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VEHICLE MAINTENANCE STUDY
PROPOSED SOLUTIONS

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PROPOSED SOLUTIONS

(By Engr. A. Hakim Youssef)

In order to execute the recommendations reached by the detailed study described in the Vehicle Maintenance study team report, immediate action must be taken by the M.O.T. to establish a special Commission or Authority of very highly proficient, technical and financial experts selected according to their personal merits. Precedent already exists for authorities cooperating with the Ministry for financial, administrative, legal and police controls; these are:

- Central Accountance Authority
- Administrative Control Authority
- Legal States Council
- Transport and Communication Police Authority

It is clear that there have already been organized controls established for each branch of activity of the Ministry, except for the technical and operational controls and inspections that are still missing in spite of the fact that they are vital factors for successful maintenance and service of vehicles. The proposed Commission would be fully authorized to issue new orders and instructions to improve vehicle maintenance and would report directly to the Ministry of Transport. Members of this commission would be entitled to punish those who:

- do not follow the maintenance and operational regulations
- cause any damage to vehicles, equipment or installations
- permit unnecessary delay in the repair of breakdowns
- cause the loss of bus trips

They would also be entitled to punish managers or administrative heads who are found responsible for repeated damages, breakdown or losses in the system due to their negligence and lack of capability to perform their duties. They would also be entitled to reward those who are extra ordinarily proficient in performing their duties and improve service by extraordinary efforts.

The Authority should develop, sponsor and execute a series of short and long term programs for improving the effectiveness of maintenance operations. These would include the following:

1.0 SHORT TERM SOLUTIONS

Maintenance Study recommendations and remarks must be examined by the Commission, classified and arranged according to their priorities. Immediate action can be taken to start with the remarks which will not need long implementation time, do not need special authorization from higher authorities (the Ministry) and whose solutions are within the capacity and authority of the companies and facilities.

Follow-up must take place daily and progress regularly reported in writing to the Minister or his designee.

Visits must be made to facilities (garages, workshops, stores and different installations) on an unscheduled basis, especially during night shifts. Such visits by members of the Commission for inspection of staff activities and evaluation of their effort at each site will oblige everybody to do his tasks properly with the potential for being punished if reluctant, or rewarded if a hard worker.

Enforce accomplishment of the following daily tasks by direct observation or report:

- Washing and cleaning of vehicles daily immediately after going back to the garage at the end of the daily service, with special attention being paid to the interior of the bus and glass areas.
- Performance of daily maintenance inspection of the vehicles and checking of drivers remarks reported daily to make sure that the drivers and inspector remarks are put right. This also includes daily maintenance and safety precautions. All vehicles must be inspected before leaving the garage for cleanliness, safety, lights, steering, brakes, ...etc.
- Performance of daily inspection for cleanliness, lighting and ventilation of the facilities, workshops, stores and terminal stations together with safety precautions are very important items which should be checked daily and given great care.
- Cleanliness campaign should start in each facility and workshop under direct supervision of the concerned managers. Groups must be formed to scrape the layers of black slick off the concrete paving that result from the accumulation of grease and oils.

Windows and sky lights must be cleaned regularly, and broken glass and burned lamps must be replaced immediately.

Accumulated water and oils in work pits must be pumped out, and pit walls cleaned. Pit lighting must be checked and burned out lamps replaced.

The system of collecting drain oils of the vehicles must be checked and installed wherever missing. This system consists of a funnel fitted to a movable pipe to carry the oils to a reservoir where it is pumped out.

N.B. The above cited instructions have been given often, but they are forgotten and neglected after some time due to the absence of supervision, as everyone considers someone else responsible. The cleaning groups should work under direct supervision of a safety officer in each facility.

Maintenance of garage yards and rough access roads; these should be paved whenever needed as they may cause suspension system breakdowns leading to lost service.

N.B. This is the Installation Engineering section's responsibility. It is neglected because there are so many damaged areas which need repaving that there is a lack of available funds. Much of the damage results from the accumulation of drained engine oils and accumulated water in the yards and on the roads.

Assuring that fire fighting equipment and first aid kits are provided in each facility, also portable extinguisher fitted in vehicles. All fire fighting hoses and extinguishers should be periodically inspected to be sure that they are always serviceable. Trained fire fighting and first aid personnel should always be ready.

N.B. First aid and fire fighting precautions are obligatory by regulations but often neglected due to absence of supervision. These are the responsibility of the safety officer in each facility and workshop. Vehicle fire extinguishers must be checked daily by garage inspectors and registered in inspection records.

Assure the maintenance of vehicle log books and files and the development of management information from the data. The log book kept with the driver, normally includes the vehicle specifications, instructions for drivers, names of drivers appointed to drive the vehicle, dates when they were in charge, reasons of changing the driver, fuels, oils, and grease supplied and date, tire numbers and when fitted, batteries and when fitted, periodical maintenance dates and remarks, repairs and overhauls when carried out, and spare parts used. The same information should be registered in the vehicle file kept in the technical section of the facility. Information extracted from log books can show repeated defects, spare parts usage, etc. and provide a basis for investigation of cases of repeated malfunctions.

N.B. According to regulations these records should be done accurately but are often neglected due to the absence of supervision and inspection by technical and financial directors and facility managers. Serious inspection must be done and persons who do not satisfy the requirement should be punished. The log book is also helpful for checking fuel consumption and engine condition.

Maintenance and repair inspection; after every periodic maintenance action, vehicle adjustment after daily inspection, or performance of light and heavy repairs, the concerned shop foreman and responsible engineer should inspect the work done and if approved make an entry in the vehicle log book stating type of repair and spare parts used. These should also be registered in the vehicle file for the calculation of maintenance costs.

N.B. The requirement exists for all of these to be done and precisely recorded but they are often neglected due to the absence of supervision and inspection by the technical and financial directors and the facility managers. All vehicle log books and files should be inspected in detail periodically and personnel who do not follow requirement should be severely punished.

The ability to respond rapidly to road breakdowns by performing emergency repairs can help solve the vehicle downtime problem. A special repair squad can be appointed for this purpose to carry out the repairs either in the garage, whenever a vehicle needs a slight repair, or on road if any breakdown happens during service.

In the second case there can be a light truck carrying necessary tools and some emergency spare parts, spare wheels, hydraulic jacks and the like. The truck can move quickly to the stopped vehicle to perform repairs on the road. There can be a heavier towing truck to tow the vehicle to the nearest garage for repair. A message has to be sent by the bus driver stating the exact location of the vehicle and the stoppage description so that the suitable truck and spare parts can be sent.

N.B. This system was created in some garages long ago but it seems that it is no longer in use as it has been noticed that there are many vehicles stopped on roads and left there for long periods. In many cases these trucks are out of action. In C.T.A. the light trucks were located in the terminal stations and the towing trucks were in the garages. Funds should be allocated to purchase enough trucks and spare parts for the already existing ones which mostly need to be repaired.

Facility and workshop stores should include spare parts for types and makes used in the facility or repaired in the workshop. These spares should be enough to cover the facility or workshop demand for about a month. Available quantities in stock should always be within limits fixed by the store control department.

N.B. The maximum and minimum is already supposed to be accurately fixed by stores control and indicated on the item card, but is neglected in most cases and therefore should be regularly inspected to assure compliance with requirements.

Garage and facility equipment should be well maintained, looked after and operated properly. It should occasionally be inspected for good function and precision and immediately repaired when needed.

The manpower of each specialization for each facility and workshop should be staffed according to plans, otherwise action should be taken to complete staffing either by appointing new experienced persons or by training available young workers.

Detailed study should be made of the use of already trained persons to make sure that they are making use of their training and that each trainee is put on the job he was trained for.

2.0 LONG TERM SOLUTIONS

The following are long term solutions that should be undertaken by the Commission or Authority.

Study and revision of the organization charts and job description sheets of the existing companies resulting in a unified system to be adopted and applied for similar companies and authorities. The adopted system can be based on the organization plan proposed by the study team for truck and bus services, after adding the following:

- A planning Department working with the chairman will be responsible for statistics of all the activities which are to be analyzed and reasons established for deviations from planned targets. According to the result, solutions can be proposed and plans studied again, modified or even changed if necessary.

This department would also be responsible for the development of new design specifications. Also layout plans for garages and workshops can be prepared by the specialists of this department.

Based on the study of manpower available and necessity of certain skills, all levels of training programs can be worked out by the training section in the planning department.

- An Industrial Safety Office adjacent to the chairman of the company or facility and workshop managers. This office will be responsible for the safety of the installation, equipment, electric supply and wiring, water system, drainage, fire fighting equipment and safety of personnel and vehicles. This responsibility extends also to:
 - the cleanliness of the working places and yards
 - provide instructions on avoiding future accidents
 - street accident records and investigations

All positions on the organization chart should be filled by efficient, qualified well chosen persons. Great care should be taken to appoint chairmen and managers who have long experience and managerial training and capabilities. Responsible managers should have full authority to perform their duties.

The creation of suitable vehicle design specifications is necessary due to many complicated maintenance problems which started long ago and remain unsolved until now in spite of huge efforts to solve them. The basic reasons for all of these troublesome complications is the large variety of different vehicle types and makes used for public transportation.

To establish a basis for overcoming this difficulty, a high level committee should be formed of transport company and Authority representatives together with some related specialists from the Nasr Automotive Manufacturing Company. The first task of this committee would be to study the technical specifications of each kind of vehicle needed for public transport services to suit local climatic, road and overload conditions which are unique to our country.

Fixed permanent specifications for the required one or two makes of vehicles should be agreed upon and a decision made to assemble or manufacture them locally. This may be in cooperation with the Nasr Manufacturing Co. or any other joint venture company. This will guarantee the procurement of vehicles and the continuous flow of spare parts which are one of the most difficult problems faced by the public sector companies.

This project can be executed in the existing Nasr works or a new bus assembly plant can be started in Tanta Facility of Middle Delta which has the capacity to assemble and rebuild about 1000 buses yearly. The truck, tractors, semitrailers and trailers can be assembled in the Direct Transport plant which can also assemble about 1000 units every year.

N.B. The above mentioned specifications have already been made for intercity buses but without any member from Nasco; a joint meeting with Nasco must take place.

The development of centralized vehicle overhaul facilities is also a concern. Overhauling a vehicle is one of the most difficult tasks faced by the companies, which takes at least 4-6 months to accomplish. The existing Automotive Repairs Co. cannot meet the demand of transport companies. C.T.A. central workshops are not able to do the job either and that is why there are large numbers of vehicles scrapped or cannibalized yearly.

The solution to this problem is to erect three major central workshops which will be capable of rebuilding engines, transmissions, axles, steering systems, fuel pumps, starters and generators. Body work for buses, trucks, tractors, trailers and semi-trailers can be done in the same shops. With this new system, the skilled workers can be collected in these shops, and the other facilities can perform their duties such as maintenance and light and medium repairs.

These central workshops can be located in Cairo, Alexandria and Assyut or Minya. The site and size of each workshop can be decided by detailed study. One of these recommended sites is the plant of East Delta Company at Nasr City. The central workshops should be equipped with modern machinery and test equipment and be planned to

operate according to the most modern technology. They can work on the unit exchange basis to reduce time losses and increase the productivity of the vehicles. A new joint venture company might be established to erect these shops and equip them with the suitable modern machines and equipment. These central workshops can also serve other governmental concerns as well as the private sector.

Maintenance teams should be organized in each facility for each make of vehicle in a facility, thus a special team of technicians will be responsible for maintenance and repairs of each make. Each vehicle should have its own driver who is never allowed to be changed except for urgent reasons. There will be competition between the groups and rewards given to the best group of each facility provided that their performance exceeds certain minimum standard levels.

N.B. This system may be now followed in some companies on an ad hoc basis, and can be generalized according to well defined rules to encourage competition between the facilities and between the companies.

The following are possible means of minimizing the number of companies and facilities:

- Intercity bus service is divided unequally between four companies which operate along overlapping areas. The fleet of each company is not big enough to be run by a separate company. It is proposed that one company operate all the Delta lines with three main regions, i.e. east, middle and west. Another company should run Upper Egypt lines, the Red Sea, Sinai and New Valley. This is the actual existing Upper Egypt company.
- C.T.A. Services are performed by several garages whose fleet are small and thus do not warrant performing the maintenance and repair functions. These garages must be studied and some of them amalgamated with each other.
- Truck services are carried out by five separate companies who start by loading from the origin and unloading at different destinations. Each company has its own garage in Alexandria and Cairo. Most are grossly over-designed from the structural viewpoint and poorly laid out from an operation or management viewpoint. Each garage has a manager and heads of technical, operation, financial and administrative sections for a fleet of less than 100 vehicles. The few available engineers and skilled workers are scattered between facilities causing excessive dilution of the trained and skilled labour force, inventory of critical spare parts and inventory of test equipment.

Truck companies should be amalgamated to form one organization which can have one or two garages in each of Cairo and Alexandria. This amalgamation will save on the need for financial and administrative staff and more economically use the available machines and equipment. The available technical staff, can then be transferred to the new central workshop. This amalgamation will also simplify the purchasing of vehicle spare parts and equipment.

N.B. Amalgamation has never been discussed, in fact the existing situation was started by one organization being subdivided into companies. This amalgamation should take place gradually after detailed study.

Need of loading and unloading equipment is also another matter to consider. With the classic old system of loading, it takes quite a long time to load vehicles; the same for unloading which takes place manually at non-equipped sites, these two operations sometimes take days after a trip of only a few hours. This means that there is always great loss of time and low productive efficiency. By mechanising loading and unloading the overall time of a trip can be easily reduced by 75% which can be utilized for making more trips, easily doubled, thus carrying double the goods and giving more chance for maintenance operations. Companies and their personnel would have a better chance to gain more and more instead of losing as is happening now.

N.B. This should be given prompt consideration and needs some investment by the AID after studying a complete detailed project prepared by specialists.

Existing facilities and workshop layouts have to be replanned on the basis of the proposed plans attached to the report. A unified plan can be reached that minimizes changes and expenses to facilitate the flow of work. For each modified facility a proposed list specifying new machines and test equipment should be prepared. To carry out the modifications in one or more facilities at a time, the facility which is going to be reconstructed has to be evacuated and its fleet has to be transferred to some neighbouring facilities as happened in 1966 when the Nasr garage (C.T.A.) was prepared to operate new Saviem buses. The same happened to Imbaba garage (West Delta at that time) when its fleet and service routes were transferred to East Delta and Upper Egypt Companies. It is stated in the report that Upper Egypt bus company has an area for a new facility and central shop along the Fayoum desert road. Actually, this site is very badly chosen and can never be used for this purpose due to sand storms which occur very often in this area. This idea started long ago but was rejected.

N.B. Reconstruction of the existing facilities and workshops will be of very great advantage and will improve maintenance and repairs. It was done at one time with Mazallat and Shubra garages very easily.

To improve training programs, already trained persons should be appointed to work in their area of specialization according to their previous training record. A detailed study should be made to find out the number of persons, of all levels in each facility and company, who need to be trained and on which specialization and professions they should be trained. Even Chairmen and managers urgently need to be trained on their jobs in Egypt and never abroad, as travels abroad for such levels are only considered as quick visits and they never use what they have seen.

Practical training is of great importance for engineers and technicians; vocational training for accountants and administrative staff of all levels.

Detailed training programs should be worked out for levels and followed up precisely.

The existing M.O.T. training centre is well equipped but not properly utilized; is working at a very low efficiency and less than 25% of its capacity. It ought to be reorganized and reinforced by more efficient instructors.

Meanwhile, C.T.A. erected a new training centre not yet working. The transport Labour Syndicate is erecting a new centre which will not be finished before a year. It is useless to spend time and money on such a huge building with massive reinforced concrete sections while there is M.O.T. centre which is not fully utilized, and could give much more than it is giving now. Managerial training, the main reason of all maintenance and transport troubles in general, is actually neglected.

N.B. Training is always of the greatest importance and never given enough care.

Accurate accounting and costing is actually neglected in the transport companies. Budgets and balance sheets are worked out for the whole company as a unit. Maintenance costs were impossible to know for each facility (except for C.T.A.) although all forms are designed and based on costs per vehicles through the detailed information which ought to be registered in the vehicle log book and file which are completely neglected.

Exact and detailed study ought to be made to reorganize accounting registers and costing system based on cost/vehicle especially for maintenance cost which is the most precise indication of the management success or failure. Effective management is really impossible without detailed knowledge of costing. Routine paper work has to be minimized and forms reduced.

N.B. Training courses are often held for this purpose but the remarks are still there.

A well studied replacement program has to be prepared based on the vehicle assumed life for each type of vehicle. No vehicle should be allowed to run after exceeding its assumed life as it will be uneconomical to run. It is noticed that normal vehicle replacement takes place every 4-5 years depending on financing possibilities including availability of funds and foreign currency. In this case a large number of vehicles enter service at the same time and need overhaul during the same period, thus causing a big drop in the service. The same situation occurs when they are to be scrapped. So there must be a yearly replacement program to avoid service drop and immense losses.

N.B. This cannot be avoided unless funds and foreign currency are regularly available, or vehicles are produced in A.R.E.

To assure continuous flow of spare parts, on purchasing new vehicles, the contract has to include spare parts needed during the first five years of the vehicle life. The choice of the parts must be based on the supplier's experience together with previous local experience. A proportional list of parts must be delivered with each vehicle consignment starting with the guarantee parts and the fast moving parts.

For each item there must be a maximum quantity order limit and minimum limits indicated on the parts card so that a new order is placed whenever the stock reaches the order limit, taking into consideration that an order takes 6-9 months to be delivered. These limits are estimated by the store control based on the average monthly consumption of each item.

The life time of each vehicle component and major part has to be studied, based on normal wear and tear and life lists (in mileage) prepared for reference. It can be a good measure of the quality of maintenance and repair in any facility.

Accurate statistics will control this measure and it can be taken as a technically precise measure of the quality of maintenance. This helps adjusting or modifying methods or systems used.

N.B. The spare parts problem is one of the main factors which affects the efficiency of the service. It happened that after 2 years service, due to lack of engine parts which were not contracted in time, 210 Barrieros engines for trucks were replaced by new RABA-MAN engines. The same happened with Ikarus spare parts for C.T.A. buses which arrived after the buses were scrapped.

The spare parts problem has to be well studied and the delivery program scheduled with the delivery of vehicles.

Providing an assured supply of power for facilities and workshops needs to be considered. Sometimes the electric current feeding the facility or workshop is interrupted or completely cut off for a long period, and all garage machinery and equipment are stopped. This means that the garage may be left a long time without light, pressurized washing water, compressed air for greasing and tire repair, steam cleaners, fuel supply pumps, workshop machines, etc; all electric driven machines are stopped.

To overcome this sudden failure a stand by motor generator set of adequate power (about 150-250 KW) would be erected at each site to operate automatically (if possible) whenever the electric supply is not available.

N.B. This was erected in few C.T.A. facilities long ago, but I believe there are none in intercity facilities or workshops. This precaution is of absolute urgency and must be adopted at each facility and workshop.

We must reduce reasons for excessive fatigue to buses and a major cause for fatigue in C.T.A. and A.T.A. buses results from their route structure. The buses run along narrow streets, many bends, turns and bumps which tend to overstress the gears and apply the brakes frequently causing excessive wear to the engine, transmission, steering and brakes. The route is much longer between the origin and destination, the trip time is longer and the trips per day are less, which greatly increases running expenses, wastes time, and causes excessive wear and fatigue to vehicle parts.

The routes must be restudied for the purpose of straightening them as far as possible, permitting buses to run on main axes only, and along well paved streets. A rule followed long ago should be reinstated, namely to stop any bus line from operating a route segment whenever damage occurs to the street paving and inform the municipality to repair it. Similar efforts should be made to restudy the routes of the intercity systems.

If this rerouting policy can be accepted, the result will be less damage to vehicle parts, less trip time, higher frequency of buses and more trips per day. By this means the system can transport more passengers per bus per day while reducing excessive loads during each trip which will lead, in the end, to less damage, fewer breakdown, and longer bus life.

Another major cause of excessive structural fatigue is over crowding. In order to decrease the crowd density there was a decision made by the Greater Cairo Planning Authority in 1965 to spread the start and end of work hours of all governmental concerns, companies, and shops of each area in order to decrease the crowd during rush hours. If the peak load is over starting times of 0730, 0800, 0830 and 0900 a.m. this means that load at each interval will go down to a quarter of its original volume. At the same time it was

proposed that shops and all concerns which work two periods a day, work one period only in order to lessen the total volume of passengers transported daily. This solution did not continue for a long time simply because there was no follow up and all concerns returned to the old system.

If the above mentioned plan could be enforced the number of standees on each bus can gradually be limited. There is also an old traffic regulation, which limits the number of standees to only four and I do not think that it is cancelled.

If all these steps are taken, the maintenance troubles can be reduced, the buses will last longer, service will improve and riding a bus can become a more pleasant experience.

3.0 CONCLUSION

In summary it is my opinion that a key element in the implementation of an improved vehicle maintenance program is the establishment of a special Commission or Authority for auditing vehicle maintenance operations in the public sectors as explained before.

The members should be appointed for three years term, with the possibility of reappointing some of them if necessary. The Authority or Commission would then undertake both long and short term programs as described. The Commission will do all study and planning work and will issue orders and regulations and it will include:

- the first section for supervising City transport authorities subdivided to two groups, one for Cairo and another one for Alexandria
- the second section for supervising intercity transport companies subdivided to groups one for each company area
- the third section for supervising goods transport services subdivided to groups one for each area of activities

Each group should be located in a suitable place in its area of activity. The members of each group should represent the technical and operational, specialization and they should be proposed by the companies of very highly efficient persons of not less than ten years experience in their specializations and of very good reputation. Their choice must be approved by the M.O.T.

The number of each group depends on the activities in each area, but must not be less than 5 and can be assisted by a convenient number to be agreed upon with each company or authority.