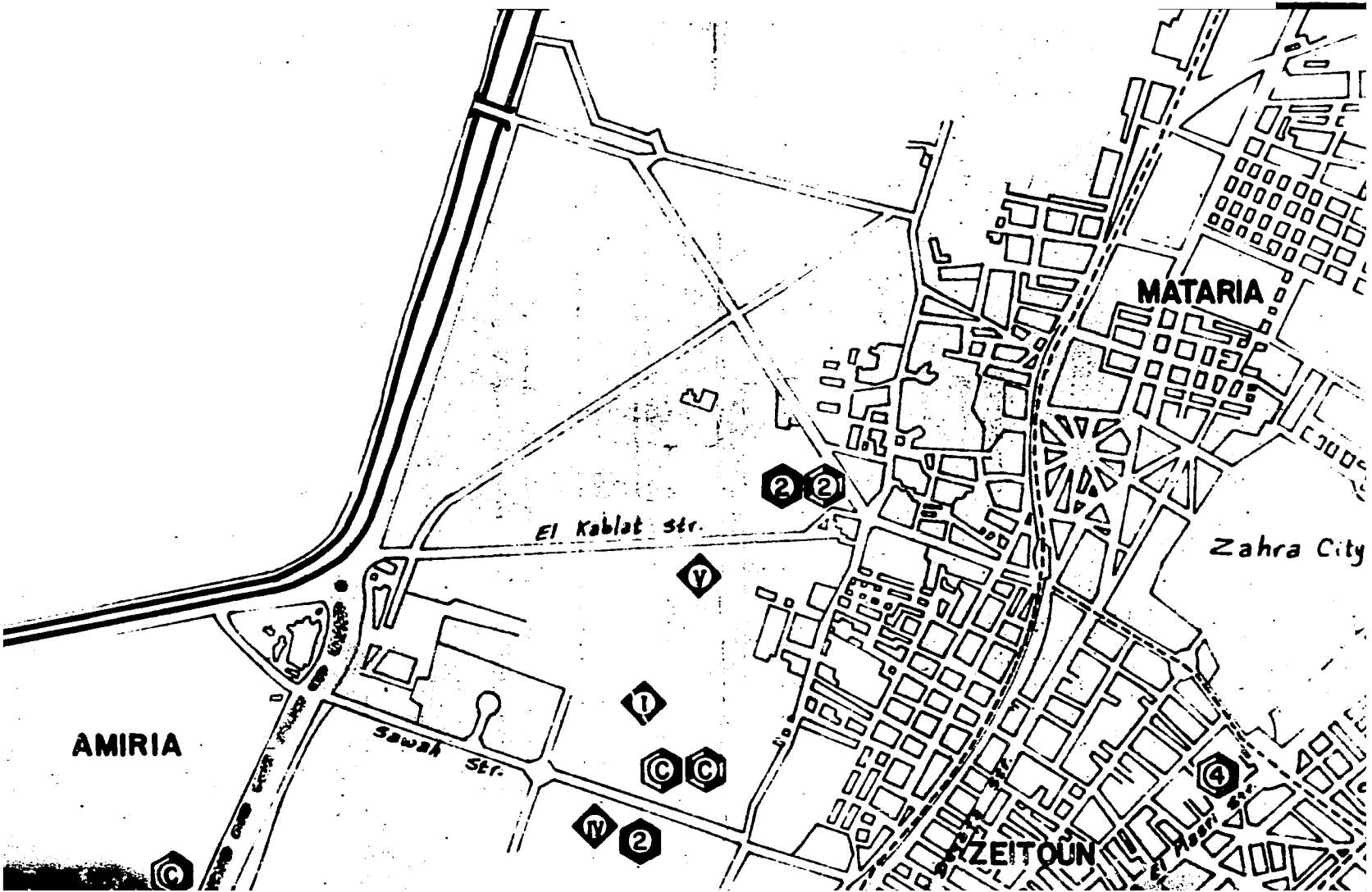

TO CAIRO
FAYOUM
I
IV
BENI SUEF
I
IV


TO HURGHADA
TO SAFAGA
B
QUENA
I
II
NAGA HAMMADI
I


Nile River
Omar Ben Abdel Aziz

457

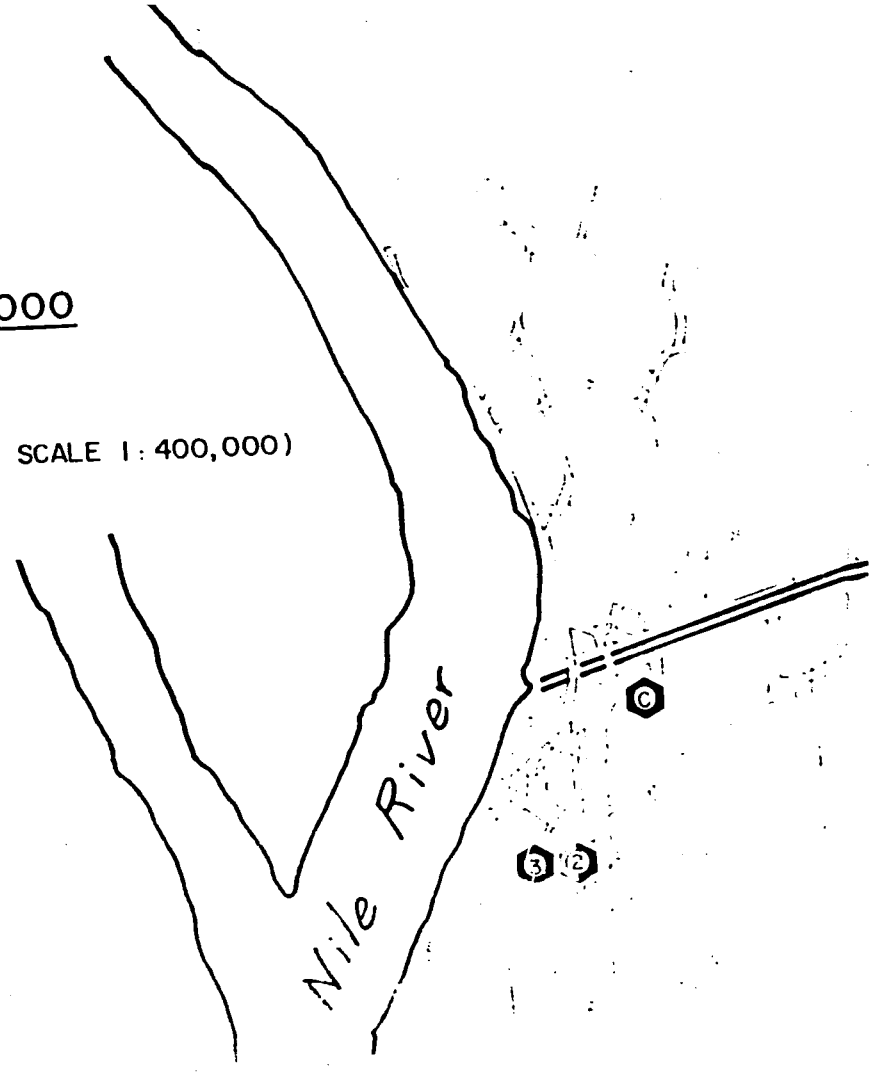

Port Said Str.
Sekket El Hail Str.
El Qubba Station Str.
ROXY
Heliopolis club
23 July Str.
Ein Shams University
ABBASIA
The Stadium
El Nasr Road
Azhar University

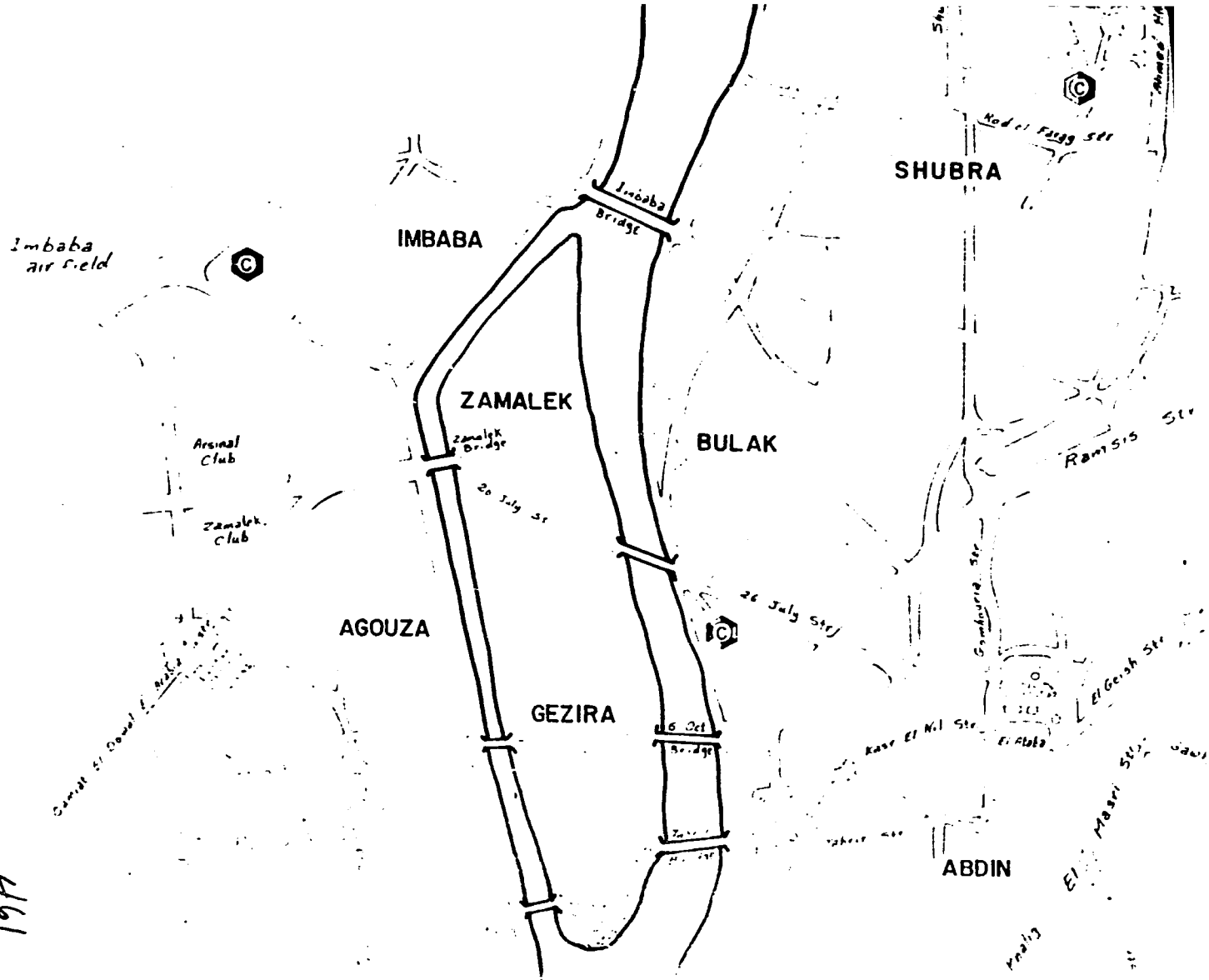

MATARIA
Zahra City
El Kablat str.
Sawah Str.
AMIRIA
ZEITOUN

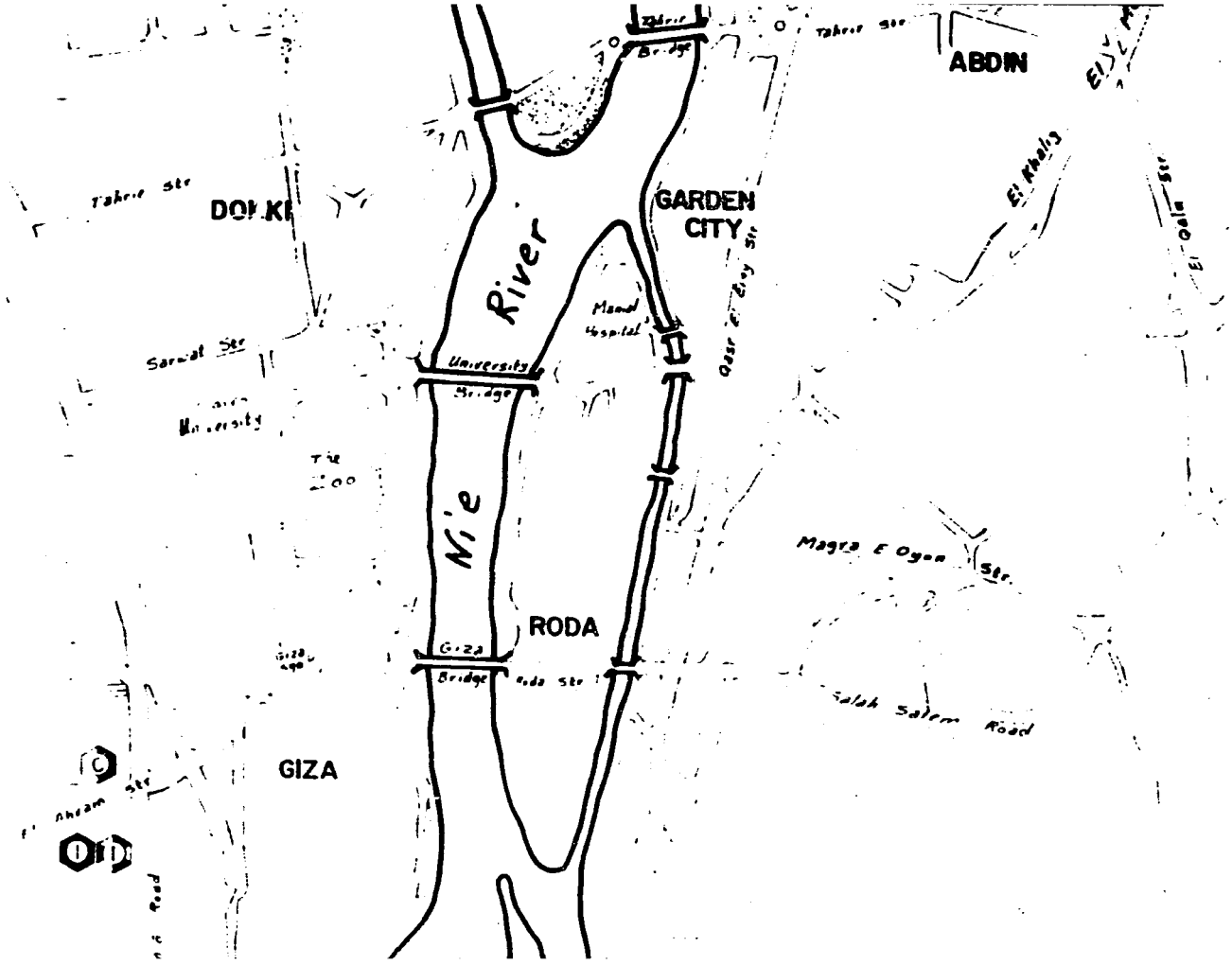
CAIRO

SCALE 1 : 20,000

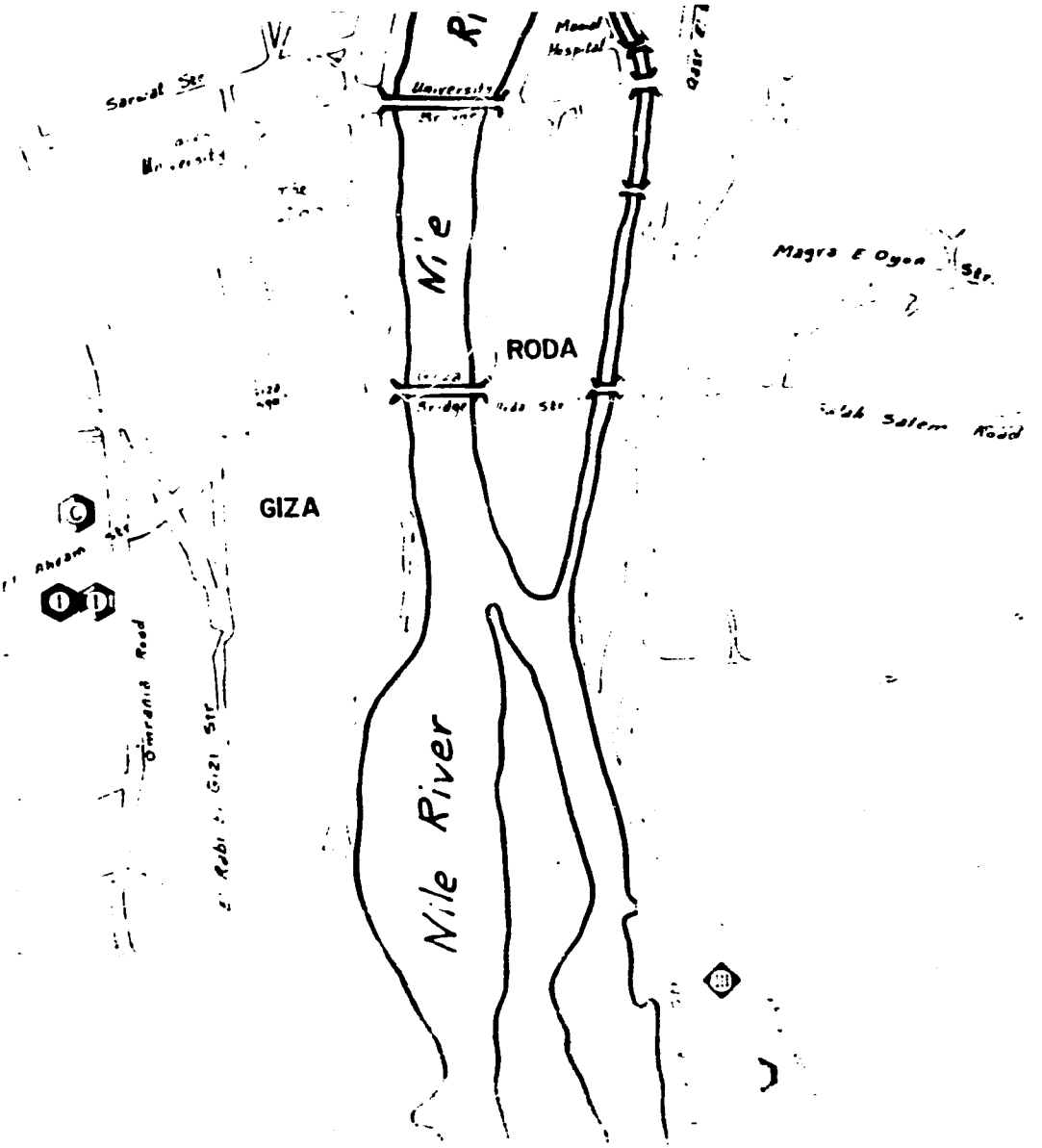
LEGEND
(SEE MAP OF "LOWER EGYPT", SCALE 1 : 400,000)




Imbaba air field
IMBABA
Imbaba Bridge
ZAMALEK
Zamalek Bridge
Arsinal Club
Zamalek Club
20 July St
BULAK
26 July Str
AGOUZA
GEZIRA
6 Oct Bridge
SHUBRA
Kod el Fagg Str
Ramsis Str
Gamhoria Str
El Gesh Str
Kasr El Nil Str
El Abba
ABDIN
El Masri Str


Tahrir Str
Tahrir
Bridge
ABDIN
El Khalig
El Qala Str
DOKKI
Tahrir Str
GARDEN
CITY
Qasr el Eny Str
River
Nile
Sarwat Str
University
Bridge
Magra E Ogon Str
RODA
Giza
Bridge
Roda Str
Salah Salem Road
GIZA

462


Nile River
GIZA
RODA
Nile
Magra E Ogon Str.
Salem Road
Emerald Road
Mount Hospital
University
Bridge