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04503

PROJECT

REPAIR AND MAINTENANCE OF INDUSTRIAL EQUIPMENT IN THE DEVELOPING COUNTRIES

FIELD–SURVEY REPORT IN U. A. R.

ITALCONSULT

Rome, March 1969

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CONTENTS

SUMMARY

A preliminary survey was carried out in the UAR on behalf of UNDP, by a two-expert Italconsult team, in order to assess the present efficiency of the maintenance and repair services for the existing industrial equipment, and the needs for future improvements.

The Mission was allowed to survey only a certain number of firms reporting to the Inland Transport Organization (Ministry of Transport); four pumping stations and one workshop of the Ministry of Irrigation's Electro-mechanical Department; and two firms reporting to the General Organization for Industrialization, Ministry of Industry, namely: The Helwan Iron and Steel Factory and the ESCO, Egyptian Spinning Company.

Within the limits of the surveyed firms the conclusion can be drawn that, with very few exceptions, many aspects of the maintenance and repair problem are particularly acute at the present time. This is especially due to the generally poor condition of the production and maintenance equipment, inventory control and spare parts availability, operation of the workshops, and training standards of personnel at all levels.

It is difficult to make general statements on the priority of the deficiencies affecting the performance of maintenance and repair services in the industrial branches and firms surveyed by the Mission.

Indeed such deficiencies are very often linked with each other by apparently reversible cause-effect relations. It is possible however to state that, whereas poor training of personnel seems to be very acute everywhere, in many cases particular problems are posed by the scarcity of spare parts. This is due: on the one hand to severe import restrictions and to insufficient local production; and on the other to an excessive consumption of parts deriving from poor maintenance and overhauling, and from the exacting operating conditions involved.

As far as concerns the branches of activity surveyed, and as far as can be judged from such a limited survey, the Mission feels that road and urban (Cairo) transport and textile industries are those most in need of assistance; these industries also have a major impact on the national economy.

An implementation program has been suggested providing for:

- short-term assistance by a 7-man team on a 12-month assignment, and

– long-term assistance the details of which can only be broadly envisaged at the moment, but it is thoughttentatively that it would involve a 6-man team on a 36-month assignment.

The short term assistance should be aimed at effectively solving the main relevant problems of a few chosen firms in the aforementioned fields; whereas the long-term assistance should aim at the solution of the basic problems on a nation-wide scale.

Official counterparts should be attached to the UNIDO teams, so as to prepare the nucleus of an efficient staff for future Management Consulting Centers to be installed at the various Ministries.

It is expected that the implementation of the whole program would make an important contribution to the Country's industrial development.

1. INTRODUCTION

The United Nations Industrial Development Organization has planned to undertake a long-term campaign to improve maintenance and repair services for existing industrial equipment in the developing countries.

Since it would have been rather difficult to tackle all developing countries at the start, it was decided to carry out a sample survey of some representative countries.

The objectives of the envisaged field studies were mainly:

- to enable UNIDO to choose the countries in which to start implementation of the campaign;
- to identify the crucial fields in the surveyed countries, in which assistance is urgently required;
- to help UNIDO to formulate a long-term working program of repair and maintenance both for the chosen countries and for developing countries in general.

Field surveys for a group of countries comprising Kenya, the United Arab Republic and Somalia were assigned to Italconsult, Rome, under Contract No. 68/1 and 68/6.

The present report refers to the field-survey carried out in the United Arab Republic from January 20 to February 18, 1969, by a mission of two Italconsult experts.

In compliance with agreements drawn up between the UAR Government and UNIDO through the local UNDP Representative, in carrying out the field survey the mission has had to depart substantially from the general plan originally laid down by UNIDO (see *Annex A* of the Purchase Order).

The scope of the investigation has, in fact, been limited to the following in-field surveys:

- *Ministry of Transport:*
  - The Inland Transport Organization
  - The Egyptian Railways General Authority
  - The Cairo Transport Authority
  - The Road and Rural Transport Organization

–	*Ministry of Irrigation:*	The Electro-mechanical Department
–	*Ministry of Industry*:	The Egyptian Spinning Company
		The Helwan Iron Steel Works

Within the limits of the assignment, the information available and the general possibilities offered by the particular features of the country, the Mission has sought to fulfil its main contractual obligations and to provide for the activities surveyed,as complete a picture of the situation as possible.

Despite the limits involved in its survey the Mission was accorded the fullest cooperation by the Authorities concerned, who gave continuous evidence of their active interest in the main objectives of the campaign.

2. PRELIMINARY

The following visits were made within the framework of the program outlined by the UAR Government. Detailed reports on these will be found in the corresponding appendices.

MINISTRY OF TRANSPORT *(Appendix A)*

– *The Inland Transport Organization (Appendix A-1)*

- The Nile Company for Automative Repairs *(Appendix A-1.1)*
- TheWork Transport Co. *(Appendix A-1.2)*
- The Goods Transport Co. *(Appendix A-1.3)*
- The Direct Transport Co. *(Appendix A-1.4)*
- Training Center for Road Transport of the Inland Transport Organizations *(Appendix A-1.5)*
- The General Nile Company for Water Transport *(Appendix A-1.6)*
- The General Nile Company for River Transport *(Appendix A-1.7)*

– *The Egyptian Railways General Authority (Appendix A-2)*

- The Egyptian Railways Diesel Workshops *(Appendix A-2.1)*
- The Egyptian Railways Carriage Workshops *(Appendix A-2.2)*
- The Egyptian Railway Abu Zabal Workshops *(Appendix A-2.3)*
- The Egyptian Railways Gabbari Wagon Workshops *(Appendix A-2.4)*

- *The Cairo Transport Authority (Appendix A-3)*
  - Nasr Garage *(Appendix A-3.1)*
  - Tram and Trolleybus Workshop *(Appendix A-3.2)*
  - The Amiria Garage for Buses *(Appendix A-3.3)*
  - The Amiria Workshop *(Appendix A-3.4)*
- *The Road and Rural Transport Organization*: The General Nile Bus Company for West Delta, Alexandria *(Appendix A-4)*

MINISTRY OF IRRIGATION *(Appendix B)*

- The Delta Barrage Maintenance Workshop *(Appendix B-1)*
- The Delta Barrage Pumping Station *(Appendix B-2)*
- The Esna Pumping Stations *(Appendix B-3)*

MINISTRY OF INDUSTRY: GENERAL ORGANIZATION FOR INDUSTRIALIZATION *(Appendix C)*

- *The ESCO Factory (Appendix C-1)*
  - The Rayon Mill *(Appendix C-1.1)*
  - The Spinning Mill *(Appendix C-1.2)*
  - The Weaving Mill *(Appendix C-1.3)*
  - The Dyeing and Finishing Mill *(Appendix C-1.4)*
- *The Iron and Steel Factory (Appendix C-2)*

2.1 MINISTRY OF TRANSPORT

The Ministry oversees the management of the Country's railway and inland transport system, including urban services.

Since about two-thirds of the inhabitants and most of the Country's economic activity are concentrated in the Nile Valley, the technical conditions under which the system operates are relatively favorable. However the sharp rise in overall traffic (about 60% during the five-year period 1960-1965 with an expected 10% rate of increase over the next few years), the pronounced trend towards urbanization in the main centers, the severe limits placed on foreign exchange expenditure for the purchase of new transport units and spare parts, and finally the problem of staff training are all matters which affect the smooth running of the service.

2.1.1 The Inland Transport Organization

This organization controls freight transport by road and river.

For road transport it operates four companies, each of which carries out its own light repairs. Heavy repair requirements are usually met by a central workshop. A Training Center provides instruction for drivers and workmen.

For river transport the Organization runs two companies, each with its own maintenance, repair and training facilities.

a) As far as repair and maintenance are concerned, the Organization's road transportation problems may be summarized as follows:

- overlapping lines of authority and responsibility between the four road haulage companies and the central repair company, particularly with regard to the allocation of spare parts and heavy repairs;
- consequent dispersion of physical and human facilities;
- out dated managerial methods and physical facilities in most workshops, poor maintenance of machinery and reclamation of spares;

– maintenance needs increased by inadequate training of drivers and workmen.

Essentially the service, already hampered by limitations regarding vehicles and spare parts, is further saddled with problems of company and inter-company organization, and with staff training at all levels and in all relevant specializations. These factors are reflected by the excessive amount of labor used for repairs (1.8 workmen per vehicle) and by the executives' opinion (though not backed up with statistical data) that the number and extent of repairs could be drastically cut – other conditions remaining unchanged – by better training of drivers and workers.

Present training capacity for drivers and workmen is somewhat on the low side, the facilities being used for a single shift per day. Improvements are also required in both the structure and the duration of the courses, and in the number and standard of instructors.

b) The situation is altogether different for the two river transport companies, chiefly on account of their different status within the Organization, of the different type and operating conditions of the fleet; and of the autonomy they enjoy, particularly as far as repair services are concerned.

Although the same general problems were observed as those which affect the road haulage companies (physical facilities, spares, organization, and training), they appear less serious in the case of the General Nile Company for Water Transport which has, moreover, a new repair yard in the design and construction stage.

Conditions seem far less favorable at the General Nile Company for River Transport, whose maintenance and repair problems are certainly very acute, while there are apparently no plans under-way to restructure the company's facilities in the near future.

2.1.2 The Egyptian Railways General Authority

This Authority manages the Country's entire railway system, amounting to a total of 4,500 km of main lines, handling 50% of the goods traffic and 30% of the passenger traffic.

Traction recently has been completely dieselized, however, the shunting locomotives are over-age and in poor condition

Not much better conditions are generally found in rolling stock. In fact, their efficiency seems to be the main problem requiring solution, and appears to be mainly affected by the supply of spares and the reliability of the repair workshops.

The Diesel Workshop seems to be fairly efficient, even if the control of spares, the maintenance of physical facilities and the management procedures appear to leave room for improvement. A point to be noted is that there is no diesel engine crankshaft grinder, and thus crankshafts must be sent abroad for repair. It seems, however, that such a costly machine tool could not be economically operated, due to its low degree of utilization even on a national scale.

The same efficiency is not to be found in the two main wagon repair shops. The renovation of the Cairo workshop is underway, but the new project for the Alexandria workshop seems far from realization due to financial and foreign exchange problems. Features common to the two workshops are poor organization and low productivity; the design of the layout; the age and maintenance of the machinery; and the lack of training of staff at all levels.

Although the Production Workshop at Abu Zabal also has to make do with old machinery, in the main, nonetheless, its organizational and productivity aspects are satisfactory, and praiseworthy efforts have been made to overcome many of the spare-parts problems. Be this as it may, the efficiency of the workshop in this respect could be considerably improved by applying more modern methods of planning, scheduling and control both to production and to stores. Finally, in this case too, some of the most serious problems (physical facilities and spares) could largely be solved through better organization and training.

The efficiency of the Training Center being set up at Wardur should be geared to meet these needs, and recourse made to special methods of up-grading the management personnel.

2.1.3 The Cairo Transport Authority

This Authority provides for public transport, by tram and bus, in the city of Cairo and its suburbs.

Operating conditions are truly critical because the marked rise in traffic has not been matched by the necessary increase and renovation of the fleet. Nor have the availability of spares, improvements in repair facilities and better training of personnel of all grades kept pace with traffic developments.

The situation is further aggravated by overloaded operation of the units (often up to 100%), by difficult urban traffic conditions, and by the inadequate training of the drivers.

The repair workshops visited during the mission by no means use their plant and machinery to full capacity. Their equipment is generally over-age, but its efficiency could largely be restored through better maintenance and operation, improved organization of spare parts supply and reclamation and more careful supervision of the labor.

On the contrary, productivity and organization are fairly good at the Amiria Workshop, which is responsible for the repair of mechanical components and – to the extent its equipment allows – for the manufacture of spares. Further improvement of its organization could, nevertheless, lead to appreciable advantages.

2.1.4 The Road and Rural Transport Organization

This Organization provides for urban and extra-urban road passenger transport. The mission visited the Alexandria workshop of the General Nile Bus Co. for the Western Delta, which carries out maintenance on about 100 vehicles and sees to heavy repairs for the whole fleet (about 370 units). The workshop is now being removed to new premises where overall organization of the work, and in particular reclamation of the spares will be improved.

2.2 MINISTRY OF IRRIGATION

The Mission was invited to look into maintenance problems of the Electromechanical Department. Some pumping stations were inspected: one, installed many years ago in the vicinity of Cairo (Delta Barrage), and four recently built at Esna (Luxor).

The first operates under fairly satisfactory atmospheric conditions and appears to be fairly well maintained, the personnel being both adequately trained and well supervised.

The others operate under typical desert conditions and appear not so well maintained, mainly due to poor staff training. No detailed instructions, for proper maintenance are provided. Indeed some basic procedures for the correct operation of electro-mecanical plants do not appear to be satisfactorily performed. Rapid revision of adequate training for personnel of all grades seems required as does also the supply of the most important spares, and maintenance tools and instruments.

The Maintenance Workshop at the Delta Barrage was also visited and here the same remarks apply as for most of the workshops visited coming under other Ministries.

2.3 MINISTRY OF INDUSTRY: GENERAL ORGANIZATION FOR INDUSTRIALIZATION

The Mission was invited to visit the Egyptian Spinning Co. (ESCO) and the Helwan Iron and Steel Works.

Prior to the visits meetings were held with the executive staff of the two companies in order to clarify points of interest and the methods to be adopted for the survey. During the visit the Mission was accompanied by officials of the Organization. A general meeting was held on completion of the program, and the need for more centralized inventory control, and spares supply and reclamation was emphasized.

2.3.1 The Egyptian Spinning Co.

This Company is made up of four works; the Rayon Mill, the Spinning Mill, the Weaving Mill and the Dyeing and Finishing Factory, merged after being nationalized.

The Company's maintenance and repair problem appears to be one of a structural nature. A detailed study of the General Plan of Management and of the lines of responsibility and authority as far as inventory control and spare parts reclamation are concerned could be a good starting point for the solution of many problems. This restructuring should attain the following aims:

- greater centralization, control and reorganization of maintenance procedures;
- creation of a central repair workshop, and redimensioning of the individual factory workshops, which will then have the sole task of carrying out light repairs and maintenance;
- providing this central workshop with a Management scheme for a proper production planning and control, and for a thorough engineering study of spares;
- reorganization of the Purchase Department, particularly with regard to spare parts and relevant raw materials, and the creation of a Central Spare Parts Store, with suitable inventory controls and reordering procedures, and appropriate methods for providing assistance to the manufacturer and for acceptance control;
- training of maintenance personnel at all levels, possibly including machine operators, at least as far as lubricating procedures are concerned.

2.3.2 The Iron and Steel Works

The Maintenance and Repair Service employs about 1,200 hands, and produces about 25% of the spare parts required. The organization is fundamentally sound and well administered, but the methods used seem

inadequate for the importance and size of the service. In this aspect there seems to be room for considerable improvement.

The laborforce is trained to the National standard, but productivity is rather low, mainly due to the over-crowding caused by an excessive number of apprentices. It would appear advisable to revise training methods.

2.4 GENERAL REMARKS

As far as it was possible for the Mission to judge from the economic activities surveyed, the country's industry seems to be passing through an important transitional phase whose outcome could be markedly influenced by a pronounced shift into better management techniques resulting in increased productivity.

An assistance program concerned with the improvement of Maintenance and Repair Services seems to be an important step for ensuring a positive outcome.

3. REPORT ON THE SURVEY

As already remarked, the Mission's survey in the UAR was confined to a limited number of activities and to a limited number of firms within each activity.

Consequently it was not possible to operate in full accordance with the Terms of Reference.

Thus the Mission had to omit (or was not allowed to investigate) certain structural and macro-economic aspects originally provided for in the survey methods and objectives. This applies in particular to the questions to be answered in Para 3.1, Annex A of the Contract, for which the answers will necessarily be incomplete.

This chapter, however, was structured and itemized according to Para. III, 1 to 4 of Contract's *Annex A*.

3.1 IMPORTANT INDUSTRIES (OR ECONOMIC ACTIVITIES)

a) As far as the transport activity, for which the survey could be fairly comprehensive, the following can be said:

- There are four large companies with a fleet of 1,600 trucks and 800 trailers operating in the road transport sector.
- In the river transport sector there are two large companies with a fleet of 800 units of various types.
- The railways have 540 diesel locomotives and units, 120 steam shunting locomotives, 1,050 passenger carriages and 16,000 freight wagons.
- The City of Cairo alone has an urban transport service with some 1,500 buses and 250 trams.

It is not possible to give any general information on the other groups of activity, which the Mission was allowed to survey only in part.

b) All the firms surveyed have been in existence for many years except for the Iron and Steel Works. However, there were grouped together in companies in 1952 when they were nationalized.

c) As far as the impact on the national economy is concerned, the following can be pointed out:

- It is difficult to define, in figures, the impact of transport on the national economy. It can, however, be stated that in the 1960-1965 period the total volume of freight and passengers increased from 4,500 to 7,200 million ton x km and from 12,000 to 19,000 million passenger x km respectively. The statistics on hand only give the values for the whole aggregate of transport items, hence it is not possible to deduce the contribution Inland Transport makes to the GNP.

- The cotton textile industry is certainly one of the most important in the country, both as regards employment and as regards the conntribution it makes to the GNP. In 1965, production was 138,000 tons of cotton yarns and 89,000 tons of cotton fabrics.

- From many aspects the Iron and Steel Industry is of considerable importance and is in continuous expansion. Its present output is around 230,000 tons, which should be substantially increased in the coming decades.

d) It is estimated that the value of manufactured cotton goods exported is around £E 40 million or 15% of total exports (1965).

Iron and steel items do not figure on the list of exports but the importance of this sector may be viewed in terms of import savings and the help it thus provides to the balance of payments position.

e) The following comments may be made on the age and condition of equipment:

- In the road transport field (goods) the age of the equipment is average in general and its efficiency – which may presently be classed as fair – could be improved. On the whole, the degree of standardization can be taken as satisfactory.

- Many of the river transport units are of recent construction and their state of maintenance is satisfactory. The same can be said, in general, for their degree of standardization.

- With the railways, the age, state of repair and standardization all seem good in the case of locomotives, not so good where passengers coaches are concerned, and only poor to fair for freight cars.

- Within the inland transport activities and within the limits of the survey, the Cairo urban transport seems to be the sector where the worst conditions are encountered in the case of age, efficiency and standardization alike.

- The Iron & Steel Factory, which is the only national steel industry of major importance, was constructed fairly recently. It is still going through a stage of expansion and its efficiency may be classed as satisfactory.

- It is not possible to give a general judgement on the other activities surveyed (textiles and irrigation) because of the small number of installations visited. It is, however, noted that there has been a decline in new investment in the textile sector in recent years, while on the other hand, the Ministry of Irrigation has a certain number of relatively new installations.

3.2 EXISTING REPAIR AND PHYSICAL FACILITIES

a) All the installations visited, apart from some small ones (Ministry of Irrigation Pumping Stations) have independent repair and maintenance sections with responsible managers. Detailed repair and maintenance schedules are not often to be found, though sometimes they are said to be under consideration. Much more rarely are such schedules carried out correctly and methodically.

b) There are a certain number of sectoral centralized repair shops, all of them Government owned. These are all large (600-1,200 workers) and

do their best to meet the requirements of the Organizations or the Ministries to which they are responsible. However, in but a few cases, the equipment appears to be generally old and not properly maintained. Furthermore, it is very often wrongly operated, its productivity and quality of work thus being of a low standard.

c) There are not sufficient spare parts, mainly because of foreign exchange difficulties which oblige the Government to exercise strict control over all imports. The general tendency is to utilize the bulk of foreign exchange to buy capital goods, and this leaves little available for the purchase of spares. This policy means that every possible used part must be reclaimed, refurbished and put back into usable condition, and the greatest possible use made of local productive capacity.

d) As a result of this situation, over the last few years there has been a marked increase in the availability of spare-parts manufacturing facilities. The quality and the cost of local production are still far from being competitive vis-à-vis foreign made items. According to a recent study of the spares situation in some of the most important sectors of activity, the present local production capacity could hardly meet more than 30% of overall requirements (by weight) and barely 10% in the case of automobile spares. The same study indicates that present capacity could be brought up to 85%. It is suggested that the findings of this study should be implemented with the minimum of delay.

e) The availability of organized adequate stores could be improved to a fair extent through more widespread application of sound inventory control methods at all levels.

3.3 PREVAILING CONDITIONS OF REPAIR ACTIVITIES AND DIAGNOSIS

a) The present facilities for repair and maintenance appear to be far too inadequate. As mentioned elsewhere some cases can be found in which the production loss or idle time can be as high as 50% and the cost of repairs can increase by up to 100%. This is not the case however in the manufacturing industries surveyed, where the losses are reported and estimated by the Mission to be of much smaller magnitude, though still very heavy.

b) Within the activities and the firms which the Mission was allowed to survey the problem of maintenance and repair seems to be particularly acute in the field of road and urban transports.

c) It would seem that the factors affecting the adequacy of maintenance and repair facilities may be identified and graded as follows:

- lack of experienced management;
- lack of training of both operators and maintenance labor;
- scarce availability and incorrect use of spare parts
- poor efficiency, maintenance and operation of the existing maintenance and repair facilities;
- lack of some special-purpose machinery.

d) In the most critical groups of activity among those surveyed by the Mission, the lack of standardization does not seem to be so acute. Of course the present degree of standardization could and should be improved, but the solution requires a very large and comprehensive implementation program both at Government and managerial level.

e) No specialized Government organization or private institution is at present to be found which deals with repair and maintenance. The problem is however deeply felt and several industrial managers are dedicating time and effort to a wider understanding of the principles and advantages involved.

f) As far as the Mission knows, there are as yet not Government policies affecting repair and maintenance.

3.4 PERSONNEL

a) The present availability of skilled personnel is fairly poor. Apparently no personnel has had or is undergoing specific training in repair and maintenance.

b) Within the actual limits of its survey, the Mission has found in many cases centralized vocational training centers, and inplant and on-the-job training systems, though not specialized on maintenance. It is the Mission's opinion that whereas the present abuse of the latter is damaging and ineffective (1), better use could be made of existing training centers, through reasonably improving their equipment, more and better trained instructors, improved programs and full capacity utilization (two shifts daily). The better training and larger availability of instructors, which seems to be the key- problem, could possibly be solved by making use of certain specialized training centers abroad, possibly on a fellowship basis.

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(1) The Mission feels it necessary to point out that in most of the surveyed firms the workshops were apparently overcrowded with unskilled labor and apprentices to such an extent that even movement becomes a problem.

It is easy to realize that under such conditions the trainees reap on real benefit, productivity of skilled labor is decreased by the reigning confusion and disorder, and idleness becomes a permanent habit of living and thinking. The direct and indirect costs of such a surfeit of trainees are much higher than may be realized, not only for the individuals and for the firms concerned but also for the country as well. For economy-minded people it will be clear that this money could be spent in a more profitable way on the improvement and expansion of Training Centers.

Furthermore it seems inconsistent that under such conditions the existing Training Centers should be operated only one shift per day, whereas they could double their capacity or make their programs more comprehensive through a two-shift system.

4. CONCLUSIONS AND RECOMMENDATIONS ON FUTURE POLICY

a) The most important maintenance and repair needs can be summed up as follows:

- spare parts and up-graded machinery, as far as physical facilities are concerned
- training of personnel, as far as human resources are concerned.

It appears very difficult to fix priorities since, as discussed elsewhere interrelationships between physical and human resources are many and complex. It has been stated, for instance, that better repairs done by better trained labor would result in anything up to 30% savings in labor and spares. And the Mission thinks that this evaluation is by no means optimistic.

It is the Mission's opinion that speeding-up the training programs as far as possible, especially those for management and supervision, would prove to be the most effective solution, in as far as this should increase the spares output of the existing facilities and improve the spares' utilization. In the meantime all efforts should be made to expand the Nation's and Companies' facilities for spare parts production and reclamation.

b) Though it is very often claimed that there is a lack of physical facilities, it is felt that up-grading the existing facilities, (which are generally in very poor condition because of a serious lack of maintenance and repair) would provide the most effective and economic solution to the problem. In a few cases, however, some new special purpose machinery is actually needed, such cases can be fully identified only at a later stage of the study, though certain have been specifically indicated in the Appendices wherever possible.

c) In general, the industrial structure of the country does not call for any new central facilities in addition to those already in existence. It is the firm opinion of the Mission that up-grading or, when necessary, redesigning the present workshops plus improvement in managerial methods and productivity of labor will in most cases be sufficient to cope with most present and future maintenance and repair requirements.

d) It has already been stated that not only is on-the-job training presently used to excess, but is also costly, ineffective and detrimental. The Mission therefore suggests that priority study be made of the possibility of transferring as many as possible of the present on-the-job trainees into the existing vocational centers. The capacity of these could be doubled by adopting a two shift system. Short period classes in the factories and in-plant training could also be adopted for up-grading workers. This program of course calls for a greater availability of instructors, and to meet this demand both domestic and abroad training facilities should be fully used.

e) Improvement of existing stores should be obtained through better inventory control methods and possibly through the use of operational research methods, which may eventually point to the need for new stores, and indicate both their optimal size and location on a nation-wide basis.

f) The same suggestions as made above apply to decisions concerning the establishment of spare parts storage systems (in-plant or central stores). In several cases during the course of the survey the paramount importance of tackling these problems was extremely apparent to the Mission.

g) As far as the establishment of spare parts manufacturing facilities are concerned, the Mission recommends that on the basis of existing studies a comprehensive and definitive survey be carried out and an implementation program be established concerning the full use of present facilities (which in some cases seem to be run well under capacity) and the installation of new ones to optimally fulfil present and future needs. The latest methods of production planning and control will be necessary for the sound operation of such concerns, both existing and future, in view of the variety of the problems to be solved.

h) At the present state of the world economy, many developed countries and mother-factories realize that it is in their own interest to play major role in helping sound development in the technically less advanced countries. However, some basic conditions are lacking, which often hinder the required full co-operation. To this end, it is suggested that a comprehensive plan of implementation be prepared and submitted to Governments and mother-factories for resolving the need for maintenance and spare parts facilities. The plan should also include a full assessment of financial and economic features of the operations, and proposals as to the help required both in the form of capital and technical assistance.

5. SUGGESTED PROGRAM OF IMPLEMENTATION

As far as the surveyed activities are concerned the program should provide for a comprehensive study of the following basic problems:

- management of maintenance and repair workshops, with special regard to maintenance and repair scheduling
- spare parts inventory-control and production
- training of maintenance and repair personnel
- cost accounting procedures for maintenance and repair.

Whereas these problems are to be found in almost all of the activities surveyed, it is thought that among these the following fields are in many aspects the most critical:

- road and urban (Cairo) transport
- textile industry.

For each of these fields the program should consist in a short-term and a long-term phase.

A) The short term phase should be carried out by the following staff:

a) one team of consultants for general management, consisting of:

- an expert in maintenance procedures and in management of workshops
- an expert in maintenance cost-control and operational statistics
- an expert in training techniques.

This team should provide assistance for both the transport and the textile fields.

b) a team of consultants for the transport field, consisting of:

- a production engineer, expert in motor-vehicle repair workshops

– an expert in motor vehicle spare-parts storage and supply.

This team should be given a 12-month assignment to study and provide practical solutions and follow up advice to a few selected transport companies.

c) a team of consultants for the textile field, consisting of:

– a production engineer, expert in textile machinery repair workshops

– an expert in textile machinery spare-parts storage and supply.

This team should be given a 12-month assignment to study and provide practical solutions and follow-up advice to a few selected textile companies.

The short term program to be inplemented for each of the selected firms in any of the two fields of activity should include the study of:

1 – lines of authority and responsibility in the whole firm for the Maintenance, Purchase and Store Departments;

2 – workshop production planning, scheduling and control; machine loads and capacity; work-flow and machinery lay-but;

3 – preventive maintenance schedule both for production and maintenance units;

4 – detailed work-sheets and procedures, whenever feasible, for repetitive maintenance jobs;

5 – drawings, specifications and work-sheets for main spare parts; possible redesigning criteria;

6 – inventory control and reordering procedures for spare parts and maintenance raw-materials;

7 – maintenance cost accounting procedures;

8 – collecting, processing and final utilization of statistical operations data;

9 – size, output, physical facilities, programs and operation of Training Centers for maintenance labor and operators as well.

Should this program be deemed to be too comprehensive, or should it be decided to implement in stages, the Mission feels that first priority should be accorded to points 1, 3, 6, 9. However, for many reasons it is felt that for the best overall results it would be better for the whole program to be implemented in only one firm rather than a reduced program in several firms.

B) The long-term phase should be carried out according to criteria and programs which can be formulated only on the basis of the observations which will emerge during the implementation of the short-period phase. However, as far as it is possible to foresee at the moment, the long-term phase should be carried out by a staff composed of 6 experts in the various fields of activity, and extend to a period of about 3 years, according to the economic activities to be covered.

C) Both for the short and long-term assistance a staff of counterparts at Ministry and Company level should be assigned to the UNIDO teams, in order to acquaint them thoroughly with the methods of tackling the type of problems involved, and so that an efficient local staff could be prepared for the institution of Management Consulting Centers at Ministry level.

6. LIST OF APPENDICES

A-3.3 THE AMIRIA GARAGE FOR BUSES

A-3.4 THE AMIRIA WORKSHOP

A-4 THE ROAD AND RURAL TRANSPORT ORGANIZATION THE GENERAL NILE BUS CO. FOR WEST DELTA, ALEXANDRIA

B – THE MINISTRY OF IRRIGATION

B-1 THE DELTA BARRAGE MAINTENANCE WORKSHOP

B-2 DELTA BARRAGE PUMPING STATION

B-3 ESNA PUMPING STATIONS

C – THE MINISTRY OF INDUSTRY: General Organization for Industrialization

C-1 ESCO

C-1.1 THE ESCO RAYSON MILL

C-1.2 THE ESCO SPINNING FACTORY

C-1.3 THE ESCO WEAVING FACTORY

C-1.4 THE ESCO DYEING AND FINISHING MOSTROE FACTORY

C-2 THE HELWAN IRON & STEEL FACTORY

Appendix A

THE MINISTRY OF TRANSPORT

Manager of Planning and Follow-up: Dr. Kamal Hishmet

The Ministry includes the following Organizations:

- The Inland Transport Organization
- The Egyptian Railways General Authority
- The Cairo Transport Authority
- The Rural and Road Transport Organization.

The main maintenance problems of each of these Organizations were briefly discussed. Special emphasis was placed on specific problems affecting the Inland Transport Organization (spare parts) and the Cairo Transport Authority (age, type and condition of the units).

The program of visits was briefly outlined, details being left to be agreed directly with the various Organizations.

At the termination of the assignment, the conclusions resulting from these visits were expounded and discussed with the Chairmen and executives of the individual Organizations (see relative Annex), and again elucidated, with Dr. Hishmet. At the end of the discussion, Dr. Hishmet indicated that he was particularly interested in UNIDO's assistance, especially in the case of the Cairo Transport Authority.

As can be seen from the reports on visits to various of the Ministry's workshops, it could well be that among the branches which the Mission was allowed to survey priority should be given to the Cairo Transport Organization, especially in view of the social implications involved.

Appendix A-1

THE INLAND TRANSPORT ORGANIZATION

Chairman: Mr. Bedawi Fouad

Deputy Chairman: Mr. Salah Khairi

The Organization, consists of the following Companies:

a) The Nile Co. for Automotive Repairs, Cairo

b) The Work Transport Co., Cairo

c) The Goods Transport Co., Cairo

d) The Direct Transport Co., Cairo

e) The Inland Transport Co., Alexandria

f) The General Nile Co. for Water Transport, Cairo

g) The General Nile Co. for River Transport, Cairo.

The first of these companies is responsible for the heavy repairs of all the units operated by the four road-transport companies *b)* to *e)*.

In addition, each of these four companies has its own workshop for routine maintenance, for light repairs and for the general overhaul of a certain number of engines.

On the contrary, the General Water Transport Co. appears to be equipped fairly completely for repairing and servicing their own units, whereas the General River Transport Co. seems not to be so well equipped.

There is also a Training Center which trains drivers and workmen for the four road transport companies, as well as a Training Center for the crew and the workshop man-power of the General Nile Co. for Water Transport.

The conclusions drawn from the visit to the six companies based in Cairo, and later confirmed at the various meetings at management and presidential level, may be summarized as follows:

Road Transport

- As far as Maintenance and Repairs are concerned, the operational conditions of the Organization and of its Companies, are hindered by structural shortcomings and by limiting factors such as availability and allocation of physical facilities and spare parts, and the training of staff at all levels.

- On the subject of structural shortcomings affecting the Maintenance and Repair Services, it would appear necessary to re-examine, in the light of the Organization's Articles of Association, exactly who is responsible for what and exactly where any given officer's authority extends. The aim of this exercise would be to correct certain tendencies towards dispersion which, even though aimed at furthering the efficiency of the individual companies, could well be detrimental to the Organization's overall efficiency. The foregoing applies particularly to the organization of spare parts storage and reclamation, as well as to the share of general overhauls to be allocated to the Nile Co. So that there should be no overlapping of responsibility, and to ensure that the best possible use is made of all available facilities, new ways of fulfilling statutary obligations should be worked out. The initiative and economy of each individual company should however be safegarded.

- The physical facilities presently available seem to be in general adequate for the requirements of the Organization as a whole, provided that their efficiency, and allocation among the single workshops be improved, the work better prepared and the training of personnel at both managerial and shop-floor level duly improved.

  As far as the need for new physical facilities is concerned it was not possible for the Mission to prepare detailed lists for the firms surveyed. It would indeed require at least a rough study of the production programs and of machine loads the basic data for which were often not available now was there time to collect them. Furthermore, since there was a general tendency to attach first or exclusive priority to physical aids, the Mission was very often obliged to stress that by far, the most important scope of the survey was to assess the needs for managerial assistance.

Nevertheless needs for special purpose machinery were pointed out whenever the case arose. However it is possible to state that in general physical facilities are not lacking, keeping in mind that repair and maintenance do not generally require up-to-date machinery; the real problem is to keep the existing ones in proper condition.

– While the present foreign exchange difficulties persist, the spare-parts problems should be tackled through:

  . more centralized inventory control;

  . more centralized and organized reclamation of used parts;

  . better training of personnel engaged both on the repair and operation of motor vehicles;

  . a careful technical and commercial study of the spare parts requirements situation, and of the possibility of producing such spares within the Organization or on a national scale.

– The problem of personnel training for all grades is of the greatest importance from the social (productivity and living standards), economic (cost of services), and foreign exchange aspects alike (increased machine life, less breakdowns and reduced spares consumption).

It is estimated that at present 1.8 workmen are used on the repair and maintenance of each motor vehicle. This is about 3 times the international standard.

Estimates made by local Managers emphasize the same point. They state that 25% of all repairs presently derive from damage caused by poorly trained drivers, and 50% from poorly trained maintenance men. Full evidence for this can be found in the excessive wear to be observed on some of the parts stripped for repair (crankshafts, gearcases, cylinder heads, etc.), in the great number of breakdowns on the road, as well as in the absurd range of revolutions under which the engines are usually operated.

Hence, better training of drivers and mechanics alike seems to be of prime importance. Both their basic education and their vocational training ought to be improved. The professional level of the executives and instructors should

be upgraded too, while the capacity and equipment of the Training Centers should receive due attention and the programs improved (1).

Water Transport

As far as maintenance and repair are concerned, the general operating conditions of the two Water Transport Co. appear to be better than those of the Road Transport Co. Nonetheless, both the Water Transport firms suffer from many of the shortcomings commented upon in the case road transport too (intercompany workshop policy, physical facilities, spare parts and training), though to a somewhat different extent. It should also be noted that while an interesting modernization program is presently under way for the General Nile Co. for Water Transport, nothing of the like is being done for the General Nile Co. for River Transport. This latter company seems to be awaiting outside assistance for resolving its problems.

As in the case of the Road Transport Co., the best approach seems to be that of drawing up a common modernization plan capable of satisfying the present and future needs of both the Water Transport Co.

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(1) To offset the shortage of the Training Centers, on-the-spot training is often adopted, each workman being given one or more apprentices. However, not only is this system inefficient and costly, it also militates against the productivity of the workshop and does little to improve the training of the apprentice. Indeed, in many cases it merely creates confusion and leads to general idleness. It is suggested elsewhere in this Report that, both for social and economic reasons, it would be better to move the excess on-the-job trainees from workshops to Training Centers, which seem to be generally used only one shift per day. The increased number or instructors should not pose any insuperable problems.

Appendix A-1.1

THE NILE CO. FOR AUTOMOTIVE REPAIRS

Technical Manager: Mr. Mohammed Hashish

Commercial Manager: Mr. Mustafa Kamel

1. This Company undertakes heavy repairs for the whole of the Inland Transport Organization's vehicle fleet (approx. 1,600 trucks and 800 trailers).

2. The production schedule calls for 60 heavy repairs (body and motor), 80 complete engine overhauls and 100 light repairs per month.

   In principle, each vehicle is scheduled for a heavy repair every two years (160,000 km approx.). However, this program is often thrown out of gear by frequent non-scheduled repairs (20-25 per month), due mainly to traffic accidents and serious breakdowns on the road (1).

3. The spare parts problem is particularly aggravated by the fact that the individual Companies cannibalize many important components (gearboxes, transmission shafts, starter motors, etc.) before sending their trucks to heavy repairs.

4. The buildings were originally designed for other purposes and do not particularly lend themselves to a rational layout for a good workflow. Space problems are also aggravated by trucks lying about an excessive length of time because of organizational and supply problems.

   Apart from the lack or shortage of certain types of machinery (e.g. internal and external surface grinders), the physical facilities – though old for the most part – could suffice for production needs if properly maintained and utilized. Actually very little care is given to the shop's physical facilities, and no preventive maintenance at all is performed.

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(1) Breakdowns on the road appear to be very frequent and are clearly due to overloading and poor execution of routine maintenance and heavy repairs.

5. There are no standard procedures for the repair and maintenance of the machinery which, for the most part, operates in a precarious state, to the detriment of quality and job cost alike.

6. There are no standard procedures for the programming, preparation, distribution and control of production. The same remarks apply to cost accounting procedures which, if carried out correctly, could do much to develop a cost-conscious approach and mentality in a system where, because of centralization, there is a risk that this important aspect may be overlooked.

7. It would seem that the labor force is considerably in excess of real needs, as also borne out by certain data supplied by the management.

   Indeed, on the basis of:

   650 hours for each heavy truck repair

   150 hours for each heavy trailer repair

   2 years between successive heavy repairs

   2,000 hours per year per worker

   1,600 trucks

   800 trailers

   then manpower requirements should be

   $$\frac{1{,}600 \times 650 + 800 \times 150}{2 \times 2{,}000}$$ = 290 hands, or 50 of the present laborforce (600 hands)

   The need to train apprentices on the job only partially accounts for this large excess.

8. The training of manpower appears to be very poor, a factor which is aggravated by the lack of experience at the middle and top management levels. The present method of on-the-jobs training of both workers and apprentices cannot therefore be effective. Furthermore the number of apprentices seem to be grossly excessive not only as far as the shop's physical

capacity is concerned, but also as compared with the expected number of future jobs available. Great confusion and overcrowding seems to be the most apparent result.

The short-term solution for resolving the question of staff training would therefore seem to consist in improving the training of the middle and top management. In this way even a low skilled worker should be able to carry out his task on the basis of detailed work sheets and under competent guidance. In other terms the problem should be shifted from upgrading a big number of uneducated workers into improving a much smaller number of educated middle-and top-management people.

CONCLUSION

Despite limitations regarding space, physical facilities and trained personnel, the workshop could be put in a state to tackle its statutory obligations through a modern organization which provides for:

- the adoption of rational methods of production planning, scheduling and control; preventive maintenance and inventory control;
- the creation of an efficient work preparation and distribution service, and the organization of a good tool room
- the vocational training of key personnel, while reducing the number of on-the-job trainees
- steps to be taken by the Inland Transport Organization to:
  - *a)* stop cannibalization of trucks for repair
  - *b)* centralize the spare parts supply, reclamation and distribution service
  - *c)* define exactly the tasks and responsibilities of each Company within the Organization
  - *d)* establish standard procedures suitable for all the Companies and covering correct operation of trucks (overloading) and the correct performance of routine checks and maintenance.

e) complete the equipment of the workshop by the purchase of new machinery and/or by better redistribution of the machinery available in the workshops of the various Companies.

With the workshop thus reorganized, quantity and quality of output would be improved thus making an appreciable contribution to the short-term solution of the spares problem and ensuring better utilization of facilities while awaiting the long-term solution (increase of National output and/or improvement of Country's foreign exchange position).

The proposed reorganization would also help solve the short-term problem of staff training until the long-term program (discussed elsewhere) is implemented.

Appendix A-1.2

THE WORK TRANSPORT CO.

Technical Manager: Mr. Ahmed Joussef

1. The Maintenance Workshop undertakes the maintenance and light repairs on the company's vehicle fleet which consists of 263 Deutz trucks (1963), 38 Berliot trucks (1966) and 270 trailers (1963-1965). Some 6 to 8 general engine overhauls are also done each month.

2. Groups of 6 mechanics see to the routine maintenance and repair programs. There is a bonus scheme in force which is in some way linked to the monthly efficiency of the vehicles for which each group is responsible.

   The drivers also enjoy a similar bonus system, related to production (ton x km).

   It would be interesting to make a more thorough study of these systems to assess their effect on the operation economics involved, and perhaps to outline a better one which might be applied to all the Companies in the Organization. There is reason in fact to think that the present system does not operate very well, especially judging by the advanced state of wear of the engines overhauled. It would also appear that the system leads to vehicles being excessively overloaded and is the cause of frequent accidents.

   Heavy repairs are generally scheduled to be done after two years (150,000 km approx.) operation. However, unscheduled general overhauls of engines are by no means infrequent. These tend to be done in the Company Workshop, rather than in the Organization's Central Workshop, as required by the Organization's policy.

3. In general the spares problem tends to be resolved by cannibalizing vehicles due for heavy repairs, as well as by hurried and costly repairs to used parts, which in turn calls for more frequent repairs.

The store is being reorganized so that spares for routine maintenance are kept in the new garage, while those required for general overhauls are stored in the new workshop being installed in the premises of the old garage.

4. Functional installations are planned at the new garage for carrying out routine maintenance while the old garage is being adapted to cope with general overhauls.

5. The age and type of the Workshop machinery is varied but on the whole it is not in a bad state, though it could be substantially improved by establishing efficient standard procedures for preventive maintenance.

6. A study is presently being made of a system of standard procedures to improve the planning, preparation, distribution and control of production. However, at the moment it runs in a fairly orderly manner.

7. Labor productivity seems to be slightly above average, both because of better general organization and because of the production bonuses. In general, the standard of training of workshop labor seems above average, even though it should be possible to make considerable improvements.

   The same could not be said for the drivers and for the routine maintenance men. Indeed the overhauled engines appear to be in very poor condition, which gives full evidence of incorrect operation and inadequate routine checking. The bonus system could well have an adverse affect on the performance of both drivers and maintenance men.

CONCLUSION

Better management methods could be easily established and so improve the performance of the workshop.

The bonus system in use should be thoroughly studied by the Inland Transport Organization, and after due improvement it could be extended to all the Companies.

For other problems such as overlapping of authority and responsibility among the Companies, spare parts shortage, preventive maintenance procedures and up-grading of personnel, refer to the conclusions drawn in *Appendix A-1.1.*

Appendix A-1.3

THE GOODS TRANSPORT CO.

Technical Manager: Mr. Kamel Ahmed

1. The Maintenance Workshop undertakes maintenance and light repairs on the Company's vehicle fleet which consists of 395 Barreiros 10-ton trucks and 360 10-ton trailers. About 6 general engine overhauls are also done each month, which according to the Organization's policy should be done by the Nile Co. for Automotive repairs.

2. As regards the organization of day-to-day maintenance and operation control, the fleet is broken down into units of 30 trucks and 30 trailers. Each unit is assigned to a group of maintenance workers and drivers. A certain monthly target for each unit is fixed in terms of tons x km. A bonus is allowed when the target is exceeded. The Manager states that he is satisfied with the results obtained with this system of bonuses. It should, however, be noted that the company's trucks are nearly all newish, i.e. in the best condition for the application of such a scheme.

   Three types of maintenance are done:

   a) Immediate repair of defects noted by the drivers

   b) Routine inspections every 3,000 km

   c) Heavy repairs over 150,000 km

   In addition, each unit sends one complete truck and one engine to the Nile Company for Automotive Repairs every month for complete overhaul.

3. Spares are in short supply, so worn parts must be repaired and rebuilt, often using materials and machinery not well suited to the job. As a result, repairs are always costly and the life of the rebuilt part is always much shorter than that of the original. Cannibalization of trucks to be repaired is again widely used.

4. The general layout is satisfactory. There is sufficient machinery, albeit of various ages and types; but this is not usually well maintained. No maintenance schedule is in use.

5. There are no standard procedures for production planning, scheduling and control, nor for inventory control and for preparation and distribution of the jobs.

6. As far as could be judged by a rapid visit to the various departments, manpower productivity appears quite unsatisfactory. The department seems overstaffed, keenness appears to be lacking and there are no control procedures.

7. Viewed broadly, personnel training is not satisfactory. There seems to be a lack of basic vocational instruction as well as insufficient specific training in maintenance work. A large excess of on-the-job trainees is apparent. The overall result is detrimental to the individuals' professional up-grading, and detrimental to the shop's productivity and efficiency as well.

CONCLUSION

The existing premises and physical facilities could be much better used through sounder management. This should provide for better production, planning and control, proper maintenance schedule and better guidance of manpower. Here again such acute problems as spares shortage and excess apprentices call for solutions as previously outlined.

Appendix A-1.4

THE DIRECT TRANSPORT COMPANY

Manager: Mr. Hassan Mohamed Hassen

For reasons beyond our control the visit to this Company was very rapid. Thus it has not been possible to collect more detailed information. The general impression gained was that its level of efficiency is similar to that of the other companies in the Inland Transport Organization.

Hence, to summarize:

1) Quantity of machinery available sufficient, but state of maintenance leaves much to be desired.

2) Difficulties stemming from shortage of spare parts and poor quality of spares made locally.

3) Personnel untrained and lacking application.

4) Lack of appropiate organizational techniques.

The company has 400 trucks (140 Deutz, 190 Fab, 50 Mercedes and 20 miscellaneous) and 100 trailers. 60%of the trucks are tippers.

Bonus system similar to those used at the Goods Transport Company are in operation.

Appendix A-1.5

TRAINING CENTER FOR THE GENERAL ORGANIZATION FOR INLAND TRANSPORT

Manager: Mr. Mourad Ahmed Hamdy

1. The Center does not carry out basic training but runs courses for up-grading personnel (drivers and technicians) of the Inland Transport Organization and of the Cairo Transport Authority. Practical courses for training newly graduated engineers before they are taken on by the ITO are also its responsibility. The Center started up in 1965, and to date the output has been: 900 new drivers up-graded, 1,700 students in various skills. It is estimated that the failure rate is 2%.

2. The Center has 10 instructors, and it runs courses on engines - transmission and brakes - batteries - car electrical equipment - fuel systems - blacksmithing - welding - tyres - greasing and lubrificating.

   The last two courses take two weeks but all the rest last one month, 10 days of which are devoted to theory (6 hours per day) and the remaining 15 days to practical work (again 6 hours per day).

   The number attending each course varies between 12 and 15, and there is a total of about 100 students per month.

3. A fairly good impression was received during the visit. The classrooms and the premises for practical work are clean and tidy, the materials being laid out with criteria. As far as the lack of materials has allowed, every effort has been made to equip the classroom with visual aids. The Center is also responsible for the preparation of technical literature (books, monographs, manuals, etc.), which seem to be good enough for training purposes.

   The instructors appear to be conscientious and take a pride is their task, though they are perhaps too young and lack as yet the desired experience.

4. The visit to the Training Center prompts the following observations:

a. The general set-up of the Center is basically good and merits improvement with the aid of experts in this specific sector. This task should neither be difficult nor should it take long.

b. The way the programs are framed should be reviewed to check their suitability and, if necessary, they should be revised.

c. The number of instructors should be increased and their professional level up-graded.

d. Specific training should also include a better basic technical grounding.

e. A check should be made to see whether the courses are long enough and whether their structure best meets the operational needs of the Companies which will be using the personnel trained.

f. More visual aids should be made available through providing cutaways of the most important parts of engines, transmissions, etc., examples of separate parts, instructional drawings (non-mechanical), slides, slide projectors, etc.

g. There is an almost total lack of special tools for the individual makes of truck operated (FIAT, MERCEDES, DEUTZ, FAB, ICAROS, BARREIROS, BERLIOT, TIMUS, BEDFORD, SAVIEM). This renders practical training difficult. The Center should be provided with the special tools needed for at least the commonest types of truck in use.

h. There is not really enough machinery in the mechanical workshop: the amount should be increased. A few types of machines could be taken from the workshops of the individual Companies within the Inland Transport Organization.

i. The amount of testing equipment available is also limited and should be increased.

j. The same comment may also be made with regard to technical literature. A technical library should be set up, well-endowed with books on automobiles and trucks, and books on workshop technology (use of various machine tools - metal working - gears - forging - heat treatment).

CONCLUSION

There seems to be little consistency between the figures and results quoted for the Training Center and the apparent professional level of the drivers and manpower in the surveyed workshops.

The conclusion must be drawn that much better profit could be expected from the Center, provided that

- minor physical facilities were supplied
- the instructors were up-graded and increased in number
- the courses were restructured to better meet the Companies' actual needs for better trained manpower
- the Center were operated on the basis of two shifts per day, so that the courses could be more comprehensive and effective, and the yeraly output courses could be more comprehensive and effective, and the yearly output be overcrowded with unskilled manpower and trainees while the Training Center is operated only on shift per day.

Appendix A-1.6

THE GENERAL NILE COMPANY FOR WATER TRANSPORT

Technical Manager: Mr. Joussef Dawoud

1. The Maintenance Workshop is responsible for the maintenance and repair of the whole fleet of 363 vessels totalling around 70,000 tons and consisting of tugs, dam-barges, pusher and pushed barges, and self-propelled units. About 50%of these units are of recent construction, 40%are 10 years old, and the remainder were built between 1920 and 1960.

2. Maintenance and general overhauls of the fleet are carefully scheduled and methodically carried out. Close supervision is also exercised through control of fuel consumption.

3. The spare-parts problem is resolved with some difficulty thanks to good inventory control and efficient workshop organization. The workshop also includes a small foundry.

4. The present layout of the yard is not very functional, being bisected by a road (Cornish-el-Nil). A new yard is, however, at an advanced stage of construction at Ather-el-Naby. This is planned to have 3 ship-yards and to have a capacity of 9 units. Four sheds are also planned. These will have a total area of around 3,000 sq.m and will be for structural steelwork, mechanical work, foundry and stores.

   Most of the machinery is old and in mediocre condition. When it is moved to the new site it should be completely overhauled and equipment added, especially for sheet-metal working and foundry. A preventive maintenance schedule is lacking.

   The assistance of UNIDO has been specifically requested for designing these new installations, in toto.

5. The assistance of UNIDO has also been requested for the general organization of the new yard so as to ensure a correct workflow and a modern system of production planning, scheduling and control.

6. The standard of the laborforce as a whole appears to be above average and so, it would seem, is its productivity. However, it is still below international standards.

7. The Company has its own training center for crew and workshop personnel. Although this only recently came into operation it seems to be too small, does not have enough equipment and the instructors do not appear to be sufficiently qualified.

CONCLUSION

The Company appears to enjoy sound management, open to new methods and outside help. No doubt the efficiency of its workshop will be greatly improved by the new premises and physical facilities under way. And the benefits would be even greater if it were to receive assistance from qualified UNIDO experts. This could be a very good starting point for UNIDO's implementation programs.

Appendix A-1.7

THE GENERAL NILE COMPANY FOR RIVER TRANSPORT

Technical Manager: Mr. Louis Zacki

As time was pressing, the visit to this Company had to be completed very rapidly. Furthermore, the Technical Manager was busy with a Board Meeting and could only participate in the General Meeting of the Organization. Impressions gained during the visit may be summarized thus:

1) The Maintenance Workshop is responsible for the repair and maintenance of 441 vessels including tugs, dam-barges, pusher and pushed barges, and self-propelled units. The average age of these is approximately the same as those operated by the Water Company.

2) The fleet's maintenance schedules and methods are also of the same type as those adopted by the Water Company.

3) The spares problem is, however, considerably more difficult since there is no foundry and because the general level of efficiency of the workshop appears to be lower.

4) The ship-yard lies on the opposite bank from the mechanical workshop. The units have to be pulled onto dry land by very primitive means. The other physical facilities are scarce and even those available are not efficient. There appear to be no plans, at present, for improving the situation.

5) There seems to be little or no organization either in the workshop or in the ship-yard.

6) By and large the personnel training level appears to be rather low. Moreover, their efficiency and productivity are further lowered by the poor organization and the small amount of assistance provided by the managerial grades.

7) There is no internal staff training program.

CONCLUSION

The maintenance and repair physical facilities seem to be quite inadequate in comparison with the actual needs of the Company and the importance of its services to the national economy.

It appears to be in much greater need than the General Nile Co. for a renewed workshop and ship-yard, for better workshop management methods and for better trained personnel.

The spare parts shortage appears to be not so acutely felt as in the road transportation Company for some reasons such as the age of many units, the sturdiness of this class of units, and the smoother operating conditions. It is felt, however, that all these maintenance and repair problems will arise in the near future, and that timely provision should be made in order to insure more secure operation for the Company.

Appendix A-2

THE EGYPTIAN RAILWAYS GENERAL AUTHORITY

General Manager Technical Affairs: Mr. Ali El Nakib

Vice Chairman of the Board: Mr. Darwish Abd El Misich

Planning and Follow-up Manager: Mr. Fayez Morgan

The Organization operates a network amounting to about 4,500 km, divided into five areas: North, East, Central, Middle and South.

In recent years, traction has shifted from steam to diesel engines and thus the locomotive fleet is fairly homogeneous and modern.

The fleet is made up as follows:

–	1,400-2,000 and 1,000 HP diesel locomotives	377
–	diesel rail-cars	60
–	diesel suburban units	100
–	diesel buses	350
–	electric suburban units (Helwan)	25
–	shunting locomotives	120
–	freight wagons	16,000
–	passenger carriages	1,050

In principle, repairs and maintenance are carefully scheduled, though emergency repairs often badly affect the implementation of the original programs. The main workshops for light and heavy repairs are: the "Diesel Workshop" and the "Carriage

Workshop" in Cairo; the "Production Workshop" at Abu Zabal (Cairo), mainly for spare-parts; and the "Gabbari Wagon Workshop" for heavy and light repairs, in Alexandria.

The escort for this visit was Mr. Ibrahim Nigm of the Mechanical and Electrical Department, who is responsible for the foregoing workshops.

The conclusions drawn from this visit were duly discussed and confirmed with the Managers of the various workshops and with the Central Authorities. They may be summarized as follows:

- By and large, the Diesel Workshop appears to have sufficient equipment and to be technically efficient. The same cannot, however, be said about the organization and control of production. If this were reorganized there would be a marked improvement in the average life of the repairs, in the volume of production and in costs. Good results could also be obtained by a careful study of the general layout, and by better use and maintenance of the physical facilities for which efficient planning appears to be lacking. The lack of a crankshaft grinder for locomotives is very strongly felt. At the present time, these parts have to be sent abroad for repair. The high cost of such a machine and the relatively small amount of use it would have in the Country as a whole do, however, make it somewhat doubtful as to whether purchase of this equipment would be an economic proposition.

- At the present time, the efficiency of the "Carriage Workshop" is low. A new workshop is under construction and if this is to be really efficient a careful study must be made of the layout and general organization.

- The basic structure of the "Production Workshop" at Abu Zabal seems sound. However, the management methods in use seem to be rather antiquated and too cumbersome to control such a diversified range of activities. The adoption of a system of punched cards (of the Mc Bee type) for hand data processing would show immediate benefits. It would also be the first step towards the introduction of computer control.

  Improved efficiency at Abu Zabal could be very useful for increasing spare parts availability.

- The "Gabbari Wagon Workshop" appears to be in a rather chaotic state. The buildings are large enough but because of irrational layout and excessive average time for repairs, they are poorly utilized. Most of the machinery is

old, but if put in good order it could cope with all those repair jobs which do not call for modern, highly specialized, high-output machines.

The standard of the workforce would seem to be somewhat low, but its productivity could be improved with good organization and good guidance. There is talk of a new workshop being built, but this seems unlikely in the near future, for a variety of reasons. Be that as it may, a careful remodernization study of the existing workshop could radically improve efficiency without proving too costly.

– By and large, the standard of training of the personnel may be considered to be above average for the Country. Nonetheless, a considerable improvement in the present standard appears necessary. To this end, a large Training Center capable of accommodating 2,000 students with full board is being built at Narden (Tahrir) with UN assistance. The Center should be ready in 1975.

Appendix A-2.1

THE EGYPTIAN RAILWAYS DIESEL WORKSHOP

Manager: Mr. Ansary

Dep. Man.: Mr. Ghanem

1. This workshop is responsible for heavy repairs on all the locomotives and diesel units in the fleet, as specified in *Appendix N*0. *A-2*. It also carries out those light repairs which necessitate the bodies being lifted from the bogies. The average life of the units ranges from 5 to 15 years.

2. The schedule calls for heavy repairs every 3-3.5 years on average, for a total of around 250,000 km. The repairs normally take about one month and absorb some 10,000 man-hours. The average percentage of units out of service for overhaul and maintenance is estimated to be 15 to 18%.

3. The limited availability of spare parts is one of the main obstacles to the regular completion of the repair jobs, and prevents the engines being put back into service as quickly as would otherwise be possible. Many spares are made in the workshop, but often drawings, suitable materials, special equipment and especially heat-treatment facilities are missing. Crankshafts have to be returned to the makers for regrinding because there is no machine capable of handling 3-meter units. It is, however, appreciated that such a machine is very costly and would be used relatively little.

4. The shed where the lifting and overhauling is done appear quite suitable, and the operational departments seem sufficiently orderly. The general layout and the workshops for the repair and fabrication of spare parts do not, however, seem to be so satisfactory.

5. The repair and maintenance of workshop machinery does not always appear satisfactory and is not carried out following standard procedures. A preventive maintenance schedule would no doubt prove to be highly effective, since the average age of the machinery is fairly advanced and breakdowns seem to be by no means infrequent.

6. The top and middle management levels seem technically well trained, even though some individuals may be rather smug. However, it is recognized that from the organizational aspect (production planning, scheduling and control; work-sheets, job preparation and distribution, inventory control) advice from consultants could well improve workshop productivity and considerably cut the time the units are out of operation.

7. The laborforce (some 1,400 hands) appears sufficiently well trained in repetitive work, but it does not seem to be as efficient or as well controlled jobs of a non-repetitive nature.

CONCLUSION

Though the Management appears to be very reticent, and though the efficiency level of the workshop appears to be well above the national and Railways' average, large improvement could be expected from outside assistance for setting-up standard procedures concerning production (especially for non-commercial spares, which are the great majority) and workshop maintenance.

The new organization should prove very effective to the workshop's overall efficiency, by drastically cutting down time and average repair times, hence increasing the rate of utilization of the fleet and of the main sheds' floor space.

APPENDIX

MORPHOLOGIC AND FUNCTIONAL DATA AND FEEDING REQUIREMENTS

Appendix A-2.2

THE EGYPTIAN RAILWAYS CARRIAGE WORKSHOP

1. This workshop is responsible for heavy repairs for the whole fleet or railway carriages manufactured by about five main makers, and from 6 to 40 years old.

2. Heavy repairs are scheduled every 15 months when the carriages are said to have covered some 15-16,000 km. Time taken for repairs is said to average about 15 days. The average percentage out of service for repairs is said to be around 12%.

3. Here again the availability of spare parts and the management methods has a major impact on workshop efficiency, cutting the average operating time of the fleet and adding to repair and maintenance costs.

4. Both the layout and machinery are old and lack efficiency. A complete modernization program is under way, including the construction of a new workshop building. A careful preliminary study could keep the cost of this modernization within very reasonable limits, while ensuring a very efficient unit. Assistance from UNIDO would be very much appreciated.

5. There is no standard procedure for the repair and maintenance of the machinery. As noted, this equipment is of old design, but if it were put in good working order it could meet the repair-work requirements, often of a non-repetitive nature.

6. There are no adequate procedures for production planning, scheduling and control, nor does workshop supervision seem to be so effective as to offset the lack of skilled manpower and keep the number of idle hours within reasonable limits. It is, however, recognized that this is not one of the easiest types of work to organize. Again in this field, UNIDO aid would be greatly appreciated.

7. The skills of the laborforce (1,700 hands) are below average and the numbers are too large in comparison with the effective needs and the statistics given above. Inefficient management is a further brake on productivity.

CONCLUSION

The workshop seems to be in great need of sound management methods which could certainly offset the adverse effect of unskilled manpower, over-age machinery and scarce availability of spares. The new workshop underway should be speeded-up, and the occasion should be taken to up-grade the efficiency of the physical facilities, to improve the general layout and to establish better managerial methods. This should greatly improve the fleet's and workshop's present efficiency which, according to the quoted figures, is well below international standards.

Appendix A-2.3

THE EGYPTIAN RAILWAYS ABU ZABAL WORKSHOP

Manager: Mr. Latif Riad Khalil

1. This workshop was originally designed for the repair of steam locomotives; but after the railways shifted to diesels it was made over for the repair of shunting locos and of ore-cars, and for the production of spare parts as well.

2. The repair schedules for shunting locomotives and ore-cars heavier than those for the normal types of locomotives and wagons. In the case of shunting locos the schedule allows for 5,000 hours operation, followed by one month's repairs involving 1,400 man-hours. The average number of units out of action for repairs is around 20%.

3. Layout and machinery are not modern, but on the whole the level of efficiency is reasonable. To better meet the call for spares particularly, additional machinery should be provided such as special lathes, milling and gear-cutting machines, multidrilling machines, heat treatment equipment, etc. The foundry should also be enlarged and modernized.

4. The equipment seems to be in a fair state, but the general efficiency could be improved by correct maintenance procedures.

5. Basically the general organization appears sound, but especially in view of the variety of work handled, it should be stream-lined and made more efficient by using a system of hand-punched cards. These would also be useful for preparing the way for the use of a central computer in the future.

6. The laborforce (1,500 hands) seems to be of a reasonable standard, and as far as is possible with the present methods of general organization, it receives a fair amount of guidance and control.

7. The Management is aware of the difficult nature of its task and of the improvements possible. It would be only too willing to accept outside assistance for general reorganization.

CONCLUSION

The workshop's efficiency seems to be fairly well above the national average, though there is room for great improvement.

Since the management seems to be keen and open-minded this could be easily achieved through improved managerial methods, proper maintenance schedules and some new physical facilities.

Improving the efficiency of this workshop could prove of paramount importance for the spare-parts problem.

Appendix A-2.4

THE EGYPTIAN RAILWAYS GABBARI WAGON WORKSHOP

1. This workshop carries out heavy and light repairs on goods wagons of various types (by about 15 different makers), ranging from 1 to 50 years in age.

2. The production schedule calls for the repairs of about 1,000 wagons per month, about half for heavy repairs and the rest for minor jobs lasting only a few days on average.

3. The question of spare parts is very serious here and is a major cause of layups and delays. The parts reclamation and storage service is completely inefficient.

4. The layout is poor, especially in the wagon parking sheds where the lines are so close together that it is difficult even for the workmen to get by. The situation is further aggravated by the lack of a shifting-bridge which seriously hinders the circulation of wagons entering and leaving.

5. Most of the machinery is old and in a poor state of repair. There is no evidence of a standard procedure in operation for improving efficiency.

6. There are no efficient procedures for production planning, scheduling and control; nor for inventory control.

7. The manpower standard is very poor. Productivity is badly hampered by an excessive number of workmen and apprentices and by the lack of technical supervision and discipline.

8. It is said that a project for rebuilding this workshop ex novo has been under study for quite some time, but lack of funds render its implementation a long-term program, it would seem. However, it should be possible to completely modernize the old workshop at a relatively modest cost, provided that it is in the hands of a capable manager. Direct assistance from UNIDO would be both useful and welcome.

CONCLUSION

Here again poor layout, out dated machinery and a shortage of skilled man-power are very decided limiting factors, which could be largely offset by sound management.

Since financial problems would seem to prevent implementation of the new project for many years, it would be advisable to tackle the problem by improving the efficiency of the present physical facilities.

An experienced consultant could be of great help in the renewal of the workshop at minimum cost and in training and selecting the management for better operational methods.

Appendix A-3

THE CAIRO TRANSPORT AUTHORITY

Chairman: Mr. Soliman Abdel Hay

Technical Manager: Mr. Jussef Said

Escort: Mr. Roshdy

Using buses and trams, the Cairo Transport Authority provides urban public transport services in the city of Cairo. It is divided into five sections:

- 3 sections for the operation and maintenance of buses
- 1 section for general overhauling and heavy repairs of buses; this, in turn, is subdivided into three workshops: 1 for engines and 2 for bodies
- 1 section for tramways.

Each of the operating sections has 2 or 3 garages and subsidiary workshops for light repairs and daily maintenance.

The fleet consists of:

- 1,500 buses, mainly locally made, many of them quite old
- 250 trams, by 10 different makers, some purchased secondhand.

Because of the considerable increase in traffic and the difficult position over the last few years, which has hindered the natural replacement of the fleet and the purchase of the requisite spares, the CTA is hard put to carry out its duties. The average monthly distance covered by its units exceeds 150,000 km/year under what are often difficult traffic conditions and with severe overloads of anything from 50 to 100 %. The difficulties are further exacerbated by the lack of training of the drivers and maintenance personnel.

A round of visits was arranged to the Nasr Garage, the Tram and Buses Workshop, the Amiria Garage and the Amiria Workshop.

The following conclusions may be drawn from the survey.

- Due to rapid rate of increase in urbanization and to finantial and foreign currency limitations, the CTA has for many years been confronted with a host of problems which prevent smooth operation. The maintenance and repair problem, of the fleet is the most apparent,not least because of the shortage of an advanced age of the vehicles.

- The main points hindering fleet maintenance seems to stem from the spare-parts shortage, lack and inefficiency of physical facilities, managerial procedures in the workshops and scarcity of skilled labor.

- A larger availability of spares would apparently provide the most effective and immediate solution to CTA's problems, but it appears to be a long-term solution far exceeding sectoral possibilities, since it implies allocation of resources at the national level

- While all attempts should be made to increase domestic production of spares, workshop physical facilities and skilled labor, it must be recognized that, especially in the short term, a major contribution to the solution of the problem could be provided by up-grading management and supervision which in turn will result in up-grading the present physical and human facilities and in the better use of all available resources.

- To this end in-field assistance should be urgently provided by an experienced team of management experts

Appendix A-3.1

THE NASR GARAGE WORKSHOP

Technical Manager: Mr. Jussef Said

1. This workshop is responsible for maintenance and light repairs on 200 buses and has a capacity for 250.

   Three shifts are operated. Daily servicing is done on the night shift, together with any urgent repairs the need for which has become apparent during the day's operations. The two daytime shifts finish the repairs not completed by the night shift and carry out complete overhauls of components such as compressors, clutch plates, shock absorbers, etc. before these are returned to store.

2. In principle, there is a maintenance schedule for the individual units of the fleet, but it is not often possible to follow this because of unscheduled breakdowns.

3. The shortage of spares is very acute and makes fleet maintenance very difficult. It is frequently necessary to reclaim and reuse parts in poor condition, which naturally cuts the life of the repair. The reclamation and storage service could be greatly improved and the opportunity to do so should be taken when the workshop moves into its new quarters.

4. The layout of the new garage is reasonably functional and lends itself well to good work organization. Some machines and installations are of recent construction, but they are not always used in the best possible manner. For example, the department concerned with the degreasing and washing of stripped parts has a solvent-vapor bath but this is not used. Instead, the operation is done in a disorderly and primitive manner which wastes both solvent and labor.

5. There is no preventive maintenance schedule for workshop machinery.

6. The general organization of the work is inefficient. The procedures for production planning, scheduling and control seem to be ill-defined and poorly applied, mainly through lack of experience at the middle management level.

7. With but a few exceptions the labor does not seem to be well trained. Judging from the information and data received, and from direct observations, the training and basic technical knowledge of the drivers is also poor. According to a by-no-means excessively pessimistic assessment made by the manager other things being equal, maintenance work could be cut by 30% at least if the training of the drivers and operators could be brought up to a satisfactory level.

CONCLUSION

Considerable improvements in efficiency could result from the new premises and physical facilities, provided that the workshop is operated in accordance with sound managerial techniques. Production and maintenance schedules are needed; inventory control and reclamation of spare parts should be improved; supervision and guidance for manpower should be up-graded. This latter seems to be the key-point, in as far as up-granding a limited number of supervisors and managers should prove to be much easier than trying to do the same for a larger number of workers; and better manpower guidance should provide a short term increase of productivity, of repairs life and of spares utilization.

Appendix A-3.2

TRAM AND TROLLEYBUS WORKSHOP

1. This workshop is responsible for the maintenance and repair work on 330 trams, 120 tram trailers and 160 trolleybuses. Never more than 75% of the fleet is on the road. Maintenance of fixed installations (overhead lines and rectifying stations) also comes within the aegis of this workshop.

2. Broadly, the maintenance schedules provide for: bi-weekly routine servicing, fortnightly light repairs, six-monthly overhauls and a general overhaul every 200,000 km approx. However, this schedule is often thrown out of gear by the need to make urgent repairs, and by service requirements.

3. Apart from limitations deriving from shortage of hard currency, the spares problem is very serious indeed because of the worn state of the fleet, the difficulty of finding parts on the market, and the delicate nature of the electrical equipment. Inventory control and spare-part reclamation could however be substantially improved through better managerial techniques.

4. The layout of the workshop is not functional, but the reigning disorder is perhaps the main cause of inefficiency. Most of the machinery is old, but its poor state of repair and incorrect use aggravates the whole problem.

5. There is apparently no planned maintenance schedule for the machinery, which is mostly in very poor condition and wrongly operated.

6. The general organization of the workshop leaves very much to be desired. Indeed, it would not perhaps be going too far to say that management is non-existent.

7. With few exceptions the personnel seems to be insufficiently trained. The low productivity, the excessive number of hands and the great plethora of apprentices are all too evident. Indeed, there are 1,600 workers (600 for heavy repairs, 380 for servicing and light repairs and 600 for fixed installations) which means 2.6 men per unit.

CONCLUSION

Again the main reason for the poor performance of the workshop is to be found in management and supervision shortcomings.

Poor premises and layout, outdated machinery or non-existent machinery, lack of spares, ill-trained manpower are all very acute problems, but they call for long-term solutions and for financial and foreign currency availability, which are unlikely to be to hand immediately. Meanwhile short term solutions are urgently needed, which only managerial ingenuity and eagerness can provide by making the best use of the physical and human resources available.

The Mission believes that in this case too up-granding of managerial techniques by in-field measures suggested by experienced consultants could provide such short-term solutions.

Appendix A-3.3

THE AMERIA GARAGE FOR BUSES

1. This workshop attends to the repair and maintenance of about 300 buses, not more than half of which are on the road. The fleet make-up is fairly homogeneous(mostly SAVIEM) but very old.

2. A maintenance schedule for the fleet has been prepared, but it has proved not to be very realistic. In part it is impossible to adhere to this because of the very frequent unscheduled repairs and the pressing need to keep the buses on the road.

3. There is the usual spare-parts problem, aggravated by the fact that this type of bus is now out of production. However spare parts' life seems to be very short, because of the poor performance of both the workers and drivers.

4. There is plenty of space in the building, but the layout and the work-flow should be substantially improved. Most of the machinery is old but, in principle, it could meet the calls made on it, if it were better maintained and utilized. No preventive maintenance schedule has been prepared as yet.

5. Organization seems to be completely lacking and the work appears to be left completely to the initiative of the workmen.

6. The standard of the workforce (about 300) seems to be very low and there is a high percentage of illiterates. There is a serious retraining problem to be tackled here.

CONCLUSION

The workshop efficiency is indeed very low, the main causes being as usual of a physical nature (layout, machinery and spares) and of a human nature (management, supervision and labor). Whereas a long-term solution is to be worked out, both in-door and out-door, immediate assistance should be provided to up-grade the management and establish sound procedures to make the best use of the available limited resources.

Appendix A-3.4

THE AMIRIA WORKSHOP

Manager: Abdel Malek Sawires

1. This workshop is responsible for the repair and, if necessary, the fabrication of components (engines, gear-cases, differentials, shock absorbers, etc.) needed to maintain and service the buses.

2. By its very nature, the work lends itself to being rationally organized so that each worker carries out a highly repetitive task. However, the organization could be considerably improved through better planning and production control methods.

3. There is the usual shortage of spares, but inventory control gives the impression of being good. Reclaimed, repaired parts are put into store and duly issued for use in the various workshops.

4. The layout is acceptable and the space sufficient to ensure normal working conditions. The machines are adequate for the jobs they must do and are in a reasonable state of repair. A few special-purpose machines are however required, such as gear cutters, grinding and boring machines and heat treatment equipment.

5. The standard of the laborforce (250 hands) is judged to be above the National average, but the type of work done really calls for a greater number of more highly-skilled fitters and machine-tool operators.

CONCLUSION

Whereas managerial procedures should be improved as a whole in order to increase production and improve quality, special mention must be made of the lack of drawings and specifications of original spares. This results in spares being made or reclaimed with no reference at all to tolerances, materials, heat treatment and so on. Basically, this workshop is a rational attempt to create a "Central spare-parts reclamation workshop" and as such could well merit a careful case study.

Appendix A-4

THE ROAD AND RURAL TRANSPORT ORGANIZATION

THE GENERAL NILE BUS CO. FOR WEST DELTA, ALEXANDRIA

Manager: Mr. Amin Moursy

1. The Alexandria workshop is responsible for heavy repairs on the 370 vehicles making up the Company's fleet, plus light repairs on the 100 units based on Alexandria. The remainder of the light repairs are done in two branch workshops at Cairo and in two at Damanhur (one in the project stage).

   The vehicles are of 10 different makes. 40% are less than 5 years old, 50% between 5 and 10 years old, and 10% over 10 years old.

2. Apart from normal daily repairs, the maintenance schedules provide for a minor overhaul every 5,000 km, a major overhaul every 50,000 km and a general overhaul every 200,000 km. On average the buses do 80,000 km per year. Not infrequently however the maintenance schedules are upset by the need to carry out unplanned repairs when vehicles breakdown on the road and when accidents occur (10 per month on average).

3. The spare parts problem is aggravated not only by the usual foreign exchange difficulties but also by the fact that there are so many makes involved and by the age of most of the vehicles.

4. The new garage and workshop are nearing completion. The layout seems sufficiently functional to permit better organization and performance of repairs and a better control over the whole question of spares, their reclamation and use.

5. The machines appear to be in a poor state of repair. When they are moved to the new workshop they should be completely overhauled. Even so, it does not appear probable that they will be able to cope with all the repair-work to be done. Some new machinery should be added, such as grinding machines and universal mills.

6. There seems to be no efficient work organization and system of controls in operations.

7. Workshop personnel and drivers alike lack training. The Management estimates that at least 30% of repairs is due to poor quality work. The annual unit cost of repairs is estimated to be £.E 1,100 of which £.E 700 for materials alone.

CONCLUSION

Though its efficiency seems to be adversely affected by all the problems usually found in this branch; this workshop seems to enjoy open-minded management, eager to improve its basic knowledge and to establish new procedures and methods mainly to cope with the lack of skilled man-power. The estimate of the cost of the lack of skilled labor may be realistic enough, and anyway prove the importance attached to human and non-material resources. Outside technical assistance can be expected to result in outstanding improvements.

Appendix B

THE MINISTRY OF IRRIGATION

Deputy Minister: Dr. Mustafa El Kady

General Manager Mechanical

and Electrical Department: Dr. Tag El Din

Specific problems concerning the maintenance of a relatively new network of pumping stations were brought to the attention of the Mission. Similar problems were said not to exist in the case of the older installations.

It was therefore decided to visit the following:

– Delta Barrage Pumping Station, old construction

– Esna Pumping Stations (Luxor), of recent construction.

During the visit to the Delta Barrage it was also decided to visit the local Maintenance Workshop.

The Delta Barrage Workshop is responsible for the repair of all plant and machinery as well as the Department's vehicles and earth-moving equipment. There is also a Training Center which runs three-month courses for 50 workmen and drivers. The results are said to be satisfactory, considering the basic educational level of the trainees. The general level of training of labor and the managerial organization are also reported to be satisfactory. However, the visit to the workshop revealed some shortcomings in these two fields. These are detailed in the corresponding annex.

The visit to the Delta Barrage Pumping Station indicated that on the whole the operational situation is satisfactory and that the workforce seems to be trained to a reasonable level.

This cannot however be said for the Esna Pumping Stations where shortcomings have been noted at the managerial and executive level (see *Appendix B-3*).

When the final meeting was held at the Ministry of Irrigation, the opportunity was taken to emphasize the decisive role correct maintenance procedures can play in the successfull operation and life of plant, especially when it has to operate under particularly adverse environmental conditions.

CONCLUSION

If general conclusions can be drawn from such a limited non-random survey, it should be said that a better understanding of the special need for maintenance is required if such installations are to operate smoothly in desert regions. But this cannot in any case be expected from personnel who lack even the basic principles of electro-mechanical techniques.

As such labor is very difficult to find or retain in the spot, good and firmly based supervision must be provided to ensure proper guidance for unskilled workers; supply them the necessary basic tools; keep in stock some of the spares needed for routine maintenance and repair; and keep the existing workshop facilities in proper condition.

Appendix B-1

THE DELTA BARRAGE MAINTENANCE WORKSHOP

1. The workshop is responsible for:

   – maintaining and repairing vehicles, earth-moving equipment and miscellaneous machinery (200 to 300 units per year)

   – fabricating non-imported spare-parts (about 70% of requirements).

2. The schedules call for heavy repairs to the various types of machinery every 2 years or after 4,000 hours operation, on average.

3. Only 30% of the spares requirements are imported. The rest are made locally with whatever material happens to be available and without any working drawings. Good inventory control, better organization of the used-parts reclamation service, and the ex-novo designing of parts to be made locally (in line with local possibilities) could make this operation much more economic and effective.

4. The workshop machinery (machine tools, welders, alloy smelting furnace and forge) is fairly old and not so well maintained. There are also four mobile workshops which carry out light repairs on site.

   No maintenance schedule is on hand.

5. Apparently there are no standard procedures for production planning, scheduling and control, nor for inventory control.

   Production and reclamation of spares is left completely to the worker's ingenuity, no drawings being to hand.

6. The laborforce (600 hands) gives the impression of not a very high standard on the whole. The number of employees seems excessively high because there are so many apprentices, and productivity is even lower than it might be because of a shortage of expert supervision and effective organization. It

would appear that there is a bonus system in operation but it would seem doubtful whether it improves productivity at all, since the necessary organizational basis is missing.

7. There is a Training Center for workmen and drivers. Three-month courses are run which accomodate 50 workmen a time. About 50% of those taking the course pass the final exam. The basic educational level seems very low and the percentage of illiteracy is apparently high.

CONCLUSION

Notwithstanding its limited physical and human resources, the workshop should markedly improve its efficiency and better meet maintenance requirements if sound management procedures and skilled and diligent supervision were established.

A proper maintenance schedule should be provided to up-grade the existing facilities and substantially improve productivity and quality as well.

Drawings of spares should be available with the necessary specifications of tolerances and materials. Redesign is in many cases needed, in order to adjust the functional requirements of the parts to existing production facilities.

Closer supervision is needed too, in order to up-grade labor.

Appendix B-2

DELTA BARRAGE PUMPING STATION

This installation has been in operation for some decades and appears to be in a good state of maintenance and repair.

The Management seems to be reasonably efficient. There is a correct schedule for routine maintenance and servicing.

Not only are the personnel well managed, they also seem to be fairly efficient and of a better-than-average standard.

The climatic conditions here are not so bad as in the Esna District Stations which were visited later; this is a great help for proper operation and maintenance of electrical machinery and equipment.

The motors, control panels and electrical equipment appear to be in reasonable condition, though more careful maintenance is both possible and desiderable.

Appendix B-3

ESNA PUMPING STATIONS

The visits made to three pumping stations of the district brought to light some shortcomings in maintenance. Indeed there appear to be many deficiencies as regards:

- experience and training, as well as of some of the basic technical knowledges commonly required to carry out this type of equipment;
- standard procedures to be followed in a routine system,
- stock of some most important spare parts;
- provision of tools and instruments necessary to carry out routine checks and maintenance.

In the workshop responsible for the repair needs of the district, a certain number of newish and valuable machine tools were not protected against dust and flakes of mortar in a shop which was being redecorated.

CONCLUSION

The typical desert climate of the Esna district no doubt poses difficulties for the proper maintenance and smooth operation of such installations as pumping stations.

Very skilled and diligent labor is required, which is very difficult to find on the spot; on the other hand imported skilled labor is costly and turn-over is high.

The solution to the problem could be found in highly skilled and firmly established supervision; and every effort should be made to achieve this end.

Appendix C

THE MINISTRY OF INDUSTRY

General Organization for Industrialization

Manager of General Organization for Industrialization: **Dr. Moheb Steno**

Manager of Industrial Process at the General Organization for Industrialization: **Mr. Ahmed Amin Ibrahim**

During the preliminary meeting, the scope and program of the Mission's survey were defined.

The ESCO (Egyptian Spinning Company) and the Helwan Iron & Steel factory were chosen, but particular emphasis was given to the first, because of the peculiar needs and importance of the textile activity in the Country.

A second meeting was held. This was attended by Mr. Steno, Mr. Ibrahim and by the Managers responsible for maintenance at the two companies to be visited. During this meeting there was a general exchange of information and views on maintenance problems. The timing of the visits was broadly fixed, an agreement reached in this respect.

The conclusions reached during these visits (see Appendices) were expounded and discussed from time to time with executives of the companies concerned. They were also aired during a final meeting with Dr. Steno who showed himself to be intensely interested in UNIDO aid for the two companies, particularly ESCO.

Appendix C-1

ESCO

Chairman:	Mr. Mohamed El Mamon Habib
Chief Engineer:	Mr. Gamal Kafai
Deputy Chief Engineer:	Mr. Bousha Youssed
Manager Purchasing Dept.:	Mr. Fouad Wahba
	Mr. Ahmed El Baz
Location:	Bahtim (Cairo)

1. The Company groups the following factories:

The ESCO Rayon Mill

The ESCO Spinning Factory

The ESCO Weaving Factory

The ESCO Dyeing and Finishing Factory

These factories once belonged to various privately-owned companies, hence they each had their own individual character and production objectives. In 1961 they were nationalized and grouped into one concern known as ESCO. The merger was implemented according to certain lines of authority and responsibility from which the present Plan of Managements was derived. This provides for a certain centralization of the services related to maintenance and repair work in the Company as a whole. It seems however, that some centrifugal forces have prevailed in this sector, so originating harmful overlapping and duplication of efforts which adversely affect the overall efficiency of the service. Some action should be taken in this respect.

2. The maintenance sector, which by and large is not very satisfactory at the present time, should receive careful attention. In fact, it is our opinion that the fabrication of spares for the four factories should be concentrated in just one of the 4 workshops. The equipment of this shop should be improved by redistributing the machinery presently installed in the four workshops, and perhaps adding certain other essential items, at least one of which should be a heat treatment plant. The remaining workshops would then be responsible for maintenance and light repairs, and, since they would no longer be burdened with spares production and reclamation, they would be in a much better position to do this according to proper maintenance schedules.

3. As the inventory control of the four factories is not centralized, each purchases materials on its own behalf and keeps them in its own stores. This results in a number of drawbacks: purchases are made in smaller lots than necessary and orders overlap; excess stocks may be held because of over ordering; it may well be that one of the factories is short of certain materials while there are plenty available at the other three; non-uniform description of materials makes a general check virtually impossible. Thus it would be as well to keep all materials in one central store and to distribute them to the factory stores by a method to be decided upon after appropriate study. In addition, considering that at least 45,000 are stocked, rigorous standardization of materials is a prime necessity.

4. One of the most pressing problems bearing on the improvement of maintenance services seems to be the training of staff.

   Since the four factories belong to one single company the problem might well be tackled on a unified basis: in other words, training of maintenance personnel for all four factories could be standardized and centralized.

   To this end the Company could: 1) equip suitable premises for courses at one of the four factories, installing some machine tools. 2) establish the total number who would be attending each course, 3) reach agreement with the four factories that they should each, in turn, send their maintenance personnel on the courses according to certain quotas. No excuses should be accepted for any factory sending less than its established quota of trainees.

CONCLUSION

The efficiency of maintenance and repair services in all factories of the Company seems to leave much to be desired. It is claimed that this is due to: very tight production schedules; difficulty in obtaining spares; shortage of skilled labor. Since no full evidence was given to support these assertions it may well be that production schedules are tight because of excessive idle time. This could be largely reduced through proper maintenance schedules and improved centralization of such ancillary services as inventory control, spares reclamation and purchase, and training of personnel. It is suggested however, that production schedules be checked against the nominal capacity of the plants and statistical methods be used to classify idle times according to their nature. An analysis could show the most important reasons for the shortcomings and definite steps could then be taken to eliminate them.

Appendix C-1.1

THE ESCO RAYON MILL

Technical Manager: Mr. Mahomood Afifi

1. This mill produces some 8 tpd of rayon thread. The general layout is reasonably functional as regards distribution and use of the space, which seems to be sufficient.

   The mill has a plant – complete with associated services – for the production of thread, starting from cellulose pulp.

   There are 104 spinning machines divided among four departments, each with 26 machines. Each department is homogeneous and has machines of the same type (Consultant Mauer). Though the machines are in good shape and above the National average, it is felt that improvements could be made in maintenance efficiency.

   The full-capacity production schedules are fairly inflexible and must be respected at all costs. This means that maintenance suffers, since too little time is available for this. There is a workforce of 1,300, of which around 80% engaged on production.

2. Regarding the maintenance department:

   a) Each department sees to its own routine maintenance and light repairs, these being done by a small central workshop. There are no planned maintenance schedules because the need for production does not allow for stoppages, it is said. Thus when a breakdown occurs, the opportunity is taken to carry out some general maintenance.

   b) There are serious problems regarding spares, supplies of which are difficult. These are made internally or obtained from outside sources, but the results are not satisfactory. Indeed no drawings are available, nor specifications for raw materials, heat treatment, etc. Furthermore, scarce technical assistance is provided to outside manufacturers, and insufficient control is exercised at the reception stage.

c) The layout of the workshop does not seem to be in keeping with the factory's ends.

d) There is just enough machinery, but the cleanliness and maintenance of this cannot be considered satisfactory.

e) There seem to be no standard procedures for the distribution, preparation and control of work, nor any systematic collection and processing of information.

f) The Maintenance Department has a workforce of about 250 but the general standard appears unsatisfactory. It is reported that internal training courses cannot be run because of the lack of basic vocational education and because some of the workmen are illiterate.

CONCLUSION

Great improvements in maintenance and repair services are urgently needed, not least because the production schedule requirements are said to be very heavy. A good preventive maintenance program could be of great help, but its implementation will require close supervision and better training both for maintenance and production hands. Due to the lack of basic education, training of workers, can only be done in part on the job; a good training center for the Company seems to be both necessary and feasible.

Spare parts are again a big problem, and the solution of this apparently calls for centralization at Company level, both for reclamation and for external purchases as well.

Appendix C-1.2

THE ESCO SPINNING FACTORY

Technical Manager: Mr.Abdel Aziz El-Mongi

1. This factory is engaged in the carding and spinning of cotton and wool.

   The layout is partly governed by the fact that the building is of old construction. Considering this limiting factor, it can be considered sufficiently functional as far as concerns the process cycle.

   The main machines installed are:

   2 mills for spinning yarn

   – one with 60,000 spindles for running a medium yarn from 12 to 40 (English count)

   – one with 58,000 spindles for running a finer yarn from 24 to 80

   Age: 1955 on.

   The necessary subsidiary machines are also installed.

   The production schedules are very tight and this, in general, causes difficulties because the productive capacity of the various installations are not precisely matched: this causes bottlenecks. Naturally, this situation has an adverse effect on the maintenance schedules. It would be very desirable if the productive capacities of the various individual plants could somehow be matched.

   The laborforce totals 2,600, of which 2,000 are engaged on production. There are 4.25 employees per 1,000 spindles (one for maintenance + 3.25 for production).

2. There are maintenance programs for each department, it being layed down on which date each job should be done. However, because of the bottlenecks referred to earlier, it is difficult to keep to these schedules. Two types of maintenance are done: light routine maintenance and general overhauls. Light maintenance takes a team of five (4 for cleaning + 1 mechanic) per department.

   General overhauls are carried out only when all the parts to be replaced are on hand.

   In collaboration with Shell Co. technicians, a lubrication manual has been drawn up and a training course run for greasers but this does not appear to have given good results.

3. The layout of the workshop is fairly good and provided for sufficient room. The equipment has 4 lathes, 2 drilling machines and 2 gear cutting machines, plus miscellaneous small tools. The machines are not in very satisfactory condition because of lack of maintenance and lack of attention to cleanliness and orderliness in general.

   There are no standard procedures for the distribution, preparation and control of the work. Nor is there any rational collection of data, and so there can be no systematic processing of information.

4. The lack of spare-parts is again a problem here. As usual, they are either made internally or bought from National suppliers, but the results are not very satisfactory.

5. The maintenance department has a workforce of 550. This number may seem high but it derives from the fact that training is not satisfactory. Moreover, since for the reasons expounded above the work of the Maintenance Department cannot be programmed, the personnel is continuously occupied and thus it seems impossible to slot in internal training courses. In any case, according to the Manager, such courses would be of doubtful use in view of the workers' lack of basic vocational training.

CONCLUSION

Heavy production schedules, bottlenecks, lack of time for preventive maintenance, idle time caused by breakdowns, bad repairs due to underskilled workers and poorly

skilled workers so busy as not to be allowed to attend training courses. All this makes for a vicious circle which could cause the whole system to collapse at any time.

As is often the case, here too maintenance problems have so many intertwined cause-effect relationships with production problems.

A sound approach to the problem could be a consistency check between capacity and production schedules; and a detailed analysis of idle time and breakdowns by random work-sampling methods. This will give full evidence of the main causes hindering the achievement of the production targets and of the action to be taken in different fields for full utilization of plant capacity. As far as maintenance and repair problems are concerned the weak points need singling out and certain preventive maintenance needs for spare parts stocks or for better repairs stressed. Accordingly a maintenance schedule and policy should be defined and implemented.

It is to be noted that this approach has proved very effective in most industrial branches particularly in the textile industry.

Appendix C-1.3

THE ESCO WEAVING FACTORY

General Manager: Mr. Mahmud Hashim

1. The factory's production program calls for 100,000 meters of cotton cloth per 24 hours. Provision is made for 22 different types of cloth: 16 gray and 6 striped. The weigh runs from 50 to 250 gr/sq.m, the average being 100.

Most of the buildings are of recent construction. The layout was specially designed to bring together machines from various old factories. Air conditioning is provided where necessary.

There are around 1,200 automatic and semiautomatic looms of 8 different makes varying in width from 44 to 68", and running 140 to 180 strokes per minute. Their age is anything from 10 to 25 years and their condition is average. The staffing rate is one weaver and one assistant for every four looms. Total performance is said to be around 80%, but there are no statistics available as to the causes of downtime.

2. As far as possible, under the rather unfavorable general operating conditions the maintenance and repair service is well run.

a) Daily maintenance is not done by the loom operators as it should be; it is mainly attended to by groups consisting of one mechanic and one assistant responsible for 70 looms. Provision is also made for more complete monthly maintenance, to be carried out on 25% of the machinery on the weekly rest days, and for a general overhaul every six months. However, no standard procedures in the strict sense of the word have been drawn up. The most serious problems seem to be lubrication and the penetration of dust into the electric motors.

b) As usual, the spares position is aggravated by foreign exchange difficulties. It could however be improved by better training of operators and maintenance mechanics, and by better organization of the reclamation services and stock control.

In this respect, it should be noted that a central punched card system is in operation, the capacity of which could well be upgraded to better meet the Company's needs. Quality control of the spares should also be improved, where possible by introducing suitable methods of statistical sampling.

c) Considering the requirements of the factory, the workshop seems sufficiently well equipped. However, the efficiency and cleanliness aspects are not satisfactory, and the machines themselves are not used with the required skill.

d) The general organization of the maintenance service is not up to the desired level of uniformity and standardization; and, for example, although data are collected in a certain way, this is not done systematically nor are the data processed regularly: something which would be useful for obtaining an insight on various phenomena.

e) The maintenance department has 250 hands plus 80 control operatives. The experience and training of this personnel gives the impression of being unsatisfactory, not only because of the lack of basic mechanical knowledge but also because there is no specific training in maintenance. This deficiency is strongly felt. Environmental conditions and work commitments which leave no free time apparently make it difficult to organize internal training courses.

CONCLUSION

Though to a lesser degree, the same remarks and suggestions apply as for the spinning factory. Better routine maintenance; centralization of spare parts reclamation and supply; central training of labor and up-grading of supervision seem to be the most important objectives. Improvement and extension of data collection and processing could be a very valuable aid for the improvement of maintenance and repair services.

Appendix C-1.4

THE ESCO DYEING AND FINISHING MOSTROE FACTORY

Technical Manager: Mr. Hosni Yassin

1. This factory is engaged in bleaching, mercerizing, dyeing, printing, finishing, raising, and folding various fabrics, and in weaving waterproof cotton. The daily output is 100,000 m.ca.

   The general layout cannot be considered satisfactory since various buildings have been added piecemeal to the main structure which was erected in 1946.

   This factory also has a very tight production schedule, and this makes the implementation of an organic maintenance plan a difficult proposition, it is said.

   The machinery is old (the newest dates back to 1952) and maintenance is generally not satisfactory. The laborforce numbers 1,000 of which 600 are on production.

2. The following remarks summarize conditions in the Maintenance Department:

   a) There is no planned maintenance because the sustained rate of production makes no provision for shutdowns. Hence, maintenance is not done in a systematic manner, but is carried out when general overhauls are required and these, in turn, are fitted in when possible. The Manager is aware that maintenance is unsatisfactory but states that under present conditions there is nothing he can do about it.

   b) The problem of spare parts is serious here too and, as with the other factories of the ESCO group, it is tackled by making parts internally or by buying in from National suppliers. The results are not, however, satisfactory.

   c) The Mechanical Workshop of the Maintenance Department is small and the layout is poor. Cleanliness and orderliness both leave much to be desired.

d) The machinery in the workshop is old and in a poor state. The Manager agrees that there are sufficient machines for the factory's needs, though a heat treatment plant is required.

e) There are no standard procedures for the distribution, preparation and control of work. Some data are collected on cards but they are never systematically analyzed.

f) The Maintenance Department has a workforce of 150. The level of training is not high and lack of time makes it impossible to organize courses inside the factory. In any case the results would be doubtful in view of the lack of basic knowledge and more specifically because of the shortage of suitable instructors and programs.

CONCLUSION

Here again tight production schedules and shortage of spares are claimed to be responsible for lack of preventive maintenance and of training courses for labor. The same conclusions apply as for the other ESCO factories.

Appendix C-2

THE HELWAN IRON & STEEL FACTORY

Maintenance Manager: Mr. Tawakol El Maghraby

Chief Spares Mfg.: Mr. Nabil Roushdy

1. This is a vertically integrated plant having a capacity of 250,000 tons, with the possibility of future expansion. Some 200,000 tpy of finished products (billets, plate and section iron) are made. Including the 1,500 workers at Aswan, the laborforce amounts to about 8,500, of which 1,200 are engaged on maintenance and spares fabrication.

2. There is a good maintenance schedule. This has to be implemented by the departmental workshops which are equipped to carry out small repairs. Heavy and special repairs are done by the Central Workshops: Mechanical, Electrical and Instruments.

3. It is estimated that 1,500 tons of spares (= 7.5% of the finished product) are consumed per annum. Some 25% of this quantity is produced in the shop while the rest come from outside workshops.

   A complete set of constructional drawings, work-sheets, and records showing average life and other important information on spares are in course of preparation. On the basis of these, it should not be difficult to make better use of the productive capacity of the outside workshops, many of which may presently be utilizing only 50% of their capacity.

4. It is report that the need for maintenance shops was virtually ignored in the general plant layout. Hence both premises and equipment for this service are still insufficient even today, and are being expanded. However, the present physical facilities are in a reasonably efficient state.

5. The general organization of the workshops is of an acceptable standard, but the very importance of the service calls for the use of the most modern and efficient methods of preparation and control.

6. The laborforce can be considered to be up to the National vocational standard, but its productivity is very low: this may be due to the unnecessarily high number of apprentices in the workshops which could well have an adverse effect in the productivity of the operatives. There are too few good foremen on the shop floor.

7. It is felt that the methods and facilities used for training at all levels should receive special attention. It should be borne in mind that the present excess of on-the-job trainees carries with it very high visible and invisible costs which damage the economy of the Company as well as the individuals, while having an adverse effect on the social aspects of development.

CONCLUSION

The efficiency of the Service is well above the national average and will more closely approach international standards when it modernizes its present managerial procedures and above all if it succeeds in weeding out from its workshops all excess unskilled workers and apprentices who at present cause only over-crowding, confusion and bad working habits.

Training of personnel should be given major attention. The factory's sound approach to the problem of spares is worthy of note; it could well be taken as a study case for similar problems in other Companies.

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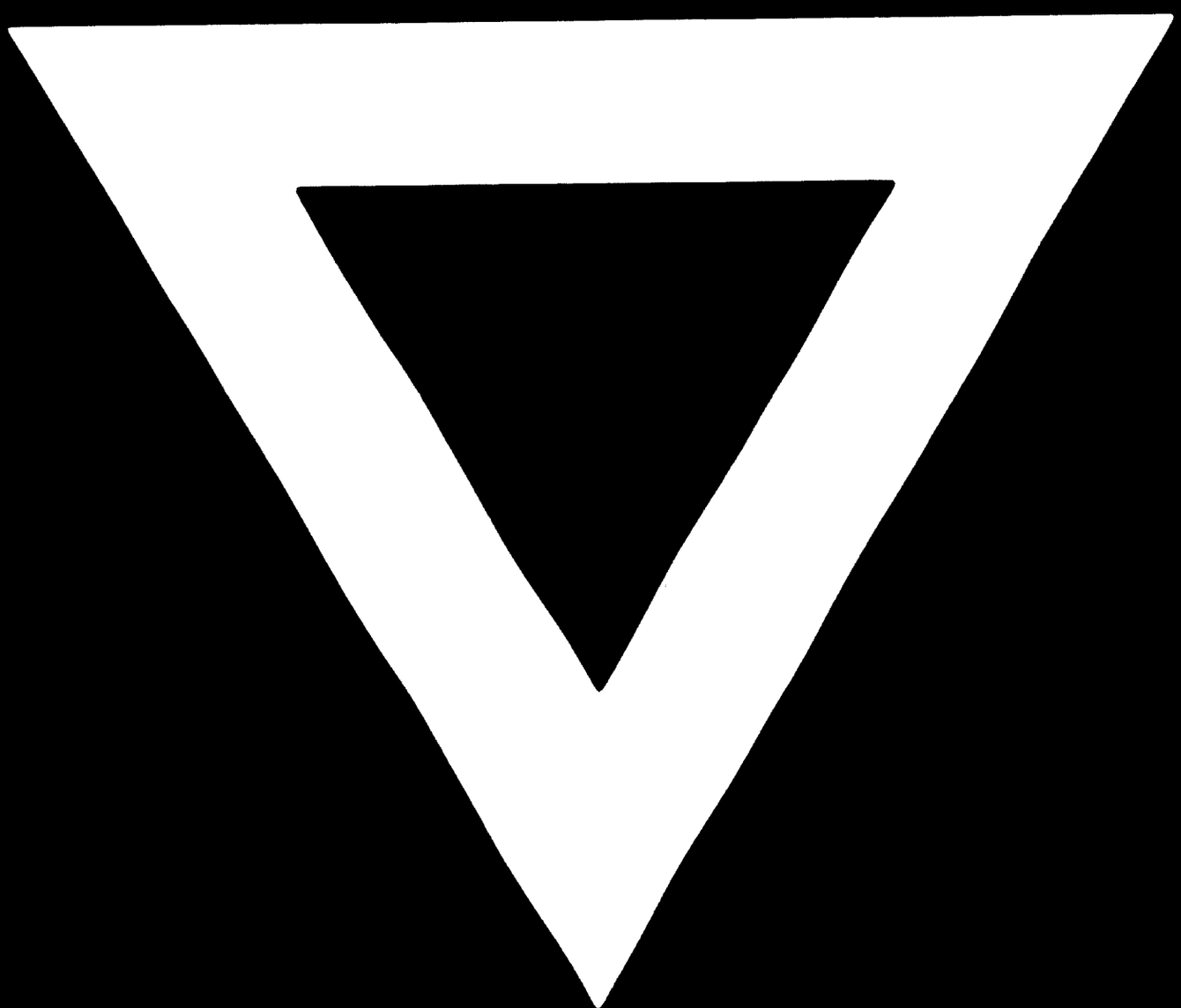

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