# THE PEOPLE'S REPUBLIC OF BANGLADESH

# THE BASIC DESIGN STUDY REPORT

# ON

# CONSTRUCTION PROJECT

# OF

# AUTOMOBILE REPAIR & MAINTENANCE WORKSHOP

OCTOBER 1979

Japan International Cooperation Agency

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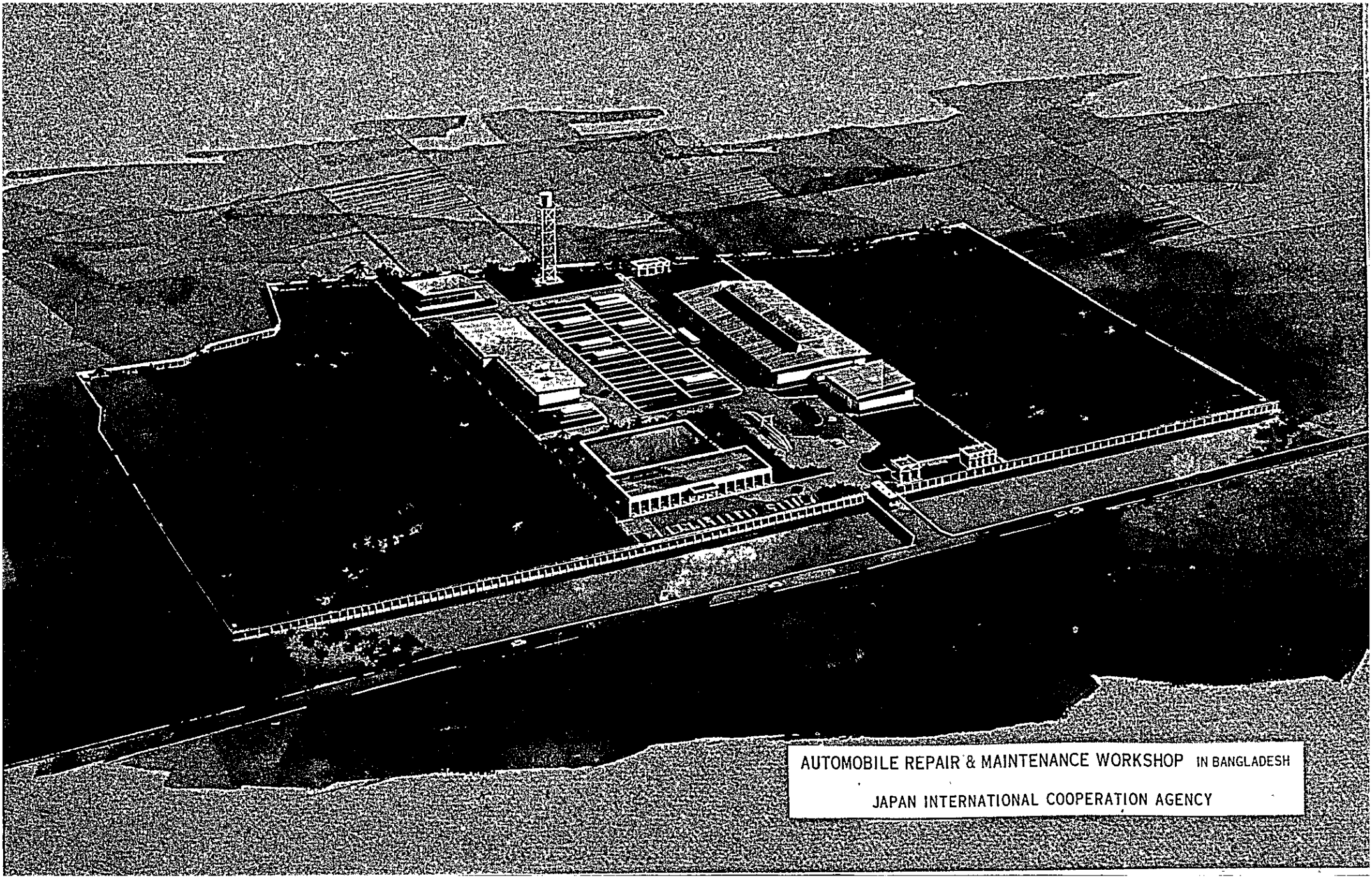


AUTOMOBILE REPAIR & MAINTENANCE WORKSHOP IN BANGLADESH

JAPAN INTERNATIONAL COOPERATION AGENCY

# FOREWORD

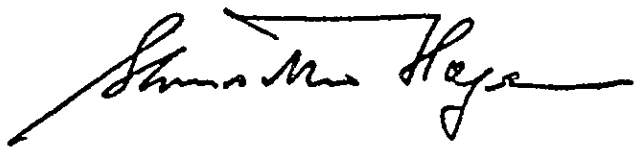
In response to the request of the Government of the People's Republic of Bangladesh, the Government of Japan executed a basic design study on the project for the development of the activities of the repair and maintenance works for vehicle's of transport in the People's Republic of Bangladesh, by dint of dispatching an Expert Team to the People's Republic of Bangladesh August, 1979 through Japan International Cooperation Agency.

The Expert Team, under the cooperation of the Government of the People's Republic of Bangladesh carried out necessary works in Bangladesh, and after coming back to Japan, completed a detail study on the project, and submitted herewith a report on the detailed design of the project.

We confirm that this report will be contribute not only to the practical implementation of the project but also to strengthening friendly and cooperative relations between the two countries.

Finally we wish to express our sincere thanks to the staffs and officials concerned who gave us kind cooperations which are essential to the implementation of our study.

October 1979



Shinsaku HOGEN
President
Japan International Cooperation Agency
Tokyo, Japan

JAPAN ENGINEERING CONSULTANTS CO., LTD. assigned by Japan International Cooperation Agency, joined the basic design survey team under this project and took charge of compiling this report.

CONTENTS

# 1. GENERAL

# CHAPTER I. GENERAL

## 1-1 Progress of Survey

The Government of People's Republic of Bangladesh made a request to the Government of Japan to provide gratuitous cooperation for establishment of automobile repair facility, which is required for increasing the transportation capacity of the People's Republic of Bangladesh, in Bangladesh.

The Japanese Government dispatched a survey team for basic design of the project for construction of Automobile Repair & Maintenance Workshop in Bangladesh, through Japan International Cooperation Agency, for making examination of the subject gratuitous cooperation.

The survey team was composed of a staff of the Japanese Government, two experts and a coordinator, four persons in total, and carried out a field survey in Blangladesh for a period of fourteen days starting on August 3 and terminating on August 16 in 1979.

During the stay in Bangladesh, the survey team drew up interim report related to the basic plan and record of discussions, and these documents were duly signed by the survey team and also by the counterparts in Bangladesh.

The survey team drew up the basic design survey report on return to Japan, based on said interim report, record of discussions and also on the data collected during their field survey in Bangladesh.

## 1-2 General Situation of Traffic

The People's Republic of Bangladesh covers the area of approximately 153,000 $km^2$ (approximately two times as much as that of Hokkaido Island in Japan), and the population is approximately 76.82 million (as of 1975).

The land is generally flat. Beside huge Jamuna River, many rivers run across the country in many directions. Flooding frequently occurs in the rainy season, and there even are cases where the majority of the country is flooded. Because the geological condition is such that the entire country is located on a delta of a river mouth, the ground of alluvium is soft to a deep level. Out of the means of transportation in this country, railroads cover the total extention of approximately 3,000 km, but because of the ground situation described above, the foundation is inferior, the track conditions are poor, and the travelling speed is slow. Besides, because of presence of many large rivers, it is hard to construct bridges across these rivers, and many of the railroad tracks are terminated before rivers. For example, the only large city which can be reached by rail without changing trains from capital city Dacca is Chittagong, and therefore, railroad services in this country are very inconvenient.

Under the circumstances stated above, transportation in the People's Republic of Bangladesh should depend on automobiles, which are maneuverable and are able to cross rivers on ferryboats. Therefore, automobiles form the major power in the land transportation instead of railroads, and bus services between cities and also in cities are utilized as "feet" of about eighty million people of this country.

Bangladesh Road Transport Corporation (abbreviation BRTC) run by the government has been organized in this country, and is currently operating the majority of bus and truck services in the country.

BRTC has a long history, and its foundation dates back to 1961 when the country was called East Pakistan. The business of BRTC which started with transportation in Dacca has made a large expansion to the whole country. The total extension of the routes of bus services is as long as approximately 3,000 km as of 1978, and it is currently planned to extend the service net work by approximately 800 km. The number of vehicles in possession of BRTC (Tables 1-1 and 1-2) and the routes of bus services (Fig. 1-1) are indicated below.

Table 1-1 Number of Buses Owned by BRTC and Original Countries

| Year | Nos. of buses | Original country |
|---|---|---|
| 1967 | 25 | U.K. |
| 1968 | - | |
| 1969 | 83 | Italy |
| 1970 | 19 | Iran (under licence of Germany) |
| 1971 | - | |
| 1972 | 58 | India |
| 1973 | 17 + 100 | India + Japan |
| 1974 | 129 | Japan |
| 1975 | - | |
| 1976 | - | |
| 1977 | - | |
| 1978 | 160 | Japan |
| Total | 591 | 6 countries |

Notes:

1. The Nos. of buses in Table 1-1 are only those still in serviceable condition. There are certain number of buses condemned, therefore, the actual number of buses procured before 1977 is not known.
2. A total of 249 buses were procured from Japan during 1973 and 1974. According to this table, 20 buses went out of service during around 5 years.

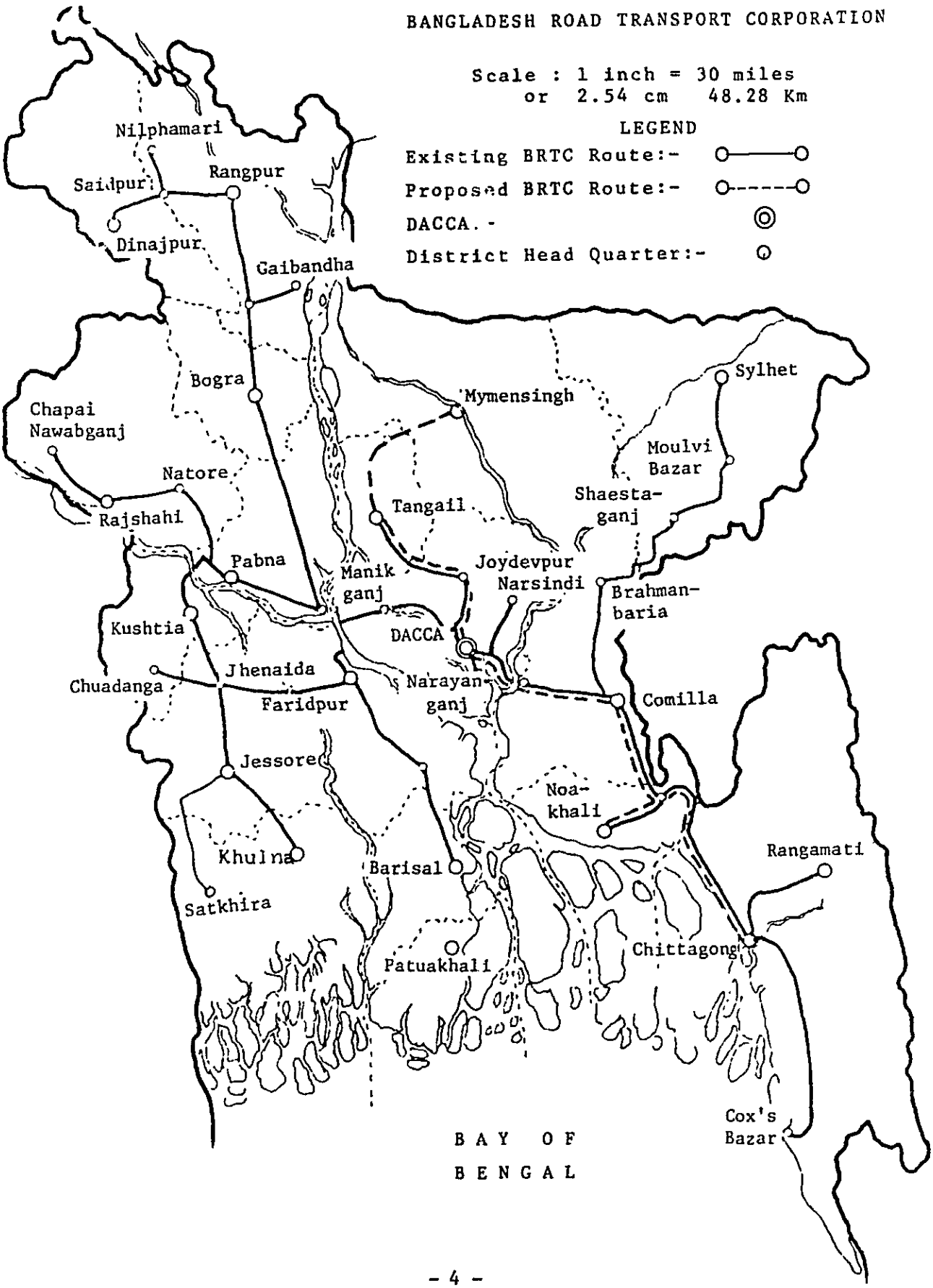
Fig. 1-1

B A N G L A D E S H

SHOWING THE ROUTES OF

BANGLADESH ROAD TRANSPORT CORPORATION

Scale : 1 inch = 30 miles
or 2.54 cm 48.28 Km



3. These figures, show only the number of buses, and BRTC procured 10 trucks for material transportation.

Table 1-2 Number of Trucks Operated by Truck Division

| Country of Origin | Nos. of Unit |
|---|---|
| Sweden | 26 |
| Japan | 90 |
| U.S.A. | 80 |
| 3 countries | 196 units |

Since buses are feet of general public in a sense that they must move about on buses within the city and inter cities, the Bangladesh Government controls the bus fare.

The bus fare as of March 1978 is as follows.

10 Paisa/mile (1 Paisa = 1/100 Taka 1 Taka ≒ ¥15
1 mile = 1.6 km)

That is, approx. ¥1/1 km. The rate is considered appropriate since the monthly wage of low class laborer is around 200 Taka/month (approx. ¥3,000/month).

However, such low bus fare discourages willingness of those who intend to venture into the private bus enterprise. Therefore, the government must make an effort to accomplish the bus business. The importance of government owned BRTC, particularly bus business, and the tendency of the business expansion may be reasoned as above.

While, many private enterprises are undertaking truck business for the reason that there is no government control of freight and BRTC concentrates its effort on the bus business to avoid useless competition with those private enterprises.

According to BRTC, the total number of bus passengers and total mileage expected in the forthcoming years keeping pace with the economic expansion are as shown in Table 1-3.

Table 1-3 Assumed Total Number of Passengers and Mileage of BRTC Buses

| Year | Total Passengers in 1,000 | Total Mileage in 1,000 Miles | Total Mileage (in 1,000 kms) |
|---|---|---|---|
| 1978 | 50,504 | 23,652 | (37,850) |
| 1979 | 55,994 | 26,280 | (42,050) |
| 1980 | 65,326 | 30,660 | (49,060) |
| 1981 | 81,658 | 38,325 | (61,320) |
| 1982 | 102,244 | 47,961 | (76,740) |
| 1983 | 127,908 | 60,060 | (96,010) |
| 1984 | 163,316 | 76,650 | (122,640) |

To cope with the expected increase of the need, it is planned to increase the number of buses as shown in Table 1-4.

Table 1-4 BRTC's Vehicle Expansion Plan

| Year | Bus | Truck | Total |
|---|---|---|---|
| 1978 | 540 | 247 | 787 |
| 1979 | 600 | 252 | 852 |
| 1980 | 700 | 312 | 1,012 |
| 1981 | 875 | 402 | 1,277 |
| 1982 | 1,095 | 485 | 1,580 |
| 1983 | 1,370 | 560 | 1,930 |
| 1984 | 1,750 | 640 | 2,390 |

The situation of transportation in Bangladesh was described above with focus on the business of BRTC.

The People's Republic of Bangladesh became independent in 1974 and its history is still short. However, signs of gradual improvement have been recently indicated with respect to development and growth of industries, economy and culture. The need for transportation in the country is increasing as a result, and the Bangladesh Government adopts increase of means of transportation as one of the main policies.

## 1-3 Current Situation of Repair and Maintenance and Significance of Provision of Automobile Repair & Maintenance Workshop

As described in item 1-2, the numbers of vehicles and depots have been steadily increased by BRTC since its inauguration in 1961. However, the maintenance equipment held in the depot in Dacca City is small in quantity and old and some of the equipment are left in unserviceable condition. The present status is such that the maintenance in depots must depend largely on the manual labor.

This is assumed to be the result of the lack of maintenance know-how due to personal reassignment, improper handling of equipment which requires correct handling and material shortage, etc., under circumstance of independent war. At present, two members of Japan Overseas Cooperation Volunteers are working and their superhuman efforts keep the vehicles operating. It is quite wasteful that even repairable vehicles are being condemned one by one because there is little equipment available. According to the data of BRTC, the operating conditions of the vehicles currently in possession of BRTC are as follows.

| | |
|---|---|
| Serviceable vehicle (A) | |
| Bus | 237 |
| Truck | 115 |
| Vehicles to be repaired (B) | |
| Bus | 204 |
| Truck | 81 |
| Total (C) | |
| Bus | 441 |
| Truck | 196 |
| Availability (A ÷ C x 100%) | |
| Bus | 53.7% |
| Truck | 58.7% |

That is, one out of two vehicles is to be repaired. However, the extent to which the repair can be done by manual labor is limited and repair function is almost non-existent. Under the circumstances, repairable vehicles have to continue the work until they become totally unfit to service.

For one thing, there is no "periodic inspection/maintenance" in this country, which is owner's responsibility in Japan. For this reason, the vehicle life is short. The life of vehicle such as bus which runs a certain distance every day is said to be around 5 years. While the same bus is used for around 10 years in Japan and remains serviceable for several more years after being exported to Southeast Asian countries as a used car. Vehicles in Bangladesh have surprisingly short life. Secondly, there are few service shops in this country which are common in Japan. The survey team visited the BRTC depot while in Dacca and found a poor maintenance function as mentioned above.

The team had a chance to see the factory exclusively for the vehicle maintenance operated by BRTC. It is an obsolete shop operated with the facilities of 6 machines donated from U.S.S.R. and 9 miscellaneous machines that have been in use from the time of Pakistan.

Because of unbalanced equipment available and poor layout of equipment, operation process encounters problems in many points. Hence the maintenance work of BRTC vehicles is hindered and results a long queue of vehicles waiting maintenance.

According to BRTC, this shop is the only one shop in Bangladesh and is originally intended to maintain the vehicles that belong to the government agencies. BRTC itself has no shop exclusively for service! This fact is for us unbelievable that the corporation that is under the obligation to operate hundreds of vehicles has no shop of this kind at all!

Thirdly, there are very few service shops even in Dacca City. Sales agencies of foreign automobile makers have their own simple

service facilities and parts warehouses, however, independent private service shop is almost non-existent. Even if one fortunately find a service shop, the capacity of the shop is limited to the service of motorcycles and small passenger cars and the service of large diesel vehicles is beyond its capability.

In addition to BRTC owned diesel cars, diesel vehicles of private enterprises are in operation, of course. In case of trouble, the repair of those vehicles would most probably require such extended time as to be counted by months, especially for heavy maintenance.

It is commonly recognized in any country of the world that commercial vehicles such as buses, trucks, etc. are productive goods and are more expensive than small cars and passenger cars. Therefore, it is quite exceptional that such productive goods are discarded after one-time use as in Bangladesh. Moreover, such situation is the result of the lack of shops for maintenance with proper capacity. Then, it is understandable from the above mentioned fact that how earnestly the officials of the Ministry of Transportation in the Bangladesh Government and BRTC's directors desire the construction of Automobile Repair & Maintenance Workshop.

Automobile Repair & Maintenance Workshop to be constructed this time has been planned since a number of years ago under the circumstances stated above, and its principles are as follows.

(a) To be equipped with a consistent repair and maintenance system

(b) To be capable of coping with repair of all sorts

(c) To make contribution to upbringing of repair and maintenance technology

Compared to the situation of discarding vehicles after one-time use only described above, it can be expected that the service lives of automobiles will be extended at a stroke when this Automobile Repair & Maintenance Workshop is established, and it will bring about a tremendous economical merit for Bangladesh which depends supply of automobiles only on import.

In addition, it will become possible to prevent frequent occurrence of traffic accidents due to lack of maintenance of automobiles. Furthermore, it can be expected that establishment of the repair factory will make contribution to improvement of maintenance consciousness and also to upbringing of engineers.

## 1-4 Necessity of Training Function and Situation of Execution of Training

It was reported as follows by BRTC regarding construction of a training institute when the survey team visited BRTC.

(a) The training institute which had been formerly maintained with assistance obtained from UNDP and ILO was closed, and it was decided to newly construct a training institute in Joydevpur with financial assistance obtained from UNDP.

(b) BRTC is largely interested in training of workers. That is, this country enacted the Wage Earners' Scheme and encourages people to go to the Near East countries to find job opportunity with resultant loss of persons with some skill and aggravation of shortage of qualified persons. Approx. 100 BRTC employees are said to have gone to the Near East countries taking advantage of this scheme.

Under the circumstances stated above, it is urgently required to upbring mechanics having knowledge of repair and maintenance, but there is no anxiety in particular regarding supply of mechanics to the repair factory, as a large private scale training facility will be provided in the site of the repair factory under the assistance of UNDP.

## 1-5 Conclusion

What can be called as full scale automobile repair factory does not exist at all in Bangladesh at the present time as described above. Therefore, when the need for repair and maintenance of automobiles is systematically considered, it reaches a broad and tremendous scale, and therefore, it was decided to limit the object of this survey only to the vehicles operating in and around capital city Dacca.

Dacca City and its surrounding area forms the nucleus of the People's Republic of Bangladesh, and is the base point of politics, industries, economy and transportation of the country. Buses and trucks of the number that is equivalent to 70 per cent of all the buses and trucks in the country are operating in this area, and accordingly, major depots of BRTC are also located in this area.

It is currently estimated by BRTC that the number of buses and trucks will reach approximately 1,300 in 1981. (See Table 1-4)

When said 70 per cent is applied to this figure,

$$1{,}300 \times 0.7 \fallingdotseq 900 \text{ (trucks and buses)}$$

is obtained.

Consequently, the number of vehicles to be the object of heavy repair and periodical maintenance was assumed as 900, and survey for establishing basic design of Automobile Repair & Maintenance Workshop with these vehicles as the major application was executed.

On planning of the factory, the prime object was placed on the provision of modern facility of high efficiency with superior functions, and efforts were made to incorporate the local situations, requests and future forecast as much as possible.

Budgetary measures for land preparation (banking, construction of fences and so forth), draw-in of electric power, supply of electric power required for construction, supply of water, customs

duties levied on the import of construction materials and equipment and expenses of land transportation of construction materials and equipment and preparation of structures for allowing smooth materialization of this plan by the Bangladesh Government are required for execution of this plan.

Finally, it is needless to say that construction of the facility alone, although it will be materialized through this plan, will not solve the problems of repair and maintenance of automobiles. Unless consideration is made as for guidance of operation technology, upbringing of engineers, improvement of quality of mechanics and guidance of operation and management of the factory together with construction of the factory, the facility will not be best utilized. It is therefore desirable that full cooperation is also made with this respect.

# 2. OUTLINE OF SURVEY

# CHAPTER II. OUTLINE OF SURVEY

## 2-1 Purpose of Survey

The Government of People's Republic of Bangladesh requested the Government of Japan to make gratuitous financial cooperation for automobile repair facility required for increasing transportation capacity in Bangladesh. In response to this request, the Government of Japan decided to dispatch a basic design survey team for examining the plan of Automobile Repair & Maintenance Workshop through Japan International Cooperation Agency.

Therefore, the purpose of this survey is to draw up the materials required for examination by the Japanese Government of this plan as for gratuitous financial cooperation, and is to consider the economic significance and national significance of this plan through seizure of the current situation of transportation and repair and maintenance of vehicles in Bangladesh.

## 2-2 Background of This Survey

"Survey of the Plan for Construction of Automobile Repair & Maintenance Workshop in Bangladesh" was started, with financial cooperation on consideration basis as the premise at the beginning, with dispatch of the primary survey team to Bangladesh in December of 1977.

This primary survey team was composed of three members including Juichi Kokubo, Acting Manager of Mining and Manufacturing Industry Planning and Survey Division of Japan International Cooperation Agency as the leader and two experts, stayed in Bangladesh for a period of twelve days from December 2 through December 13, carried out a survey of the basic plan, and submitted a survey report of the basic plan dated December 20, 1977 to the governments of both Bangladesh and Japan.

Successively, the secondary survey team was organized for the purpose of carrying out a survey of execution design in February of 1978. This secondary survey team was composed of ten members in total including Akira Gomi of Technical Advisor of Japan Engineering Consultants Co., Ltd. as the leader, eight experts and one coordinator. This secondary survey team stayed in Bangladesh for a period of one month from February 21 through March 21, carried out survey and collection of data required for execution design, and made preliminaries regarding the design with the government agencies concerned and with BRTC. The team immediately commenced execution design on return to Japan, and completed the execution design in September of the same year. The survey team composed of three members including said Akira Gomi as the leader visited Bangladesh for a period of eight days from September 5 through September 12 for reporting the contents of the execution design, explained the contents of the design to the government agencies concerned and to BRTC, and obtained their approval.

After reporting the contents of the design in Bangladesh, the team submitted "Report on Execution Design of Automobile Repair

& Maintenance Workshop Construction Plan in Bangladesh" consisting of seven volumes dated October of 1978 to the governments of both Bangladesh and Japan.

A request for gratuitous financial cooperation for the said plan was made in 1979 from the Bangladesh Government due to financial situation of Bangladesh as already described. In response to this request, the Japanese Government dispatched Masaaki Ono, Chief Officer of Second Economic Cooperation Section of Economic Cooperation Bureau of the Ministry of Foreign Affairs and one coordinator visited Bangladesh in June, and made preliminaries regarding basic points with the authority of Bangladesh. The contents of preliminaries are as follows.

(A) To make consideration to replete repair and maintenance in general, and not to lay emphasis in heavy repair only.

(B) To provide training facility (80 persons).

(C) To provide a canteen

(D) To provide an office.

The survey team of this time was dispatched for carrying out a survey of basic design with the basic points stated above as the premises.

2-3 Composition of Survey Team

| | | |
|---|---|---|
| Leader | Tomoo Aoyagi | Officer, Second Economic Cooperation Section, Economic Cooperation Bureau, Ministry of Foreign Affairs |
| Generalization | Akira Gomi | Technical Advisor of Japan Engineering Consultants Co., Ltd. |
| Construction | Michio Hoshino | Acting Manager, Construction Division, Japan Engineering Consultants Co., Ltd. |
| Coordination | Hisatoshi Naito | Industry Planning Section, Mineral and Manufacturing Industry Planning and Survey Division, Japan International Cooperation Agency |

Counterparts in Bangladesh

| | | |
|---|---|---|
| Generalization | C.R. Dutta | Chairman |
| Repair and operation | Moula | Acting Chief Technical Officer |
| Construction | M. Ibrahim | Executive Engineer |
| Repair machinery | F. Mohammad | Works Manager |
| " | Rub | " |
| " | Mustafa | " |
| | | c/o BRTC |

## 2-4 Schedule of Survey Team

The survey team departed Japan on August 2, 1979 and returned to Japan on August 17, 1979. The detailed schedule is described below.

| | |
|---|---|
| August 2, Thur. | Tokyo - Bangkok |
| 3, Fri. | Bangkok - Dacca<br>Afternoon : Courtesy visit to Japanese Embassy in Dacca<br>Ambassador, Mr. Ito,<br>Counselor, Mr. Hamano |
| 4, Sat. | Morning : Courtesy visit to Ministry of Railways, Roads, Highways & Road Transport<br>Mr. Nassirudin (Joint Secretary)<br>Afternoon : Visit to BRTC (Bangladesh Road Transport Corporation)<br>Mr. Dutta (Chairman),<br>Mr. Mong Kew (Acting Chairman),<br>Mr. Moula (Acting Chief Technical Officer),<br>Mr. Mustafa (Planning Officer),<br>Mr. Fouz (Works Manager) |
| 5, Sun. | |
| 6, Mon. | Morning : Courtesy visit to ERD (External Resources Division)<br>Mr. Ali<br>Afternoon : Visit to depots in and around Dacca<br>Motijheel, Mohammadpur, Kariyanpur,<br>Mirpur - 13 Depot, etc. |

| | |
|---|---|
| August 7, Tues. | Meeting with BRTC<br>Mr. Dutta (Chairman), ° Mr. Ibrahim (Executive Engineer), ° Mr. Moula, ° Mr. Mustafa, ° Mr. Fouz, ° Mr. Rub<br>Note : o marks indicate counterpart members. |
| 8, Wed. | Meeting with BRTC |
| 9, Thur. | Meeting with BRTC |
| 10, Fri. | 9:00 - 10:00 Courtesy visit to Planning Commission<br>Mr. Yusuf Zai (member of Planning Commission), Mr. Nassirudin, Mr. Moula, Counselor, Mr. Hamano<br>10 : 00 Meeting with BRTC |
| 11, Sat. | Visit and survey at proposed construction site in Joydevpur together with Mr. Ibrahim, Mr. Mustafa |
| 12, Sun. | |
| 13, Mon. | Morning : Meeting with BRTC<br>Afternoon : Preparation of Interim Report |
| 14, Tues. | Morning : Meeting with BRTC<br>Confirmation of Record of Discussions<br>Mr. Dutta and other members<br>Afternoon : Preparation of Interim Report |
| 15, Wed. | Morning : Confirmation of Record of Discussions with Ministry of Railways, Roads, Highways & Road Transport (Mr. Nassirudin) with attendance of BRTC counterpart members.<br>Presentation of Interim Report<br>Afternoon : Visit to Japanese Embassy in Dacca (Reported the result of survey to Ambassador, Mr. Ito and Counselor, Mr. Hamano) |

| | |
|---|---|
| August 16, Thu. | . Signing of Record of Discussions by Mr. Dutta, chairman of BRTC and Mr. Aoyagi, leader of Japanese Survey Team<br>. Presentation of Interim Report<br>Dacca - Bangkok |
| 17, Fri. | Bangkok - Tokyo |

## 2-5 Contents of Discussions Made by Survey Team

The results of discussions made by the survey team with the counterpart are summarized in the Record of Discussions indicated in the following pages.

The Interim Report which indicates the outlines of Automobile Repair & Maintenance Workshop determined based on the agreement with the counterpart is also indicated after the Record of Discussions.

RECORD OF DISCUSSIONS BETWEEN JAPANESE EXPERT TEAM AND THE BANGLADESH ROAD TRANSPORT CORPORATION ON THE BRTC CENTRAL WORKSHOP PROJECT FOR REPAIR AND MAINTENANCE OF VEHICLES OF TRANSPORT IN BANGLADESH :

Attached herewith is the "Record of discussions" that has been agreed upon between Expert Team and the Bangladesh Road Transport Corporation, Government of the People's Republic of Bangladesh for afore mentioned subject.

It should be noted that this " Record of Discussions " does not legally bind both Governments.

I have few points which will be sent in a seperate letter.

( TOMOO AOYAGI )
Leader,
Japanese Survey Team.

MAJOR GENERAL (RELEASED) C.R. DUTTA
Chairman,
Bangladesh Road Transport Corporation,
DACCA.

Dacca ;
Dated the 15th August,
1979.

RECORD OF DISCUSSIONS

The following points were discussed and agreed upon between the Basic Design Survey Team of Japan International Cooperation Agency and the officials of ~~the Ministry of Railways, Roads, Highways and Road Transport and of~~ Bangladesh Road Transport Corporation.

1. The Integrated Central Workshop which would be built at Joydebpur (hereinafter called as " the Center ") shall be so designed as to be able to cater for the heavy repair of vehicles to be done once in every two years, periodical repair to be done once in every 6 months, body repair and painting works etc as appropriate, and other necessary related repair works. As for tyre recapping ~~works, it is~~ and foundary shop under study by the survey team. The necessary equipment for the periodical repair to be done once in every 3 months would be installed in the suitable depots inside or arround the Dacca city (hereinafter called as " the Depots ").

2. The buildings which would be built inside the Center are as follows and in building these structures, attention will be paid so as to take local conditions into consideration ~~as far as possible~~ and use local materials as far as practicable.

   (a) Administration Building ;

   (b) Heavy repair and periodical repair factory including inspection stalls.

   (c) Parts storage house.

Continued/--

(d) Body repair and painting factory, also, the Survey Team is now under studying tyre recapping space connected to this factory.

(e) Canteen ;

(f) Water supply system to the whole buildings ;

(g) Small buildings such as oil and paint storage house, a check gate, a sub-station and exterior works like pavement, etc.

3. The layout and construction of above mentioned buildings is shown in the attached paper No.1, but this is subject to change for purposes of detailed designing as may be required by costing and other practical and compelling circumstances.

4. The service machinery, tools, etc to be equipped in the center would be so planned as to make the proposed central workshop to be self-complete and sufficient with spare parts for machineries duly provided for, although the total value of such machineries, tools, spare parts etc. shall be subject to change due to costing and other circumstances.

5. The following advisers or instructors are necessary for the operation and mangement of the Centre and the Depots :

(a) Heavy repair and inspection works ;

(b) Periodical repair works ;

(c) Body repair works ;

(d) Spare parts and stock control.

Also, sending above mentioned experts from Japan, it is essential that an official request will be made by the Bangladesh Government to the Government of Japan.

T.H. E.K.

Continued/--

6. The tentative schedule of this project is shown is attached paper No. 2.

7. It was confirmed that the Bangladesh side shall be responsible for the following :

(a) Levelling of land and fencing wall;
(to be commenced immediately prior to relevant Exchange of Notes.

(b) Water and electric power supply for construction outiside and upto the proposed premises.)

(N.B) Both parties confirmed that the works mentioned in (a) and (b) to be done by Bangladesh side are essential to comply with the schedule mentioned in paragraph - 6.

8. Both party confirmed that the application of the report done by the Japanese Team in 1978, called "Detailed Design Report on constbuction project of Automobile Repair and Maintenance Workshop", is the most essential factor in carrying out this project successfully. Also both party confirmed that in order to implement this project promptly and successfully it is essential for the both party to engage some appropriate and qualified consultant,, who is (or are ) nationals of Japan.

9. The Japanese Survey Team will work out in Japan necessary works for the Basic Designing and submit the report duly completed to the both Governments as soon as possible.

# INTERIM REPORT OF THE BASIC DESIGN STUDY
# ON
# THE ESTABLISHMENT PROJECT OF THE CENTRAL WORKSHOP FOR REPAIR AND MAINTENANCE OF VEHICLES OF TRANSPORT
# IN
# THE PEOPLE'S REPUBLIC OF BANGLADESH

AUGUST 1979

JAPAN INTERNATIONAL COOPERATION AGENCY

## INTRODUCTION

In response to the request of the Government of the People's Republic of Bangladesh, the Government of Japan, through its executive agency, Japan International Cooperation Agency, despatched a mission to the People's Republic of Bangladesh from the 3rd of August to the 16th of August, 1979, for basic design study on the establishment project of the Central Workshop for the repair and maintenance of vehicles of transport in the People's Republic of Bangladesh. The study team, with the cooperation of Bangladesh Road Transport Corporation staff, carried out the necessary survey and studies to make up a basic design report for the afore mentioned project.

As for the matter of the result of the survey is concerned, completed in the Draft Final Report and it will be submitted to the both Governments.

It is expected that the result of this survey will be useful not only for the establishment of the Central Workshop, but also for the enhancement of friendly and cooperative relations between Japan and the People's Republic of Bangladesh.

Finally, the members of the survey team wish to express their sincere thanks to the staff of the Ministry of Railways, Roads, Highways & Road Transport and staff of the Bangladesh Road Transport Corporation for the friendly cooperation they have provided to the mission.

##########

1. Purpose

This project is planned for BRTC to maintain its fleet in the best operating condition and extend the vehicle life.

2. Scope of maintenance and necessary Nos., of stalls

This project is planned to cover following conditions;

A) To maintain Approx 1,300 units of buses (45 ~ 60 seater, single decker) and trucks (Payload of 4.5 ~ 7tons) within The People's Republic of Bangladesh. According to the BRTC, some 70% of all units belonging to the BRTC are working arround Dacca, therefore, central workshop shall have the annual capacity of repairing of 900 units (70% of 1,300 units).

B) The central workshop to be constructed in Joidepur shall have the following activities;

1) Heavy repair to be done once every 2 years. And this requires 8 stalls.

2) Heavy periodical repair to be done once every 6 months. And this requires 6 stalls.

3) Body repair and painting works. And this requires 6 stalls.

4) Tire recapping works. (Japanese Survey Team is under study of this matter.)

5) Other necessary repair and maintenance works.

C) All necessary buildings and/or attachments shall be constructed and attached in the central workshop within the budget.

D) To extend vehicle life of each units, it is necessary to check vehicles once every 3 months --- so called light periodical repair --- in the central workshop, but due to the limitation of budget both Survey Team and counterparts of BRTC decided to put some maintenance machineries in the existing depots belonging to BRTC as follows;

1) The name of depots are Mctijheel, Kallyanpur and Mirpur-13 depot.

2) Over all Nos., of stalls to be distributed in above mentioned depots are 15 stalls, to cover 900 units, but to cover another 400 units mainly working for inter-city service, it

is decided to add 5 stalls, therefore, 20 stalls shall be distributed.

3. The scale and schedule of maintenance/repair works

A) The comparison on scale and schedule beteen the survey of this time and last time (refer to Vol. 1 of Detailed Design Report of Construction Project of Automobile Repair and Maintainance Workshop, done by JICA in October, 1978.) is as follows.

| | This time | Last time |
|---|---|---|
| Nos. of vehicles to be repaired/maintained per year | 1,300 units | 2,400 units |
| Heavy repair | 900 units (70% of 1,300 units) | 2,400 units |
| Nos. of stalls for heavy repair | 8 | 20 |
| Duration of stay in stalls for heavy repair | 4 days | 4 days |
| Periodical repair per year | minimum 900 units (70% of 1,300 units) | 1,680 units (70% of 2,400 units) |
| Nos. of stalls for periodical repair 6-months | 6 (provided in Central Workshop) | 25 (provided in Central Workshop) |
| Nos. of stalls for periodical repair 3-months | 20 (provided in Depots) | - |
| Duration of stay in stalls for periodical repair 6-months | 1 day | 1 day |
| Duration of stay in stalls for periodical repair 3-months | 2 days | - |
| Body and painting works per year | maximum 195 units (15% of 1,300 units) | 360 units (15% of 2,400 units) |
| Nos., of stalls for body and painting works; | | |
| body sheet metal work | 4 | 6 |
| painting | 2 | 6 |

| | This time | Last time |
|---|---|---|
| Duration of stay in stalls | | |
| for body sheet metal work | 4 days | 4 days |
| painting work | 3 days | 4 days |
| Preliminary inspection | Approx 10 units/day | Approx 30 units/day |
| Nos., of stalls for preliminary inspection | 1 | 2 |
| Duration of stay in stall | 30 minutes | 30 minutes |
| Final inspection | same as above | same as above |
| Nos., of stalls for final inspection | not fixed yet | 3 |

B) All other data which not mentioned here shall be fixed in the Detailed Design.

C) All studies, theory and data mentioned in the Detailed Design Report of Construction Project of Automobile Repair and Maintenance Workshop in 1978, were utilized and applied for working out of paragraph (A).

D) Necessary machineries, tools, dimensions of buildings, parts storage house, and other buildings etc., are planned to satisfy the schedule of maintenance/repair works.

E) A very strong request for establishment of tire recapping shop without concerning its scale was offered to Japanese Survey Team from counterpart members, the chairman of BRTC and Joint Secretary, Ministry of Communication, and Japanese Survey Team answered to take this matter into consideration in Detailed Design.

F) As for metal casting shop, Japanese Survey Team is not recognized urgent necessity, therefore, the team gave up to provide said shop this time.

G) According to BRTC, the support for construction and operation of Training Institute to be managed by BRTC has been offered from

U.N.D.P. and Japanese Survey Team eliminated all ideas and plannings on this matter.

4. Plan for construction

A) Factories and annexed buildings to be constructed in Joydepur together with necessary civil works shall be done within the limited budget, however, Survey Team minded following points;-

1) As the land is very wide and BRTC is planning future expansion, Survey Team is so planned the location of each building that future expansion can be easily done and minimize the land leveling.

2) To satisfy the objective of the Central Workshop and avoid too much investment for construction of buildings, Survey Team decided to utilize existing maintenance/repair stalls , as before mentioned, in the depots belonging to BRTC, locating inside and arround Dacca City.
Name of depots and Nos., of stalls is as follows.

| | | |
|---|---|---|
| ※ | Motijheel Depot | 8 stalls |
| | Kaliyanpur Depot | 6 stalls |
| | Mirpur - 13 Depot | 6 stalls |

B) Independent buildings to be built in Joydepur together approximate area are as follows;-

| | | |
|---|---|---|
| 1) | Main office building | 560 $M^2$ |
| 2) | Heavy and periodical maintenance factory - steel frame work - | 2,720 $M^2$ |
| 3) | Parts strage house - steel frame work - | 420 $M^2$ |
| 4) | Body and paint works factory - steel frame work - | 600 $M^2$ |
| 5) | Canteen | 270 $M^2$ |
| 6) | Sub-station | 60 $M^2$ |
| 7) | Checkgate, oil-paint storage house etc. | 110 $M^2$ |
| 8) | Water supply system | 1 set |

Denote;-

1) Compressed air supply system is included in each factory, and the space for installation of tire recapping équipment connected to body and paint works factory is under study.
2) Plot-planning and layout of factories are shown in the annexed drawings.
3) Necessary investment for construction of above mentioned buildings and external works are estimated as approx. one billion Japanese yen.

5. Equipment

Machineries and tools necessary for maintenance/repair works of 10 units per day are arranged within the budget with following conditions.

A) There are some machinery/tools necessary to provide at least one units without concerning the scale of workshop. Therefore, such machinery/tools must be equipped almost same quantity as the workshop planned in October, 1978.
B) To enable heavy repair factory to do overhaul once every two years, 3 and 6 months repair is essential. For this purpose, some machinery/tools are distributed to depots as before mentioned.
C) Adjusting of price had done along the change of Japanese economical situation.
D) Concerning specifications, requirements of machinery/tools, it already mentioned in the Vol.4 of Detailed Design Report on Construction Project of Automobile Repair and Maintenance Workshop, and only quantities were changed, therefore, Survey Team eliminated detailed document here.
E) Everything concerning machinery/tools shall be fixed down in the Detailed Design to be done in Japan.
F) Installation of machinery and tools, initial instruction of handling to be given Bangladesh nationals from Japanese shall be done by Japanese nationals.
G) The necessary expense of sending these machineries/tools from Japan to Chittagong on C & F base including installation and instruction is estimated as approx. 0.5 billon Japanese yen.
H) As for tire recapping equipment, Japanese Survey Team is now under study and will be decided in the Detailed Design.

6. Operation

The operation and management of whole maintenance/repair system is mentioned in the report which done by JICA in Oct, 1978. But it is necessary to modify some portion to be suitable for operation of central workshop this time.

A) The estimation of necessary Nos., of workers and advisors are as follows;

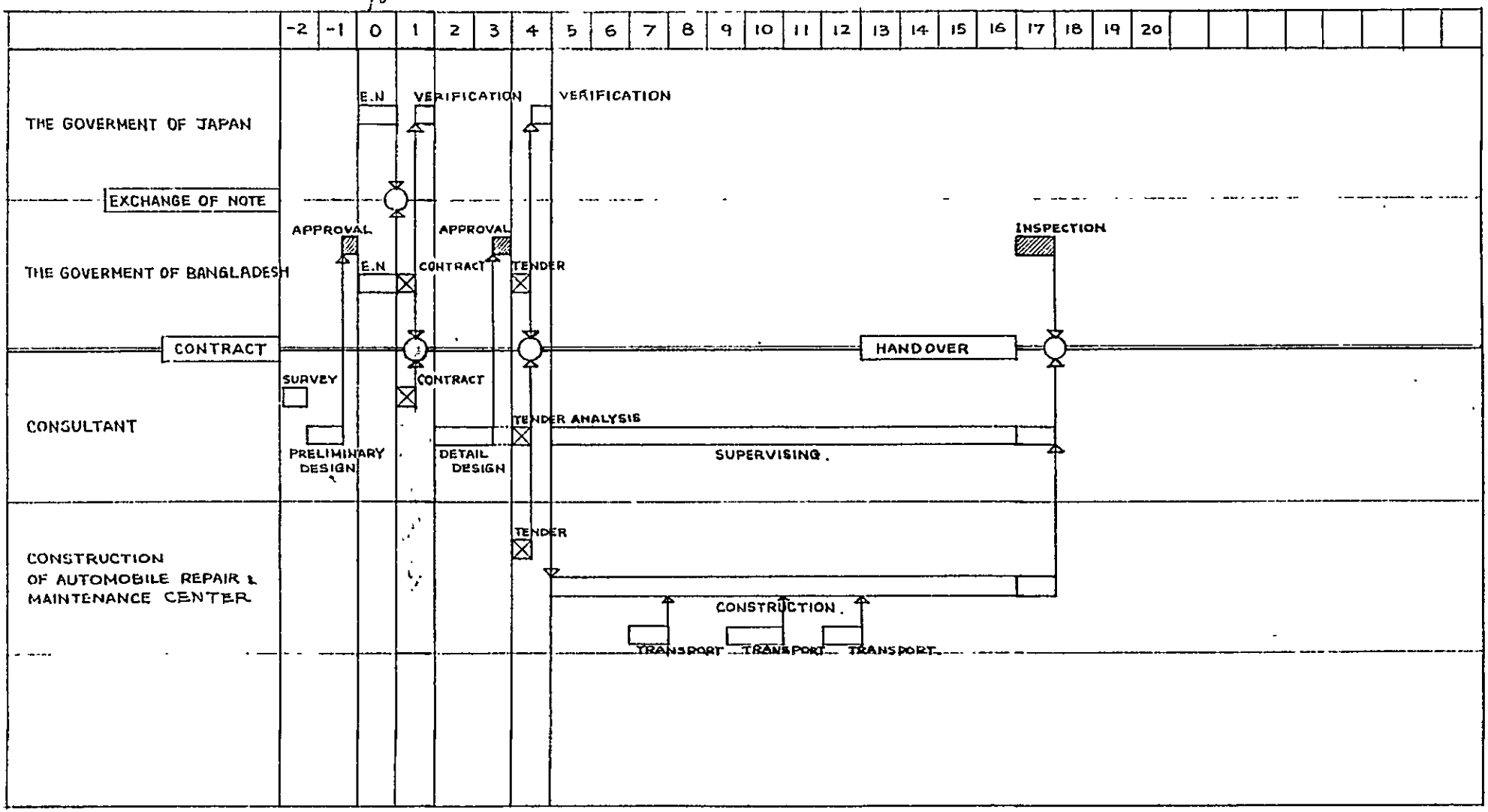
| | This time | Last time |
|---|---|---|
| Nos.,of workers including stuff and management | 600 to 700 | 1,022 |
| Advisor from Japan concerning | | |
| Heavy repair } | | 1 |
| Inspection } | 1 | 1 |
| Periodical repair | 1 | 1 |
| Reclamation | ------ | 1 |
| Body and painting works | 1 | 1 |
| Parts and stock control | 1 | 1 |

B) Dispatching above mentioned advisors by Japanese Goverment shall be done based on the request of Bangladesh Goverment.

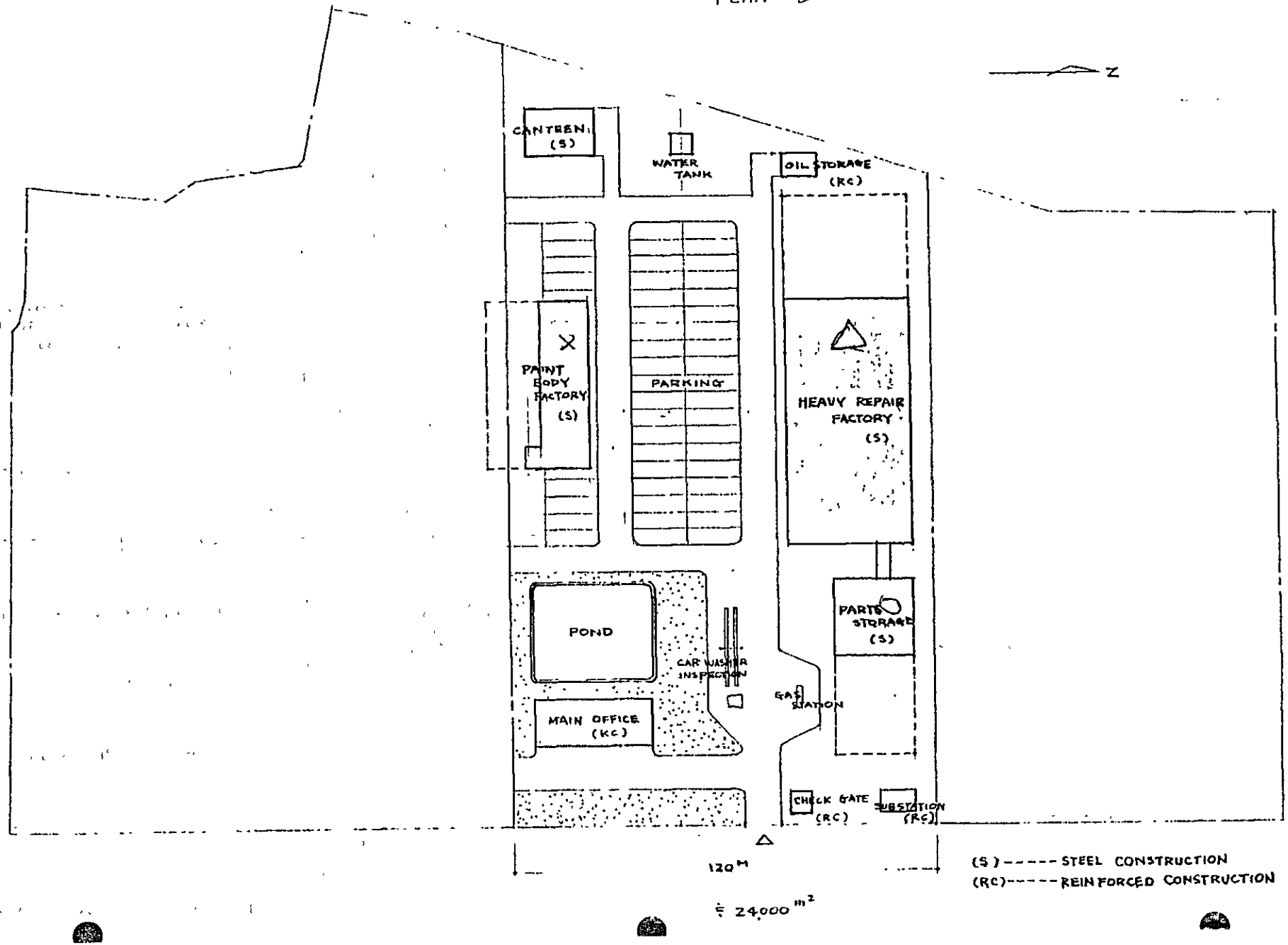
7. Schedule of construction

The schedule on the construction including necessary paper work and/or procedures is shown attached schedule chart.

PROGRAM OF THE PROJECT.



PLAN - B


N
CANTEEN (S)
WATER TANK
OIL STORAGE (RC)
PAINT BODY FACTORY (S)
PARKING
HEAVY REPAIR FACTORY (S)
POND
CAR WASHING INSPECTION
PARTS STORAGE (S)
GAS STATION
MAIN OFFICE (RC)
CHECK GATE (RC)
SUBSTATION (RC)
120 M
± 24000 m²
(S) ----- STEEL CONSTRUCTION
(RC) ----- REINFORCED CONSTRUCTION

# 3. SIGNIFICANCE AND EFECT OF ASSISTANCE

# CHAPTER III. SIGNIFICANCE AND EFFECT OF ASSISTANCE

Buses and trucks play the main roles in the land transportation in Bangladesh, and it is expected that the demand for transportation will keep on increasing in accordance with development of industries and economy of Bangladesh.

Nuvertheless, the current situation is such that the facilities for repair and maintenance of automobiles are almost none in this country. Consequently, recognition of repair and maintenance is low and technical level is also low.

Even though automobiles are imported with valuable foreign currency used, the service life of automobile is as short as about five years because repair and maintenance are not made with them. This life is less than one half of that in Japan. (It is 10 to 12 years in Japan.)

For example, there are such cases that although the bodies are still good, minor troubles occurred with engine, throttle system, power line and/or electrical system, these minor troubles cannot be repaired and the cars left in the open air in inoperative state and are then discarded.

Commercial vehicles such as buses and trucks are not consumable goods unlike passenger cars, but are durable goods. Their prices are also higher than those of passenger cars. As such expensive articles are discarded after one-time use only, the country is wasting money.

When construction of Automobile Repair & Maintenance Workshop of this plan is completed it will become possible to systematically perform heavy repair and periodical repair and maintenance of the buses and trucks operating in and around Dacca City, in which the demand for such

repair and maintenance is the largest in the country.

When it is assumed that the service life of buses and trucks is extended to eight years from current five years, it is possible to save foreign currency equivalent to about TK 17,105,000 per year. (See VII, Other Related Matters)
This saving brings a large merit for the financing of Bangladesh.

The fact that no repair factories can yet be constructed although it is well understood that discarding of automobiles after one-time use is wasting is caused by small financial scale of this country.

Buses and trucks are currently aided by many countries at the present time. This is because they are easy object of aid which do not require troublesomeness, and the current situation is such that the goods to be wasted are kept supplied indiscrimately.

This plan is matched with the true need of Bangladesh, and the financial merit of the country obtained by the repair factory when it is completed is immesurable. When automobiles are suitably maintained, it is possible to prevent frequent traffic accidents due to lack of maintenance, and it will make contribution to increased safety of the citizens. Furthermore, it is possible to make contribution to improvement of automobile maintenance technology and upbringing of engineers and highly skilled mechanics through the operation of this factory.

As judged from the functionalability and effectiveness stated above, it can be expected that this repair factory will make large contribution to the development of automotive transportation, which is very important for the development of Bangladesh, and in turn, to increased and deepened friendly relationship between both countries, through the efforts of both Bangladesh and Japan.

# 4. BASIC DESIGN

# CHAPTER IV BASIC DESIGN

## 4-1 Purpose and Conditions

### 4-1-1 Purpose

The purpose of this project is to construct an automobile repair & maintenance workshop in the suburbs of Dacca in accordance with a request made by the Government of Bangladesh, also install some machinery in some Depots located in and arround Dacca, belonging to the BRTC and enable BRTC people efficient repair and maintenance work using modern techniques and system for elongation of vehicle life.

### 4-1-2 Conditions

A) Object of repair and maintenance work

The object of repair and maintenance work shall mainly be buses of seating capacity of 40 to 60 persons and trucks of loading capacity of 5 to 7 tons. The vehicles belonging to BRTC are the object for some time.

B) Number of units to be maintained

The number of vehicles belonging to BRTC is assumed as around 1,300 units. The time when the number of units belonging to BRTC reaches this level is estimated as around 1981 - 1982 according to the expansion plan of BRTC.

According to the BRTC, 70 per cent of 1,300 units are operating in and around Dacca City, therefore, 1,300 x 0.7 = 900 (units) are the object of repair and maintenance work at the subject workshop.

The vehicles for inter-city use are considered as a part of the remaining 400 units, and light maintenance of these vehicles shall also be taken into consideration.

C) Contents of work and allotment

i) Contents of work

(a) Heavy repair : To be carried out once every two years as a rule.

(b) Periodical repair : To be carried out once every six months as a rule.

(c) Periodical repair : To be carried out once every three months as a rule. Daily inspection.

(d) Body repair and painting works.

(e) Other works such as washing and inspection which accompany the works stated above.

ii) Allotment

(a) Workshop in Joydevpur: Items a, b, d and e of paragraph i)

(b) Depots in Dacca City : Items c and e of paragraph i)

The following three depots (all of them are located in Dacca City) belonging to BRTC are designated as the workshops to carry on said maintenance work.

Kariyanpur Depot
Motijheel Depot
Mirpur-13 Depot

D) Training institute

Training institute is not considered at all.

## 4-2 Layout Plan

### 4-2-1 Necessary Number of Stalls at Workshop in Joydevpur

A) Number of stalls for heavy repair

| | |
|---|---|
| Number of vehicles | 900 units |
| Repair/maintenance frequency | Once every 2 years |
| Number of vehicles to be repaired/maintained per year | 900/2 = 450 units per year |

The number of stalls is calculated by the following formula.

$$S_N = \frac{N}{\left(\frac{n}{no}\right)}$$ where, $S_N$ : Necessary number of stalls

n : Number of working days per month

no : Duration of stay in stalls

N : Number of vehicles to be repaired/maintained per month

From the current situation in Bangladesh,

| | |
|---|---|
| Number of working months | 10 months per year |
| Number of working days | 24 days per month |

Number of days for heavy repair/maintenance

| | |
|---|---|
| Engine dismounting | 0.5 day |
| Cleaning and disassembly | 1 day |
| Machining | 1 day |
| Partial assembly | 0.5 day |
| General assembly | 1 day |
| Total stay period | 4 days |

Consequently,

$$S_N = \frac{45}{\left(\frac{24}{4}\right)} = 8 \text{ stalls}$$

B) Number of stalls for heavy periodical repair/maintenance (once every 6 months)

| | |
|---|---|
| Number of vehicles | 900 units |

| | |
|---|---|
| Number of vehicles per year | 900 x 3/2 = 1,350 units<br>(6-month repair is 4 times in 2 years; and 1 time out of them is heavy repair) |
| Number of vehicles per month | 1,350/10 = 135 units |
| Number of days required for work | 1 day |

Consequently,

$$S_N = \frac{135}{\left(\frac{24}{1}\right)} = 5.625 \rightarrow 6 \text{ stalls}$$

C) Number of stalls for body repair and painting works

According to BRTC, 15% of the vehicles belonging to BRTC are damaged per year due to collision, etc. Consequently,

| | |
|---|---|
| Number of vehicles per year | 1,300 x 0.15 = 195 units |
| Mean duration of stay for body repair and painting works | 8 days |

Consequently,

$$S_N = \frac{\frac{195}{10}}{\left(\frac{24}{8}\right)} = 6.5 \rightarrow 7 \text{ stalls}$$

However, it is desirable to form a set by two stools from the standpoint of efficiency of arrangement of personnel and maintenance tools. Therefore, 6 stalls are adopted.

4 stalls are assigned to body repair and 2 stalls are assigned to painting. Painting material shall be natural bask drying type.

D) Number of stalls for inspection and washing

Number of vehicles coming into workshop

| | |
|---|---|
| Heavy repair | 450 units/year |
| Periodical repair | 1,350 units/year |
| Body repair | 195 units/year |
| Total | 1,995 units/year |

Number of vehicles accepted per day $\frac{\frac{1995}{10}}{24} = 8.31 \rightarrow 9$ units

i) Number of stalls for washing

Washing time:45 min. = 0.75 hr.

Working hours per day : 7.5 hrs. Consequently,

$$S_N = \frac{8.31}{\left(\frac{7.5}{0.75}\right)} = 0.831 \rightarrow 1 \text{ stall} \quad \text{(Outdoor)}$$

ii) Acceptance inspection

Inspection time : 45 min. = 0.75 hr. Consequently,

$$S_N = \frac{8.31}{\left(\frac{7.5}{0.75}\right)} = 0.831 \rightarrow 1 \text{ stall} \quad \text{(Outdoor, close to washing stall)}$$

iii) Final inspection

Inspection time : 1 hr. Consequently,

$$S_N = \frac{8.31}{\left(\frac{7.5}{1}\right)} = 1.108 \rightarrow 1 \text{ stall} \quad \text{(A stall for periodical repair is to serve a double purpose)}$$

4-2-2 3-Month Light Periodical Repair at Each Depot

| | |
|---|---|
| Time of repair | Every 3 and 9 months (this year) and Every 3 and 9 months (next year), 4 times. |
| Number of vehicles to be maintained | 900 units + $\alpha$. When $\alpha$ is removed; |
| Total number of vehicles per year | 900 x 4/2 = 1,800 units per year |

Duration of stay at a depot is assumed as 2 days (2 times of that at Joydevpur)

$$S_N = \frac{1800/10}{(24/2)} = 15 \text{ stall}$$

5 stalls are added for the vehicles of other areas ($+\alpha$) entering Dacca.

Consequently,

$S_N$ = 20 stalls

It was decided to distribute these stalls to the following depots as the result of survey.

| | |
|---|---|
| Motijheel Depot | 8 stalls |
| Kariyanpur Depot | 6 stalls |
| Mirpur-13 Depot | 6 stalls |

No stalls for washing or inspection will be provided at any depot.

The size of each factory building is determined based on the results of calculation made above.

4-2-3 Comments Regarding Subsidiary Buildings

Please refer to section 3-3 for the details of workshop buildings.

It can be hardly said that sufficient space is secured, particularly parts storage for example, but the parts storage itself is designed with both the structure and location which facilitate future expansion.

As the current situation in Bangladesh, no parts stock control is made at all, and it is most essential to set up proper parts management system. Correct parts ordering points should be determined and the problem of the space stated above should be solved by timely obtaining the really necessary parts only, after establishment of said parts management system.

## 4-3 Outline of Construction Design

The layout of the factories is basically the same conception as what decided in the report prepared in October, 1978, and also future expansion is taken into consideration.

The prime object of the buildings is to form spaces in which works can be carried out efficiently, with priority given to work functions.

Care shall be exercised in the practical designing work to adopt local method of construction and materials as much as possible while incorporating modern technology, and also the design shall be matched with the climate and nature of Bangladesh.

### 4-3-1 Factory Site

(a) Location

With future expansion being planned by Bangladesh side taken into consideration, the ground of about 24,000 $m^2$ located at about the center of the site was selected as the area for construction of the factories this time.

(b) Ground leveling

The current ground level is lower than the front road level by 1.8 - 2.0 m in average. From the standpoint of environment as the site for a maintenance factory, it is desirable that the ground level should as high as possible. However, as reclamation work must taken into consideration, therefore, the same height as the front road surface was determined as the design ground level. The volume of earth required for reclamation in this case is as enormous as about 43,000 $m^3$. Minute land reclamation plan is required.

(c) Geology

As a result of geological survey, it was found out that the ground is generally of the stratum of silt and silt containing fine sand, and high bearing capacity cannot be expected.

Therefore, piling is necessary for main factory buildings.

Although piling is not required for buildings of small scale, the reclamation depth is large and supporting ground level is low as described in paragraph (b) above, consequently, these facts should be taken into consideration in design. The ground water level is about 0.5m from the ground surface.

(d) Water supply

A deep well of about 100 m will be provided and water shall be fed from this well through an elevated water tank.

(e) Water drainage

Waste water will be discharged to the borrow pit located outside of the site through water drain pipes and water drain ditch provided inside of the site. Each building shall be provided with a septic tank for treatment of waste water and an oil separator shall be provided for separation of used oil from waste water of the workshop, and thus waste water will be treated before being discharged to the exterior of the site.

(f) Electric power supply

The overhead transmission cables carrying 11 kV of electric power located in the distance of about 3 km in the south of the site shall be extended and led into the site. (Separate work)

4-3-2 Building Plan

(a) Factory buildings

Long span structure and effective ceiling height of 6 m are required due to the functions. Therefore, it was decided to use steel construction. Consideration was made to get good lighting and ventilation for improving working circumstance.

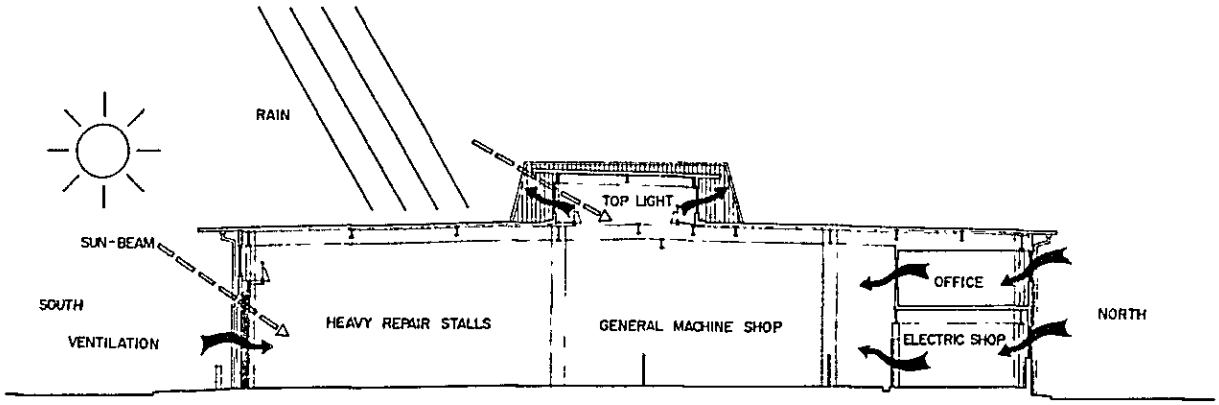



Fig. 4-1

The internal floors are concrete floors, the equipment of water and oil drainage are considered for maintaining clean environment.

(b) Administration office building, and others

The main office building and other minor buildings shall be of the construction of the local method using local materials as main material.

(c) Outline of buildings and utilities

The plan view of each building is indicated in Chapter 8. The breakdown of planned floor space is as follows.

Table 4-1

| | Building Name | Construction | | Total ($m^2$) |
|---|---|---|---|---|
| | | Reinforced Concrete | Steel Frame | |
| 1 | Heavy repair factory | | 2,720 | 2,720 |
| 2 | Parts storage | | 420 | 420 |
| 3 | Paint body factory | | 600 | 600 |
| 4 | General office | 600 | | 600 |
| 5 | Canteen | | 270 | 270 |
| 6 | Oil storage | 60 | | 60 |
| 7 | Check gate | 30 | | 30 |
| 8 | Sub-station | 60 | | 60 |
| | Total | 750 $M^2$ | 4,010 $M^2$ | 4,760 $M^2$ |

Other facilities

Car washer and inspection stall, gas station, elevated water tank (including pump house), waste oil tank, etc.

4-3-3 Construction Plan

(a) Both reinforced concrete construction and steel construction shall be of frame construction for enabling them to cope with future plans, for this purpose, braces and curtain walls shall be provided as few as possible.

(b) The foundation shall be depended on the bearing capacity of soil as much as possible. However, "piles" which mainly generate friction bearing force shall be used in unavoidable cases such as the excess weight of the building or by the situation of reclamation of the ground.

(c) Seismic force of lateral seismic coefficient of 0.1 and wind force of the velocity of 60 m per second are considered as external forces.

(d) As the standard of materials for reinforcing bars and steels, Japanese Standard shall be used, but aggregate and bricks to be used for curtain walls shall be locally available materials as much as possible.

(e) The standards and specifications to be used for construction design shall be the ones specified by the Architectural Institute of Japan. But it is needless to say that local situations and conditions will be fully taken into account on their application.

4-3-4 Finishing Material Plan

(a) External finish

i. Steel construction

| | |
|---|---|
| Berm | Reinforced concrete |
| Lower wall | bricks |
| Wall | Covered with steel sidings |
| Roof | Covered with corrugated steel sheets |

ii. Reinforced concrete construction

| | |
|---|---|
| Berm | Reinforced concrete |
| Baseboard | Finished with mortar |
| Wall | Bricks |
| Roof | Finished with water-proof lime terracing |

(b) Internal finish

i. Steel construction

| | |
|---|---|
| Floor | Reinforced concrete |
| Lower wall | Bricks and finished with mortar |
| Wall | Outside covered steel siding only, and rear side of sidings exposed (Plaster board coasted with vinyl paint shall be put on the parts storage, office portion, etc.) |
| Ceiling | Outside covered with corrugated steel sheets only and heat insulator exposed. |

ii. Reinforced concrete construction

| | |
|---|---|
| Floor | Terrazzo block |
| Baseboard | Terrazzo |
| Wall | Finished with mortar and coated with vinyl paint |
| Ceiling | Plaster |

4-3-5 Exteiror Plan

(a) Fences (separate work) and gate

Fences made of bricks with the height of 2.4 m shall be provided along four sides of the site.

(b) Pavement of passages

The passages shall be of asphalt pavement of local construction method.

(c) Pavement of parking

The parking shall be paved with bricks by local construction method.

(d) Car wash and inspection stall

To be constructed as indicated in the drawing.

(e) Gas station

Underground tank, station stand, etc. will be constructed as indicated in the drawing.

(f) Water supply tower

(g) Waste oil tank

4-3-6 Plumbing Installations

a. Water supply installation

A deep well will be excavated on the west side of the site and water will be pumped out of it by using a submarine pump. The water pumped out of the well will be once contained in the water reservoir for settlement of sand and is then pumped up to the elevated water tank for delivery to each building.

b. Drainage installation

Of Drainage living drainage, sanitary sewage (water from water closets) will be caused to flow through the purifying tank provided for each building before being discharged to the side ditch. Miscellaneous waste water (water from wash-rooms and shower rooms) will be directly discharged to the side ditch. Waste water from kitchen will be discharged to the side ditch after being caused to flow through a grease trap.

Of factory waste water, waste water from engine washing group of the Heavy Repair Factory will be caused to flow through

oil separating tank before being discharged. Other floor waste water will be directly discharged to the side ditch.

c. Sanitary fixtures

Each toilet and shower room as well as other necessary places will be equipped with the fixture which correspond to the application. Washing of closet bowls will be of flush system.

d. Septic tank

Each purifying tank will be of independent treatment long time aeration system, and the tank main unit will be made of concrete to be placed at the site. A spare blower for aeration will always be prepared.

e. Fire extinguishing equipment

Large size fire extinguishers will be provided in each factory.

f. Well

The well will be of the depth of 100 m and of the diameter of 200 mm. A strainer of the length of 15 m will be provided. The pump to be used will be a submarine pump, and a spare will be always prepared.

4-3-7 Air Conditioning and Ventilation Installations

a. Air conditioning installation

The injection pump shop of the heavy repair factory will be air conditioned by a package type air conditioner.

Design condition will be as follows.

Table 4-2

| | Dry bulb temp. | Relative humidity |
|---|---|---|
| Ambient temp. and humidity | 35°C | 90% |
| Room temperature and humidity | 26°C | 55% |

b. Ventilating equipment

Forced ventilation by ventilator fans will be provided for the paint shop of Paint Body & Retreading Factory, steam cleaner room of Heavy Repair Factory, and Parts Storage.

4-3-8 Basic Design of Electrical Installation

This installation is the electrical installation in the facility based on the local conditions and design conditions, and the design conditions and the contents of the installation are as follows.

(A) Design conditions

| | | |
|---|---|---|
| (1) | Incoming electric system | 3-phase 3-wire<br>11 kV, 50 Hz |
| (2) | Distribution system in the facility | 3-phase 4-wire<br>415 V/240 V, 50 Hz |
| (3) | Rating of electric equipment | 3-phase 415 V, single phase, 240 V, 50 Hz |
| (4) | Specification and standards | Specification and standards of Japan or equivalent |
| (5) | Used equipment and materials | Japanese products or equivalent |

(6) Separate works to be provided by the Owner

a) Electric power supplying work to the substation on the site from the exterior

b) Central office trunk work to the office building on the site from the exterior

c) Countermeasures against service interruption and voltage fluctuation

(B) Contents of installation

(1) Items of electrical installation

a) Substation equipment

b) Main line system

c) Power control system

d) Lighting fixture and socket outlet system

e) Interphone system

f) Lightning conductor

(2) Outline of electrical installation

The outline of the items indicated above are described below.

a) Substation equipment

Substation equipment is provided on the site for receiving the electric power supplied from the exterior (separate work) and for transforming it to what is required for distribution within the facility. This equipment is a cubicle of indoor type installed in the substation building, and safety and protection are fully considered with this equipment.

b) Main line system

This is the system for distribution of required electric power to each building from the substation equipment. Underground cable is sued from the standpoints of safety and appearance.

c) Power control system

This is the system for performing supply and control of electric power required for repair of automobiles, water supply, water discharge, ventilation, cooling equipment, etc.

d) Lighting fixture and socket outlet system

This is the lighting fixture and socket outlet system required for each building, each room and also outdoors.

e) Interphone system

Interphone for intra-office communication will be provided at necessary places in the facility. Piping will also be provided to enable draw-in of central office trunk to the office building (separate work).

f) Lightning conductor

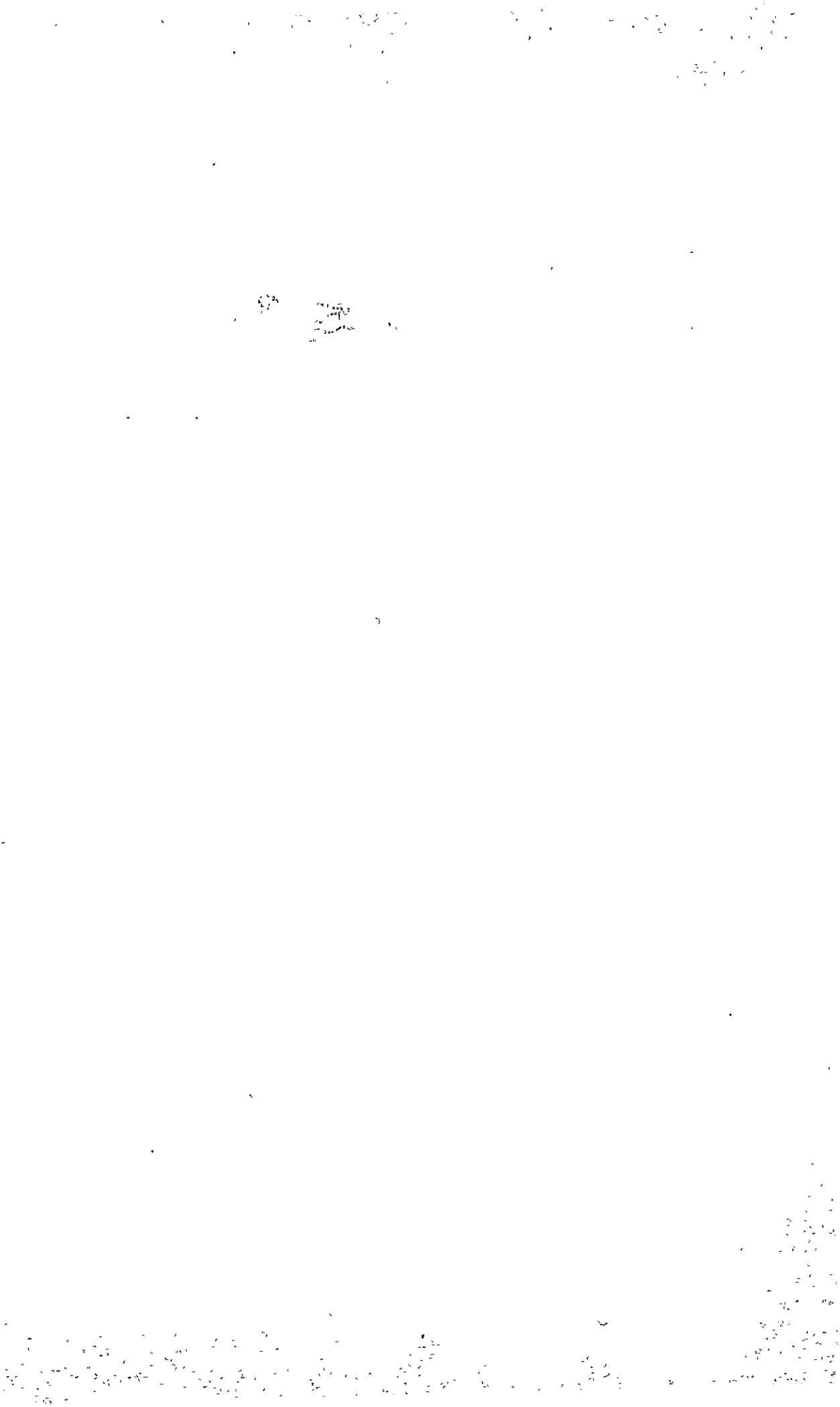
This is the equipment for protection of buildings and equipment in the facility from lightning.

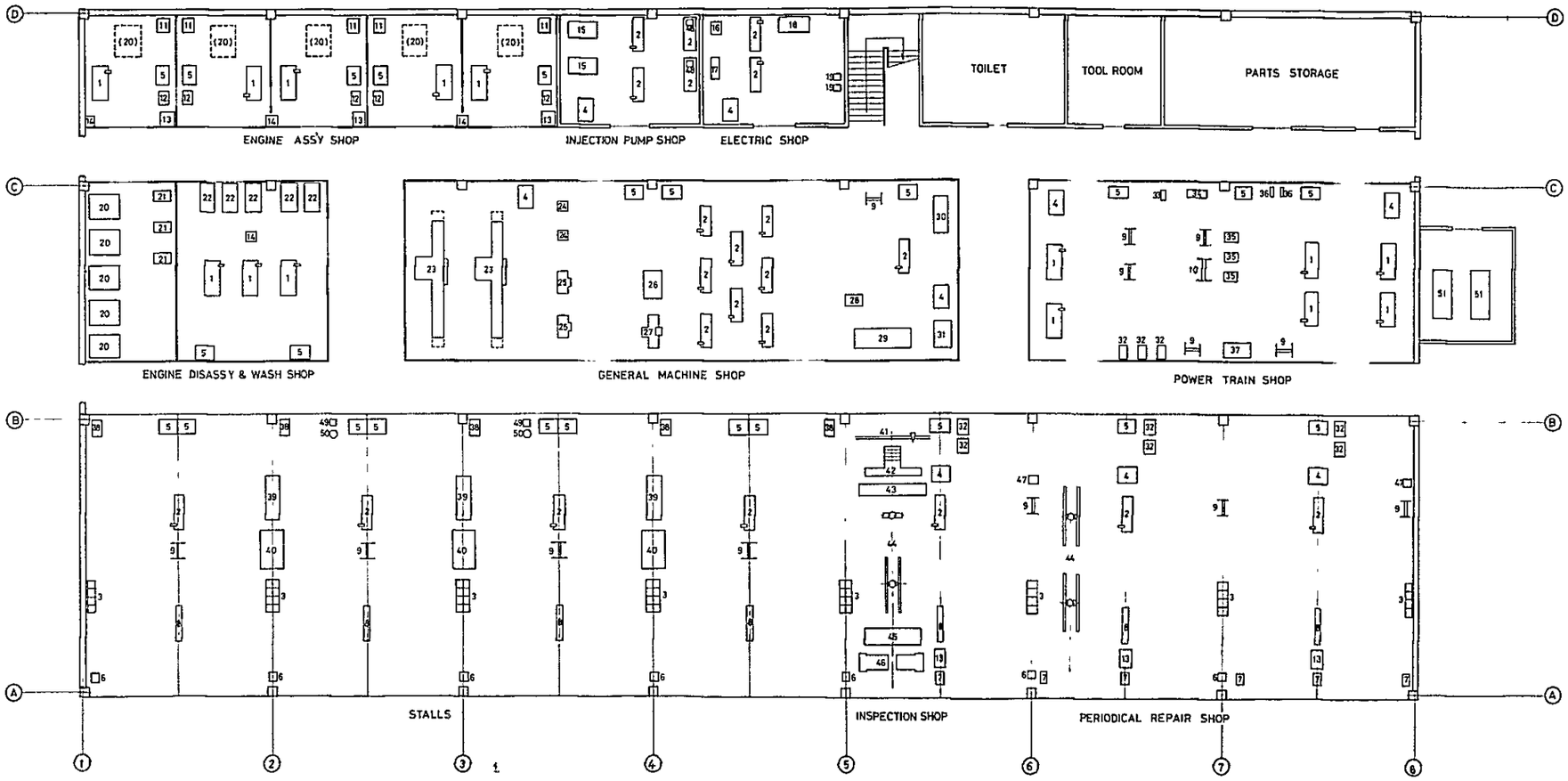
## 4-4 The Outline of Machinery

Local conditions (high humidity in wet season and dusty air in dry season) had been taken into consideration in the specifications of said machineries.

Further, following list shows basic items only, and quantity, specifications of small machines/tools etc. shall be decided after job specifications and procedures etc., are confirmed and necessary numbers of workers are fixed.

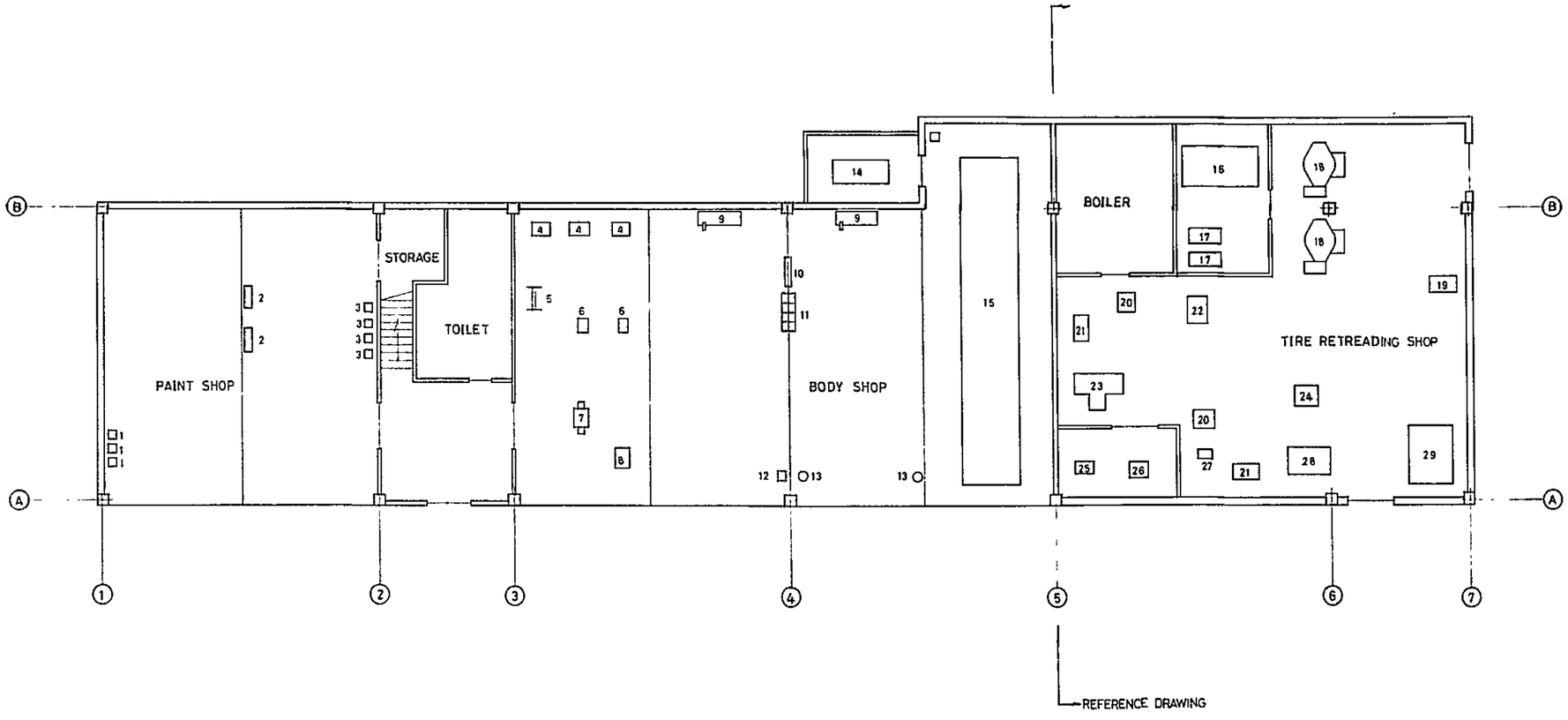
Also, these confirmation works shall be done during guidance time of operation by advisors mentioned in paragraph 3-5 and 3-6.






| NO. | DESCRIPTION | NO. | DESCRIPTION |
|---|---|---|---|
| 1. | WORKING TABLE | 27. | COMBINATION MILLING MACHINE |
| 2. | WORKING BENCH | 28. | BRAKE DRUM LATHE |
| 3. | RIGIT RACK | 29. | LATHE |
| 4. | WRITING TABLE | 30. | RADIAL DRILLING MACHINE |
| 5. | PARTS WASHING STAND | 31. | SHAPING MACHINE |
| 6. | AIR METER | 32. | TRANSMISSION JACK |
| 7. | DRAIN CART | 33. | AIR POWER RIVETTER |
| 8. | AIR HYDRAULIC GARAGE JACK | 34. | BRAKE SHOE GRINDER |
| 9. | HYDRAULIC PRESS | 35. | DIFFERENTIAL JACK |
| 10. | HYDRAULIC PRESS (ELECTRIC) | 36. | CHASSIS SPRING CHANGER |
| 11. | RADIATOR, FAN COMBINATION | 37. | BRAKE BOOSTER TEST STAND |
| 12. | OIL SEPARATOR SET | 38. | DRUM GREASER |
| 13. | AUTO LUBE SET | 39. | AIR LIFT |
| 14. | JIB CRANE | 40. | HYDRAULIC FLOOR CRANE |
| 15. | FUEL INJECTION PUMP TEST BENCH | 41. | HEAD LIGHT TESTER |
| 16. | DRY OVEN | 42. | WHEEL ALIGNMENT TESTER |
| 17. | COMMUTATOR MICA CUTTER & LATHE | 43. | SIDE SLIP TESTER |
| 18. | ELECTRIC UNIVERSAL TESTER | 44. | AUTO LIFT |
| 19. | BATTERY CHARGER | 45. | SPEEDOMETER TESTER |
| 20. | ENGINE JACK | 46 | BRAKE TESTER |
| 21. | STEAM CLEANER | 47. | BENCH DRILLING MACHINE |
| 22. | ENGINE TROLLEY | 48. | NOZZLE TESTER |
| 23. | CRANK SHAFT GRINDER | 49. | ARC WELDER |
| 24. | CYLINDER BORING MACHINE | 50 | GAS WELDER SET |
| 25. | CYLINDER HONING MACHINE | 51 | AIR COMPRESSOR |
| 26. | SURFACE GRINDER | | |

| | |
|---|---|
| CONSTRUCTION PROJECT OF AUTOMOBILE REPAIR & MAINTENANCE WORKSHOP IN BANGLADESH | DATE |
| | SCALE |
| TITLE OF DRAWING: LAYOUT OF HEAVY REPAIR FACTORY | DRG. NO. |
| JAPAN INTERNATIONAL COOPERATION AGENCY | |




| NO. | DESCRIPTION |
|---|---|
| 1. | COATER |
| 2. | INFRARED RAY STAND |
| 3. | AIRLESS SPRAY UNIT |
| 4. | SEWING MACHINE |
| 5. | HYDRAULIC PRESS |
| 6. | CIRCULAR SAW |
| 7. | SURFACE PLANER |
| 8. | BAND SAW |
| 9. | WORK BENCH |
| 10. | HYDRAULIC GARAGE JACK |
| 11. | RIGID RACK |
| 12. | ARC WELDER |
| 13. | GAS WELDER |
| 14. | AIR COMPRESSOR |
| 15. | FRAME STRAIGHTENER |
| 16. | HOT WATER SYSTEM |
| 17. | AIR COMPRESSOR |
| 18. | CURING PRESS |
| 19. | TRIMMING MACHINE |
| 20. | WORKING TABLE |
| 21. | - DO - |
| 22. | TIRE TREAD BUILDER |
| 23. | TIRE SPREADER |
| 24. | - DO - |
| 25. | CEMENT MIXER |
| 26. | CEMENT SPRAYING |
| 27. | FLEXIBLE GRINDER |
| 28. | TIRE INSPECTION MACHINE |
| 29. | TIRE BUFFING MACHINE |

| | |
|---|---|
| CONSTRUCTION PROJECT OF AUTOMOBILE REPAIR & MAINTENANCE WORKSHOP IN BANGLADESH | DATE |
| | SCALE |
| TITLE OF DRAWING: LAYOUT OF PAINT & BODY FACTORY | DRG. NO. |
| JAPAN INTERNATIONAL COOPERATION AGENCY | |

| Factory | Group | Name of Machinery and Tool | Q'ty | Refer to Vol. 4 of Reports MPI-CR-78-25(4/6) | | |
|---|---|---|---|---|---|---|
| | | | | Group Code Number | Item Number | page |
| HEAVY REPAIR FACTORY | Engine Washing and Disassembling Shop | Parts Washing Stand | 2 | 1-1-2 | No.5 | 27 |
| | | Steam Cleaner | 3 | 1-1-5 | No.3 | 113 |
| | | Engine Trolley | 5 | 1-1-5 | No.23 | 131 |
| | | Working Table | 3 | 1-1-6 | No.2 | 145 |
| | | Tool Cabinet Set | 1 | 1-1-3 | No.46 | 87 |
| | | Air Impact Wrench | 6 | 1-1-3 | No.33 | 80 |
| | | Air Impact Wrench | 6 | 1-1-3 | No.34 | 81 |
| | | Jib Crane | 1 | 1-1-6 | No.16 | 156 |

| Factory | Group | Name of Machinery and Tool | Q'ty | Refer to Vol. 4 of Reports MPI-CR-78-25(4/6) | | |
|---|---|---|---|---|---|---|
| | | | | Group Code Number | Item Number | page |
| HEAVY REPAIR FACTORY | Engine Assembling Shop | Parts Washing Stand | 5 | 1-1-2 | No.5 | 27 |
| | | Working Table | 5 | 1-1-6 | No.2 | 145 |
| | | Fuel Tank | 5 | 1-1-6 | No.12 | 152 |
| | | Radiator, Fan Combination | 5 | 1-1-6 | No.13 | 153 |
| | | Exhaust System | 5 | 1-1-6 | No.14 | 154 |
| | | Battery Carrier | 2 | 1-1-6 | No.15 | 155 |
| | | Oil Separator Set | 5 | 1-1-6 | No.18 | 158 |
| | | Auto Lube Set | 3 | 1-1-3 | No.25 | 73 |
| | | Tool Cabinet Set | 3 | 1-1-3 | No.46 | 87 |
| | | Parts Stand | 6 | 1-1-6 | No.10 | 14 |
| | | Air Impact Wrench | 10 | 1-1-3 | No.33 | 80 |
| | | Air Impact Wrench | 10 | 1-1-3 | No.34 | 81 |
| | | Jib Crane | 3 | 1-1-6 | No. 16 | 156 |

| Factory | Group | Name of Machinery and Tool | Q'ty | Refer to Vol. 4 of Reports MPI-CR-78-25(4/6) | | |
|---|---|---|---|---|---|---|
| | | | | Group Code Number | Item Number | page |
| HEAVY REPAIR FACTORY | Power Line (Brake) Shop (Heavy Repair Shop) | Air Power Riveter | 1 | 1-1-1 | No.1 | 5 |
| | | Brake Shoe Grinder | 1 | 1-1-1 | No.4 | 8 |
| | | Brake Booster Test Stand | 1 | 1-1-1 | No.7 | 11 |
| | Transmission Shop (Heavy Repair Shop) | Working Table | 6 | 1-1-6 | No.2 | 145 |
| | | Transmission Jack | 3 | 1-1-2 | No.1 | 25 |
| | | Parts Washing Stand | 3 | 1-1-2 | No.5 | 27 |
| | | Hydraulic Press | 1 | 1-1-2 | No.16 | 35 |

| Factory | Group | Name of Machinery and Tool | Q'ty | Refer to Vol. 4 of Reports MPI-CR-78-25(4/6) | | |
|---|---|---|---|---|---|---|
| | | | | Group Code Number | Item Number | page |
| HEAVY REPAIR FACTORY | Front Axle and Rear Axle Shop (Heavy Repair Shop) | Differential Jack | 3 | 1-1-3 | No.21 | 70 |
| | | King Pin Press Set | 2 | 1-1-4 | No.11 | 99 |
| | | Hydraulic Press | 1 | 1-1-4 | No.6 | 96 |
| | | Writing Table | 2 | 1-1-1 | No.8 | 12 |
| | | Chassis Spring Changer | 2 | 1-1-4 | No.1 | 95 |
| | | Hydraulic Press | 4 | 1-1-2 | No.16 | 35 |

| Factory | Group | Name of Machinery and Tool | Q'ty | Refer to Vol. 4 of Reports MPI-CR-78-25(4/6) | | |
|---|---|---|---|---|---|---|
| | | | | Group Code Number | Item Number | page |
| HEAVY REPAIR FACTORY | Electric Shop | Electric Universal Tester | 1 | 1-1-7 | No.1 | 185 |
| | | Commutator Mica Cutter and Lathe | 1 | 1-1-7 | No.2 | 186 |
| | | Dry Oven | 1 | 1-1-7 | No.3 | 187 |
| | | Battery Charger | 2 | 1-1-7 | No.7 | 189 |
| | | Writing Table | 1 | 1-1-1 | No.8 | 12 |
| | | Working Bench | 2 | 1-1-1 | No.2 | 6 |
| | | Tool Cabinet Set | 1 | 1-1-3 | No.46 | 87 |
| | | Air Impact Wrench | 2 | 1-1-3 | No.34 | 81 |
| | | Circuit Tester | 10 | 1-1-3 | No.45 | 86 |

| Factory | Group | Name of Machinery and Tool | Q'ty | Refer to Vol. 4 of Reports MPI-CR-78-25(4/6) | | |
|---|---|---|---|---|---|---|
| | | | | Group Code Number | Item Number | page |
| HEAVY REPAIR FACTORY | Pump Shop | Fuel Injection Pump Test Bench | 2 | 1-1-8 | No.1-1/2,2/2 | 209-211 |
| | | Nozzle Tester | 2 | 1-1-8 | No.2 | 213 |
| | | Injection Pump Stand | 2 | 1-1-8 | No.3 | 214 |
| | | Working Bench | 4 | 1-1-1 | No.2 | 6 |
| | | Writing Table | 1 | 1-1-1 | No.8 | 12 |

| Factory | Group | Name of Machinery and Tool | Q'ty | Refer to Vol. 4 of Reports MPI-CR-78-25(4/6) | | |
|---|---|---|---|---|---|---|
| | | | | Group Code Number | Item Number | page |
| HEAVY REPAIR FACTORY | General Machine Shop | Crank Shaft Grinder | 2 | 1-1-9 | No.1-1/2,2/2 | 237-239 |
| | | Cylinder Boring Machine | 2 | 1-1-9 | No.2 | 241 |
| | | Cylinder Horning Machine | 2 | 1-1-9 | No.3-1/2,2/2 | 242-243 |
| | | Hydraulic Press | 1 | 1-1-9 | No.33 | 281 |
| | | Parts Washing Stand | 3 | 1-1-2 | No.5 | 27 |
| | | Lathe | 1 | 1-1-9 | No.16-1/2.2/2 | 257-259 |
| | | Valve Refacer | 2 | 1-1-9 | No.4 | 245 |
| | | Valve Seat Grinder | 2 | 1-1-9 | No.6 | 247 |
| | | Radial Drilling Machine | 1 | 1-1-9 | No.17 | 261 |
| | | Surface Grinder | 1 | 1-1-9 | No.17-1/2,2/2 | 265-267 |
| | | Cutting Grinder | 1 | 1-1-9 | No.20 | 269 |
| | | Brake Drum Lathe | 1 | 1-1-9 | No.22 | 270 |
| | | Shaping Machine | 1 | 1-1-9 | No.30-1/2,2/2 | 277 |
| | | Combination Milling Machine | 1 | 1-1-9 | No.15-1/2,2/2 | 253-255 |
| | | Bench Grinder | 1 | 1-1-9 | No.23 | 271 |

| Factory | Group | Name of Machinery and Tool | Q'ty | Refer to Vol. 4 of Reports MPI-CR-78-25(4/6) | | |
|---|---|---|---|---|---|---|
| | | | | Group Code Number | Item Number | page |
| HEAVY REPAIR FACTORY | General Machine Shop | Working Bench | 9 | 1-1-1 | No.2 | 6 |
| | | Writing Table | 2 | 1-1-1 | No.8 | 12 |
| | | Surface Plate | 1 | 1-1-4 | No.8 | 98 |
| | | Surface Plate | 1 | 1-1-9 | No.24 | 272 |
| | | Tool Cabinet Set | 1 | 1-1-3 | No.46 | 87 |
| | | Out Side Micrometer Set | 2 | 1-1-9 | No.27 | 274 |

| Factory | Group | Name of Machinery and Tool | Q'ty | Refer to Vol. 4 of Reports MPI-CR-78-25(4/6) | | |
|---|---|---|---|---|---|---|
| | | | | Group Code Number | Item Number | page |
| HEAVY REPAIR FACTORY | Stall | Hydraulic Floor Crane | 3 | 1-1-3 | No.5 | 57 |
| | | Differential Jack | 4 | 1-1-3 | No.21 | 70 |
| | | Arc Welder | 2 | 1-1-3 | No.8 | 59 |
| | | Gas Welder Set | 2 | 1-1-3 | No.9 | 60 |
| | | Rigid Rack | 32 | 1-1-3 | No.3 | 55 |
| | | Air Hydraulic Garage Jack | 4 | 2-2 | No.2 | 515 |
| | | Hydraulic Garage Jack | 4 | 1-1-3 | No.2 | 54 |
| | | Parts Washing Stand | 8 | 1-1-2 | No.5 | 27 |
| | | Transmission Jack | 4 | 1-1-2 | No.1 | 25 |
| | | Wheel Dolly | 5 | 1-1-3 | No.4 | 56 |
| | | Drum Greaser | 5 | 1-1-3 | No.18 | 67 |
| | | Air Meter | 5 | 1-1-3 | No.30 | 77 |
| | | Brake Fluid Bleeder | 8 | 2-2 | No.18 | 518 |
| | | Air Compressor | 2 | 1-5 | No.1-1/2,2/2 | 463-465 |

| Factory | Group | Name of Machinery and Tool | Q'ty | Refer to Vol. 4 of Reports MPI-CR-78-25(4/6) | | |
|---|---|---|---|---|---|---|
| | | | | Group Code Number | Item Number | page |
| HEAVY REPAIR FACTORY | Stall | Special Tool for Isuzu | 4 | 1-3-4 | No.3-1/9-9/9 | 410-418 |
| | | Special Tool for Mitsubishi | 4 | 1-3-4 | No:2-1/13-15/13 | 397-409 |
| | | Fork Lift | 3 | 1-1-3 | No.37 | 82 |
| | | Drain Cart | 8 | 1-1-3 | No.39 | 83 |
| | | Air Lift | 3 | 1-1-3 | No.7 | 58 |
| | | Service Creeper | 16 | 1-1-3 | No.12 | 62 |
| | | Working Bench | 4 | 1-1-1 | No.2 | 6 |
| | | Tool Cabinet Set | 2 | 1-1-3 | No.46 | 87 |
| | | Air Impact Wrench | 8 | 1-1-3 | No.32 | 79 |
| | | Air Impact Wrench | 16 | 1-1-3 | No.33 | 80 |
| | | Air Impact Wrench | 16 | 1-1-3 | No.34 | 81 |
| | | Bench Grinder | 4 | 1-1-9 | No.23 | 271 |
| | | Hydraulic Press | 4 | 1-1-2 | No.16 | 35 |

| Factory | Group | Name of Machinery and Tool | Q'ty | Refer to Vol. 4 of Reports MPI-CR-78-25(4/6) | | |
|---|---|---|---|---|---|---|
| | | | | Group Code Number | Item Number | page |
| PERIODICAL REPAIR FACTORY | Periodical Repair Shop | Air Hydraulic Garage Jack | 3 | 2-2 | No.2 | 515 |
| | | Hydraulic Garage Jack | 3 | 1-1-3 | No.2 | 54 |
| | | Wheel Dolly | 3 | 1-1-3 | No.4 | 56 |
| | | Drum Greaser | 3 | 1-1-3 | No.18 | 67 |
| | | Air Meter | 2 | 1-1-3 | No.30 | 77 |
| | | Gas Welder | 1 | 1-1-3 | No.9 | 60 |
| | | Bench Drilling Machine | 2 | 2-2 | No.19 | 519 |
| | | Bench Grinder | 1 | 1-1-9 | No.23 | 271 |
| | | Parts Washing Stand | 3 | 1-1-1 | No.5 | 27 |
| | | Working Bench | 3 | 1-1-1 | No.2 | 6 |
| | | Parts Washing Stand | 6 | 1-1-1 | No.10 | 14 |
| | | Writing Table | 3 | 1-1-1 | No.8 | 12 |
| | | Hand Truck | 6 | 1-1-1 | No.5 | 9 |
| | | Transmission Jack | 6 | 1-1-2 | No.1 | 25 |
| | | Auto Lube Set | 3 | 1-1-3 | No.25 | 73 |

| Factory | Group | Name of Machinery and Tool | Q'ty | Refer to Vol. 4 of Reports MPI-CR-78-25(4/6) | | |
|---|---|---|---|---|---|---|
| | | | | Group Code Number | Item Number | page |
| PERIODICAL REPAIR FACTORY | Periodical Repair Shop | Rigid Rack | 24 | 1-1-3 | No.13 | 55 |
| | | Service Creeper | 12 | 1-1-3 | No.12 | 62 |
| | | Drain Curt | 6 | 1-1-3 | No.39 | 83 |
| | | Auto Lift | 1 | 1-1-5 | No.6-1/2-2/2 | 115-117 |
| | | Tool Cabinet Set | 1 | 1-1-3 | No.46 | 87 |
| | | Air Impact Wrench | 6 | 1-1-3 | No.32 | 79 |
| | | Air Impact Wrench | 12 | 1-1-3 | No.33 | 80 |
| | | Air Impact Wrench | 12 | 1-1-3 | No.34 | 81 |
| | | Bench Grinder | 3 | 1-1-9 | No.23 | 271 |
| | | Hydraulic Press | 3 | 1-1-2 | No.16 | 35 |

| Factory | Group | Name of Machinery and Tool | Q'ty | Refer to Vol. 4 of Reports MPI-CR-78-25(4/6) | | |
|---|---|---|---|---|---|---|
| | | | | Group Code Number | Item Number | page |
| IMSPECTION FACTORY | Inspection Shop | Speedometer Tester | 1 | 2-1-1 | No.1-1/2,2/2 | 477-479 |
| | | Brake Tester | 1 | 2-1-1 | No.2-1/2,2/2 | 481-483 |
| | | Side Slip Tester | 1 | 2-1-1 | No.3-1/2,2/2 | 481-483 |
| | | Wheel Alignment Tester | 1 | 2-1-1 | No.4 | 489 |
| | | Head Light Tester | 1 | 2-1-1 | No.5 | 490 |
| | | Auto Lift | 1 | 1-1-5 | No.6-1/2,2/2 | 115-117 |
| | | Tool Cabinet Set | 1 | 1-1-3 | No.46 | 87 |
| | Gas Station | Gas Stand Diesel | 1 | 2-1-2 | No.1 | 497 |

| Factory | Group | Name of Machinery and Tool | Q'ty | Refer to Vol. 4 of Reports MP1-CR-78-25(4/6) | | |
|---|---|---|---|---|---|---|
| | | | | Group Code Number | Item Number | page |
| PAINT AND BODY FACTORY | Body Shop | Frame Straightener | 1 | 3-1-1 | No.30 | 556 |
| | | Rigid Rack | 8 | 1-1-3 | No.3 | 55 |
| | | Surface Plate | 2 | 3-1-1 | No.26 | 553 |
| | | Working Bench | 2 | 1-1-1 | No.2 | 6 |
| | | Gas Welder | 2 | 1-1-3 | No.9 | 60 |
| | | Air Compressor | 1 | 1-5 | No.1-1/2,2/2 | 463-465 |
| | | Arc Welder | 2 | 1-1-3 | No.8 | 59 |
| | | Bench Grinder | 1 | 1-1-9 | No.23 | 271 |
| | | Single Side Surface Planer | 1 | 3-1-1 | No.1 | 535 |
| | | Hand Wood Planer | 1 | 3-1-1 | No.2 | 536 |
| | | Band Saw | 1 | 3-1-1 | No.3 | 537 |
| | | Circular Saw | 2 | 3-1-1 | No.4 | 538 |
| | | Sewing Machine | 3 | 3-1-1 | No.5 | 539 |
| | | Air Drill | 2 | 2-2 | No.34 | 523 |
| | | Air Driver | 2 | 3-1-1 | No.7 | 540 |

| Factory | Group | Name of Machinery and Tool | Q'ty | Refer to Vol. 4 of Reports MPI-CR-78-25(4/6) | | |
|---|---|---|---|---|---|---|
| | | | | Group Code Number | Item Number | page |
| PAINT AND BODY FACTORY | Body Shop | Hydraulic Garage Jack | 1 | 1-1-3 | No.2 | 54 |
| | | Power Pack | 2 | 3-1-1 | No.13 | 544 |
| | | Air Drill | 2 | 1-1-1 | No.6 | 10 |
| | | Hydraulic Press | 1 | 1-1-9 | No.33 | 281 |
| | | Air Impact Wrench | 2 | 1-1-3 | No.32 | 79 |
| | | Air Impact Wrench | 3 | 1-1-5 | No.10 | 121 |
| | Painting Shop | Airless Spray Unit | 4 | 3-1-2 | No.2 | 564 |
| | | Coater | 3 | 3-1-2 | No.5 | 566 |
| | | Infrared Ray Stand | 2 | 3-1-2 | No.1 | 563 |

| Factory | Group | Name of Machinery and Tool | Q'ty | Refer to Vol. 4 of Reports MP1-CR-78-25(4/6) | | |
|---|---|---|---|---|---|---|
| | | | | Group Code Number | Item Number | page |
| PARTS STORAGE, PAINT AND OIL STORAGE | Parts and Oil Storage | Shelter | 5 | 1-2 | No.1 | 333 |
| | | Shelter | 5 | 1-2 | No.1 | 333 |
| | | Shelter | 3 | 1-2 | No.1 | 333 |
| | | Shelter | 1 | 1-2 | No.5 | 334 |
| | | Shelter | 3 | 1-2 | No.6 | 335 |
| | | Rack | 1 | 1-1-7 | No.9 | 191 |
| | | Keyable Stock | 2 | 1-2 | No.7 | 336 |
| | | Hand Truck | 2 | 1-1-1 | No.5 | 9 |
| | | Writing Table | 5 | 1-1-1 | No.8 | 12 |
| | | Fork Lift | 1 | 1-2 | No.10 | 337 |
| | | Vacuum Cleaner | 2 | 1-1-7 | No.35 | 205 |
| | | Filing Cabinet | 2 | 1-2 | No.12 | 338 |
| | | Filing Cabinet | 2 | 1-2 | No.13 | 339 |
| | | Filing Cabinet | 2 | 1-2 | No.14 | 340 |
| | | Filing Cabinet | 6 | 1-2 | No.15 | 341 |
| | | Bolt Clipper | 1 | 1-2 | No.16 | 342 |
| | | Hammer | 5 | 1-2 | No.17 | 343 |
| | | Nail Hammer | 5 | 1-2 | No.18 | 344 |
| | | Drum Openner | 3 | 1-2 | No.19 | 345 |
| | | Drum Carrier | 2 | 1-2 | No.20 | 346 |

| Factory | Group | Name of Machinery and Tool | Q'ty | Refer to Vol. 4 of Reports MPI-CR-78-25(4/6) | | |
|---|---|---|---|---|---|---|
| | | | | Group Code Number | Item Number | page |
| CAR WASHER | Car Washer | Steam Cleaner | 5 | 1-1-5 | No.3 | 113 |
| | | Hose 20 m with Coupler and Nozzle | 5 | 1-6 | No.2 | 469 |
| | | Brush | 4 | 1-1-5 | No.1 | 122 |
| | | Car Washing Bruch | 12 | 1-6 | No.4 | 470 |

| Factory | Group | Name of Machinery and Tool | Q'ty | Refer to Vol. 4 of Reports MPI-CR-78-25(4/6) | | |
|---|---|---|---|---|---|---|
| | | | | Group Code Number | Item Number | page |
| FOR DEPOT IN DACCA | Depot | Drilling Machine | 10 | 1-1-2 | No.19 | 36 |
| | | Bench Grinder | 10 | 1-1-9 | No.23 | 271 |
| | | Writing Table | 10 | 1-1-1 | No.8 | 12 |
| | | Working Bench | 10 | 1-1-1 | No.2 | 6 |
| | | Parts Stand | 20 | 1-1-1 | No.10 | 14 |
| | | Hydraulic Garage Jack | 10 | 1-1-3 | No.1 | 53 |
| | | Hydraulic Garage Jack | 10 | 1-1-3 | No.2 | 54 |
| | | Rigid Rack | 80 | 1-1-3 | No.3 | 55 |
| | | Wheel Dolly | 10 | 1-1-3 | No.4 | 56 |
| | | Hydraulic Floor Crane | 3 | 1-1-3 | No.5 | 57 |
| | | Transmission Jack | 20 | 1-1-2 | No.1 | 25 |
| | | Air Lift | 3 | 1-1-3 | No.7 | 58 |
| | | Arc Welder | 6 | 1-1-3 | No.8 | 59 |
| | | Gas Welder Set | 3 | 1-1-3 | No.9 | 60 |
| | | Hand Truck | 20 | 1-1-1 | No.5 | 9 |

| Factory | Group | Name of Machinery and Tool | Q'ty | Refer to Vol. 4 of Reports MPI-CR-78-25(4/6) | | |
|---|---|---|---|---|---|---|
| | | | | Group Code Number | Item Number | page |
| FOR DEPOT IN DACCA | Depot | Drum Greaser | 10 | 1-1-3 | No.18 | 67 |
| | | Universal Jack | 6 | 1-1-3 | No.19 | 68 |
| | | Differencial Jack | 10 | 1-1-3 | No.21 | 70 |
| | | Auto Lube Set | 10 | 1-1-3 | No.25 | 73 |
| | | Air Meter | 6 | 1-1-3 | No.30 | 77 |
| | | Parts Washing Stand | 10 | 1-1-2 | No.5 | 27 |
| | | Drain Cart | 20 | 1-1-3 | No.39 | 83 |
| | | Service Creeper | 40 | 1-1-3 | No.12 | 62 |
| | | Tool Cabinet Set | 4 | 1-1-3 | No.46 | 87 |
| | | Air Impact Wrench | 20 | 1-1-3 | No.32 | 79 |
| | | Air Impact Wrench | 40 | 1-1-3 | No.33 | 80 |
| | | Air Impact Wrench | 40 | 1-1-3 | No.34 | 81 |
| | | Bench Grinder | 10 | 1-1-9 | No.23 | 271 |
| | | Hydraulic Press | 10 | 1-1-2 | No.16 | 35 |

| Factory | Group | Name of Machinery and Tool | Q'ty | Refer to Vol. 4 of Reports MPI-CR-78-25(4/6) | | |
|---|---|---|---|---|---|---|
| | | | | Group Code Number | Item Number | page |
| TIRE RETREADING | Group Tire Retreading | Tire Inspection Machine | 1 | 1-4-1 | No.2 | 434 |
| | | Tire Butting Machine | 1 | 1-4-1 | No.3 | 435 |
| | | Working Trimming Table | 2 | 1-4-1 | NO.4 | 436 |
| | | Working Table | 2 | 1-4-1 | No.5 | 437 |
| | | Tire Spreader | 1 | 1-4-1 | No.6 | 438 |
| | | Tire Spreader | 1 | 1-4-1 | No.7 | 439 |
| | | Flexible Grinder | 1 | 1-4-1 | No.8 | 440 |
| | | Rubber Cement Mixer | 1 | 1-4-1 | No.10 | 442 |
| | | Rubber Cement Spraying Machine | 1 | 1-4-1 | No.11 | 443 |
| | | Tire Tread Builder | 1 | 1-4-1 | No.12 | 444 |
| | | Curing Press with Matrix | 2 | 1-4-1 | No.13 | 445 |
| | | Working Trimming Table | 1 | 1-4-1 | No.14 | 446 |
| | | Air Compressor | 2 | 1-4-1 | No.16 | 451 |
| | | Boiler | 1 | - | - | - |
| | | Hot Water System | 1 | 1-4-1 | No.18 | 453 |
| | | Miscellaneous Tools | - | 1-4-1 | - | - |

## 4-5 Operation and Management

A new system should be introduced for the operation and management of the central workshop and of the light periodical repair at depots, because workshops of this kind were not in existence in Bangladesh before.

### 4-5-1 Administration and Operation of Automobile Repair & Maintenance Workshop

A) Repair and maintenance system

Optimum working sequence
- Heavy repair
- Periodical repair
- Emergency repair

B) Management of supply parts

Layout of parts storage

Inventory management

C) Documents to be issued

Kinds and functions of documents

Document management system

### 4-5-2 Organization and Regulations of Automobile Repair & Maintenance Workshop

A) Personnel composition

| | |
|---|---|
| Registration, inspection, car wash | 45 persons |
| Heavy and periodical repair factory stalls | 125 persons |
| Engine maintenance at heavy and periodic repair factory | 110 persons |
| Power line, axle and suspension maintenance at heavy and periodic repair factory | 30 persons |
| Body reapir and painting works | 45 persons |
| Parts stock control | 40 persons |
| Indirect divisions such as general affairs and accounting | 101 persons |
| Canteen | 15 persons |
| Total | 511 persons |

B) Administration structure

Establishment of administrative organization is essential for a workshop of this scale, and it is necessary to orderly control works, personnel, expenses and so forth with the scope of rights and responsibility clarified through establishment of office regulations and service regulations.

4-5-3 Periodical Repair at Each Depot

Vehicle repair/maintenance system is based on the repair/maintenance of once every 3 months and heavy repair of once every 2 years described in section 4-2. These works should be carried out regardless whether troubles occurred to the vehicles or not, and repair/maintenance at each depot should be carried out in the 3rd month and 9th month of this year and also in the 3rd month and 9th month of next year.

A) Administration and operation

The administration and operation of the stalls for periodical repair installed at each depot are entrusted with each depot. But the regulations of Automobile Repair & Maintenance Workshop should also be applied to the depots.

The organization of depots should be what corresponds to that of Automobile Repair & Maintenance Workshop, and it is also necessary to make rotation between the personnels belonging to the stalls of depots and the personnels of Automobile Repair & Maintenance Workshop for improving their technical capacity.

B) Subsidiary equipment

The works can be carried out with the machinery to be installed in Motijheel, Kariyanpur and Mirpur-13 Depots, but office space for issuing forms and slips and the space for storage of parts (fast moving parts only) are required in addition.

## 4-6 Training

One of the characteristics of repair/maintenance works at Automobile Repair & Maintenance Workshop and at the depots is devided work. Namely, such a work system that each worker is concentrated in one work only, and after finish of a work by a worker (or by a group of workers), each vehicle is subject to another work by another worker (or by a group of workers). This is the shortest way for upbringing skilled workers and increase working efficiency of the workshop.

For Automobile Repair & Maintenance Workshop which is to be constructed for the first time in Bangladesh, operation training and work guidance are essential for overcoming lack of experience in Bangladesh, and effective operation and upbringing of skilled workers can be accomplished only through on the job training and work guidance..

There are three important occasions as for training and guidance.

1) Upbringing of key mechanics and some staff members before start of operation.

2) Supervising for installation, test run and guidance of operation to key mechanics of the machinery to be equipped in the factories by the personnel dispatched from suppliers.

3) Guidance of operation by advisors after start of operation and upbringing of the ability to cope with even unexpected situations as one of the prime objects.

As a result of the survey made this time, the survey team recognized the necessity of dispatch of experts from Japan, and decided necessary experts of the following categories as a result of discussion with Bangladesh side.

| | | |
|---|---|---|
| 1. | Heavy repair and inspection | 1 person |
| 2. | Periodical repair and inspection (including guidance to depots) | 1 person |

3. Body repair and painting 1 person

4. Parts and stock control 1 person

A) Duties of dispatched experts

The followings will be the main duties of the experts.

(1) Establishment of repair/maintenance system using the machinery described in this report.

(2) Final decision of number of personnel required and decision of quantity of tools.

(3) Establishment of various regulations.

(4) Upbringing of key mechanics and staff members.

(5) Guidance after commencement of operation

B) Term of office of experts

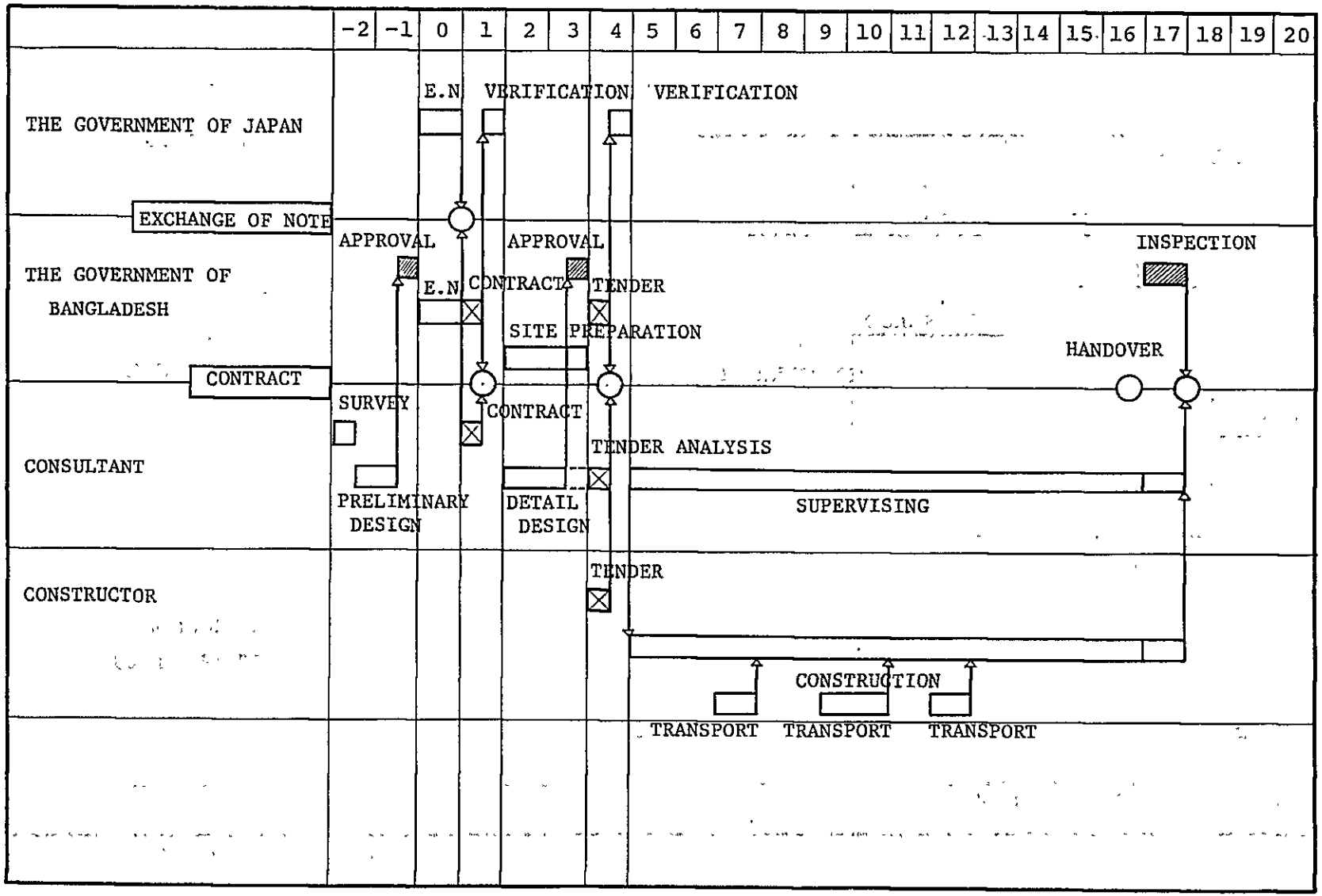
It is considered that the term of office of the experts should be 2 years at minimum.

C) Others

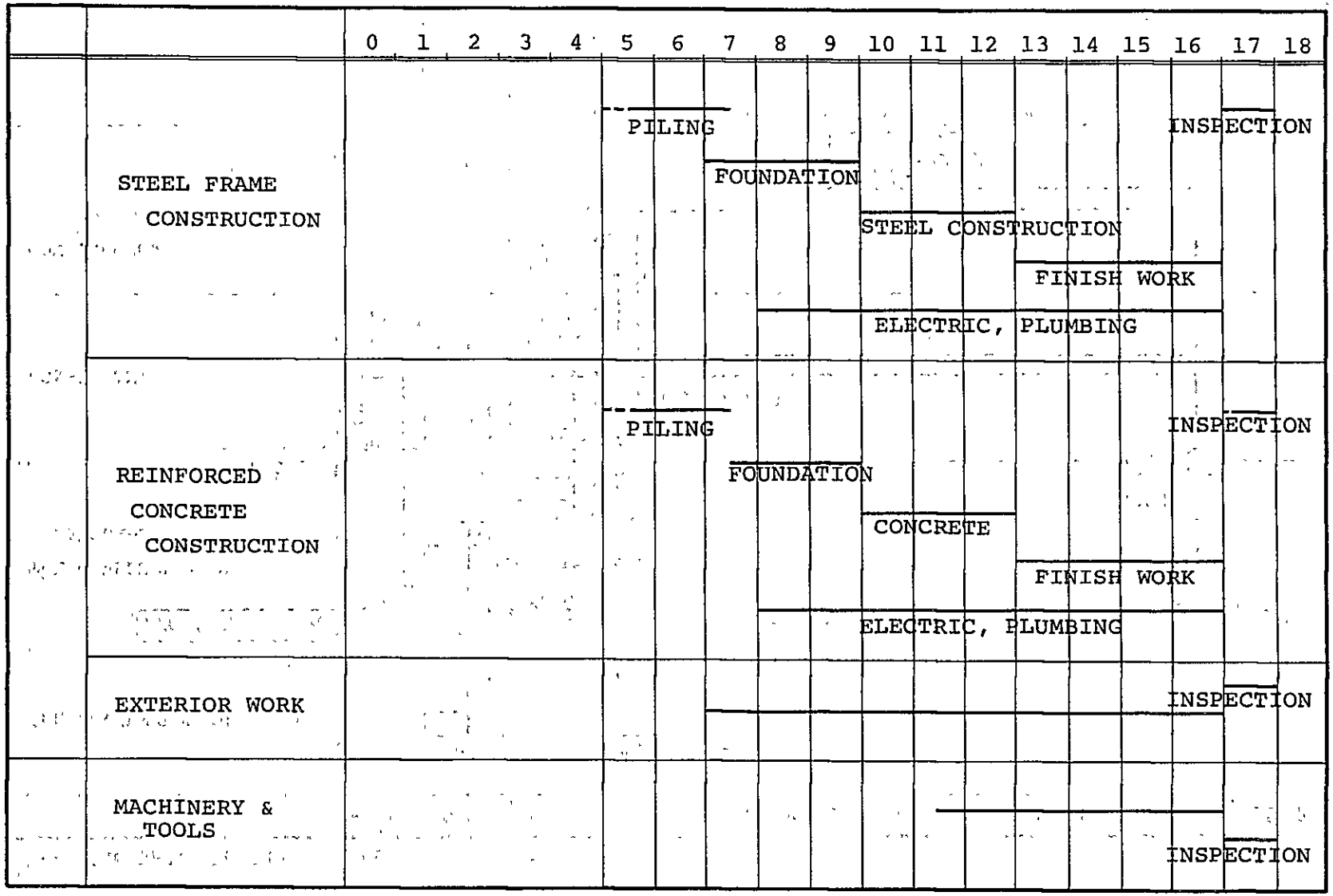
(1) Bangladesh side made a request to dispatch an expert to act as the general manager of Automobile Repair & Maintenance Workshop besides four experts stated above for making guidance of overall operation.

# 5. CONSTRUCTION SCHEDULE

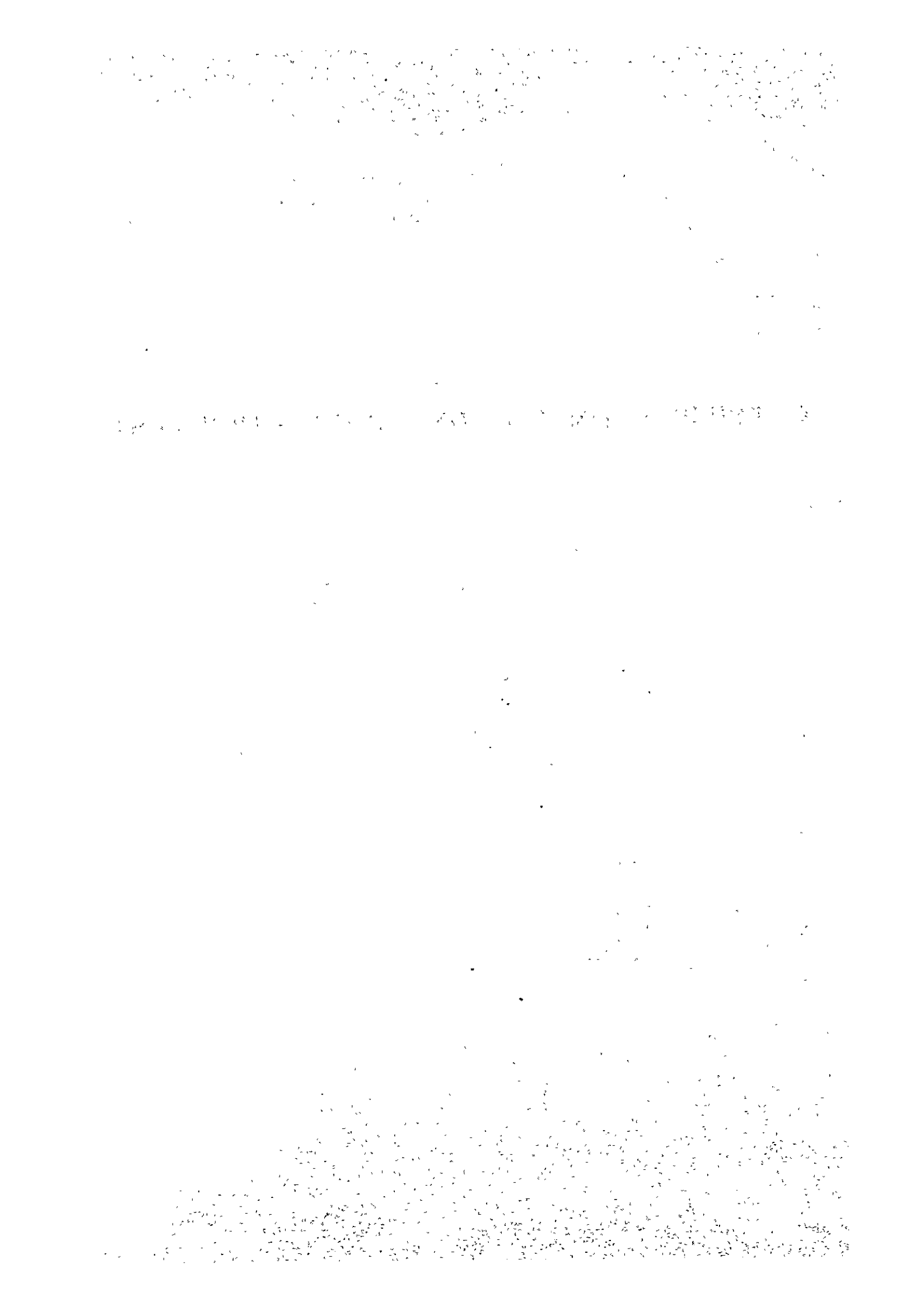
5-1 PROGRAM OF THE PROJECT



5-2 SCHEDULE OF CONSTRUCTION



# 6. ROUGH ESTIMATION OF CONSTRUCTION COST



(unit: ¥1,000)

| | Item | 1st year | 2nd year | Total | Remarks |
|---|---|---|---|---|---|
| Building Construction | General Office | 78,000 | | 78,000 | |
| | Heavy Repair Factory | 392,000 | | 392,000 | |
| | Parts Storage | 60,000 | | 60,000 | |
| | Paint Body Factory | | 90,000 | 90,000 | |
| | Canteen | | 35,000 | 35,000 | |
| | Oil Storage, etc. | | 20,000 | 20,000 | |
| | Sub-station | 60,000 | | 60,000 | |
| | Exterior Work | | 150,000 | 150,000 | |
| Sub Total | | 590,000 | 295,000 | 885,000 | |
| Machinery & Equipment | Heavy Repair & Periodical Repair | 337,000 | 130,000 | 467,000 | |
| | Paint Body | | | | |
| | Periodical Inspection for Depot | | | | |
| | Installation, etc. | 3,000 | 10,000 | 13,000 | |
| Sub Total | | 340,000 | 140,000 | 480,000 | |
| | Design & Execution Control | 70,000 | 65,000 | 135,000 | |
| Total | | 1,000,000 | 500,000 | 1,500,000 | |

# 7. OTHER RELATED MATTERS

# CHAPTER VII OTHER RELATED MATTERS

The economic result of the Central Workshop which has the capacities of periodical maintenance and heavy maintenance, etc., as before mentioned can be stated roughly in figures as follows:-

## 7-1 Necessary Expense of Operation

### 7-1-1 Estimation of Wages

Table 7-1

| Employee's Job Classification | Nos. of Employee | Wage/head/monthTK | Total/monthTK |
|---|---|---|---|
| Top Management | 6 | 1,500 | 9,000 |
| Management of Divisions | 7 | 800 | 5,600 |
| Engineer/Officer | 22 | 400 | 8,800 |
| Junior Engineer and Clerk | 80 | 350 | 28,000 |
| Mechanics | 480 | 300 | 144,000 |
| Total | 595 | | 195,400 |

Total necessary wages/year = 195,400 x 12 = 2,344,800

7-1-2 Estimation of Parts' Purchasing Cost

Table 7-2

| Classification of Work | Nos. of Unit to be Repaired/year | Necessary cost of parts/year-unit TK | Total cost/year TK |
|---|---|---|---|
| Heavy maintenance | 450 | 15,000 | 6,750,000 |
| Periodical maintenance | 1,300 | 4,000 | 5,200,000 |
| Body repair/ painting | 195 | 1,000 | 195,000 |
| Total | | | TK12,145,000 |

7-1-3 Estimation of Other Expenditures

Table 7-3

| Item | Foundation of Estimation | Charges/year TK |
|---|---|---|
| Communication, printing, utility charges | 10% of total wages | 2,344,800 x 10% = 234,480 |
| Repair Cost of Automobile Rpair & Maintenance Workshop | 2% of construction cost | 67,000,000 x 2% = 1,340,000 |
| Work suit for worker | TK 200 per head | 200 x 595 = 119,000 |
| Total | | TK1,693,480 |

Consequently, grand total of operation cost is

(1-1) + (1-2) + (1-3) = TK 16,183,280/year

## 7-2 Necessary Foreign Exchanges for Operation

At present, there is no plant or works to produce the vehicle parts in Bangladesh, therefore, all spare parts to be used in maintenance and repair work in the central workshop have to import from abroad.

By this reason, it is requested to prepare the foreign exchanges by Bangladesh side and according to the estimation of Japanese Survey Team, total amount of said exchanges is equivalent to TK 12,145,000 (approx. ¥182,000,000) per year. Refer to 7-1-2

7-3 Merit of Automobile Repair & Maintenance Workshop Operation (Curtailment of foreign exchanges)

The existence of C.W.S. which maintain the operation of 1,300 units results the extension of vehicle life.

From the difference of vehicle life, curtailment of foreign exchanges can roughly estimate in figures as follows:

7-3-1 No Existence of Automobile Repair & Maintenance Workshop

New vehicle price : TK 300,000 (¥4,500,000)

Total purchasing cost (in foreign exchanges) of 1,300 units : 300,000 x 1,300 = TK 390,000,000

Vehicle life : 5 years

Allotment of purchasing cost per year : 390,000,000/5 = TK 78,000,000/year -(3-1)

7-3-2 Existence of Automobile Repair & Maintenance Workshop

Extension of vehicle life by maintenance is 3 years in the initial stage, consequently allotment of purchasing cost per year.

: 390,000,000/8 = TK 48,750,000/year

Import cost of spare parts : TK 12,145,000/year (See 7-1-2)

Total necessary foreign exchanges : 48,750,000 + 12,145,000 = TK60,895,000 -(3-2)

Then, curtailment of foreign currencies is given as (3-1) -(3-2)
= 78,000,000 - 60,895,000 = TK 17,105,000

Total operation cost of C.W.S. : TK 16,863,280

Overall expenditure (including C.W.S. operation cost) 48,750,000 + 16,183,280 = TK64,933,280 -(3-3)

Then overall merit is given as (3-1) - (3-3)
78,000,000 - 64,933,280 = TK 13,066,720

7-4 The Necessity of Establishment of Tire Retreading Factory and Its Merit

There is no tire manufactures in Bangladesh as well as parts manufacturer and all tires must be imported, while as tire changing job is very simple, and not necessary do it in the C.W.S. Therefore, Japanese Survey Team did not add tire purchasing cost in the table of 7-1-2.

However, the Survey Team worked out the estimation of purchasing cost and comparison etc., in figures as follows.

Parts purchasing cost (Automobile Repair & Maintenance Workshop) TK 12,145,000 -(1)

Consumption of tire : Size 8.25-20, unit price is TK 3,000.-

At least 6 tires are necessary for each unit. Tire life is 6 months. Then

Tire purchasing cost per year for 1,300 units

1,300 x 2 x 6 x 3,000 = TK 46,800,000 - (2)

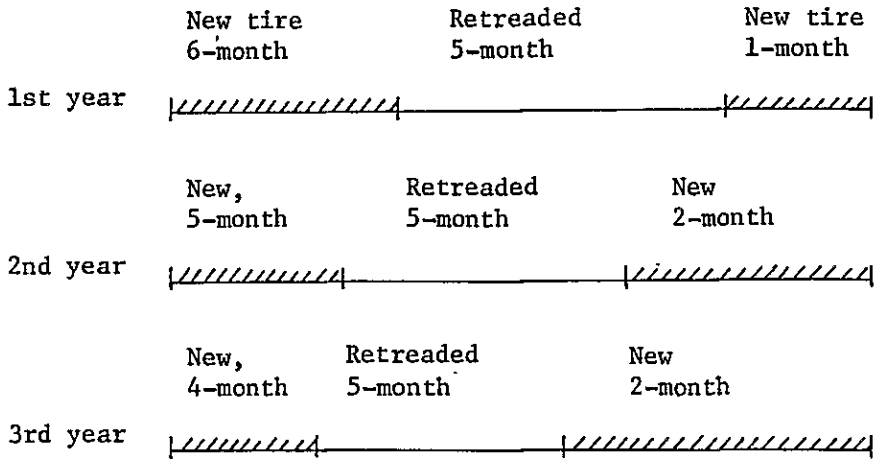
(2)/(1) = 46,800,000/12,145,000 = 4

Above mentioned figure shows that tire purchasing cost is approximately 4 times bigger than other parts purchasing cost.

Tire retreading job is assigned to curtail foreign exchanges appropriated for new tire purchasing and effect of this job is expected very big. By existence of tire retreading equipment, following curtailment is estimated.

7-4-1 The curtailment in case when all tires are assumed to undergo retreading once in their life (actually, retreading can be done twice).

Tires are assumed to use along following pattern.




Namely, new tires are always used 7-months while retreaded tires are 5-months. Consequently, necessary expense can be worked out as follows.

Retreading cost of 8.25-20 tire is TK 1.000.-

$$1{,}300 \text{ (units)} \times 6 \text{ (tires)} \times \text{TK } 3{,}000 \times \frac{7}{12} + 1{,}300 \text{ (units)}$$

$$\times 6 \text{ (tires)} \times \text{TK } 1{,}000 \times \frac{5}{12} = \text{TK } 16{,}950{,}000$$

Then, difference between new tire purchasing cost and above mentioned cost is given as 46,800,000 - 16,950,000 = TK 29,850,000/year

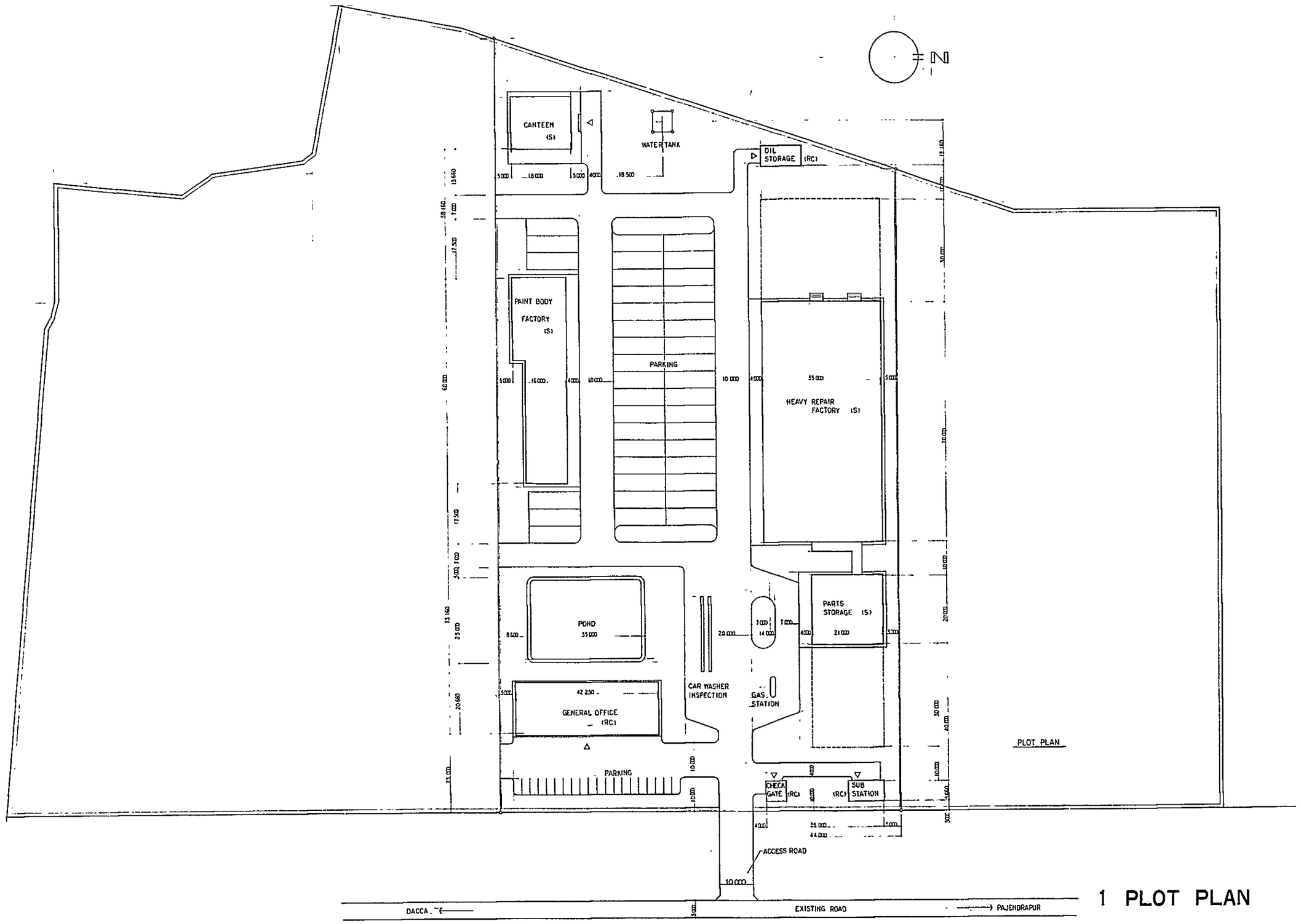
This figure is clearly shown the effect of curtailment of foreign exchanges.

7-4-2 The Curtailment by Planned Retreading Factory This Time

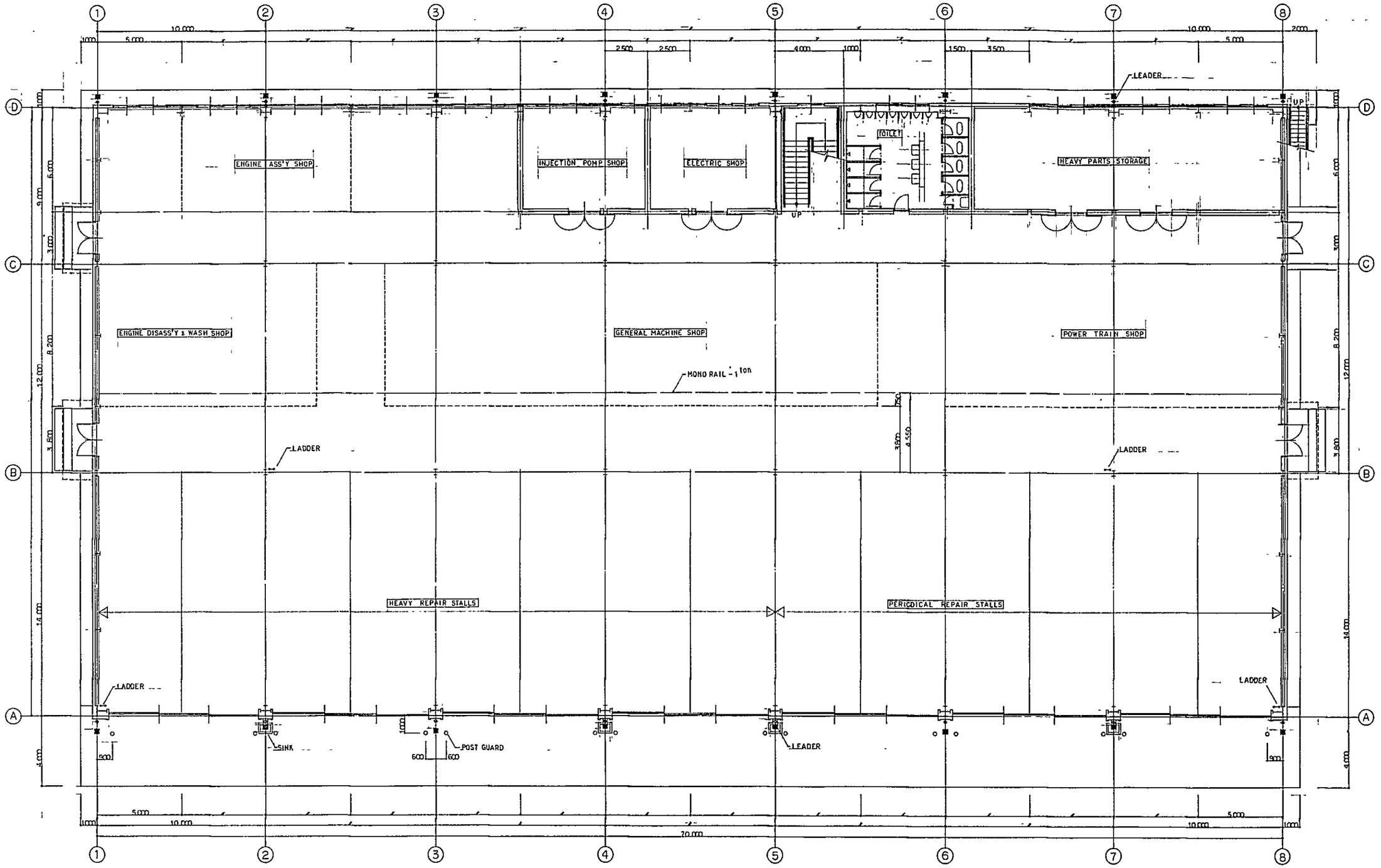
| | |
|---|---|
| Planned retreading capacity | 14/day 2400/year |
| Life of retreaded tire | 0.8 x life of new tire |
| Retreading frequency | 1 (normally 2 times) |
| Tire size 8.25-20 | |
| New tire purchasing cost | 2400 x TK 3,000 = TK 7,200,000/year |
| Retreading | 2,400 x TK 1,000 x $\frac{1}{0.8}$ = TK 3,000,000/year |
| | Diference TK 4,200,000/year |

Planned tire retreading plant has not enough capacity to fullfil the demand, however, above mentioned curtailment shows that this plant is worth to be pilot plant in this country and suitable place to upbring workers.

# 8. BASIC DESIGN DRAWINGS


N
CANTEEN (S)
WATER TANK
OIL STORAGE (RC)
PAINT BODY FACTORY (S)
PARKING
HEAVY REPAIR FACTORY (S)
POND
PARTS STORAGE (S)
CAR WASHER INSPECTION
GAS STATION
GENERAL OFFICE (RC)
PARKING
CHECK GATE (RC)
SUB STATION (RC)
PLOT PLAN
ACCESS ROAD
DACCA
EXISTING ROAD
PAJENDRAPUR

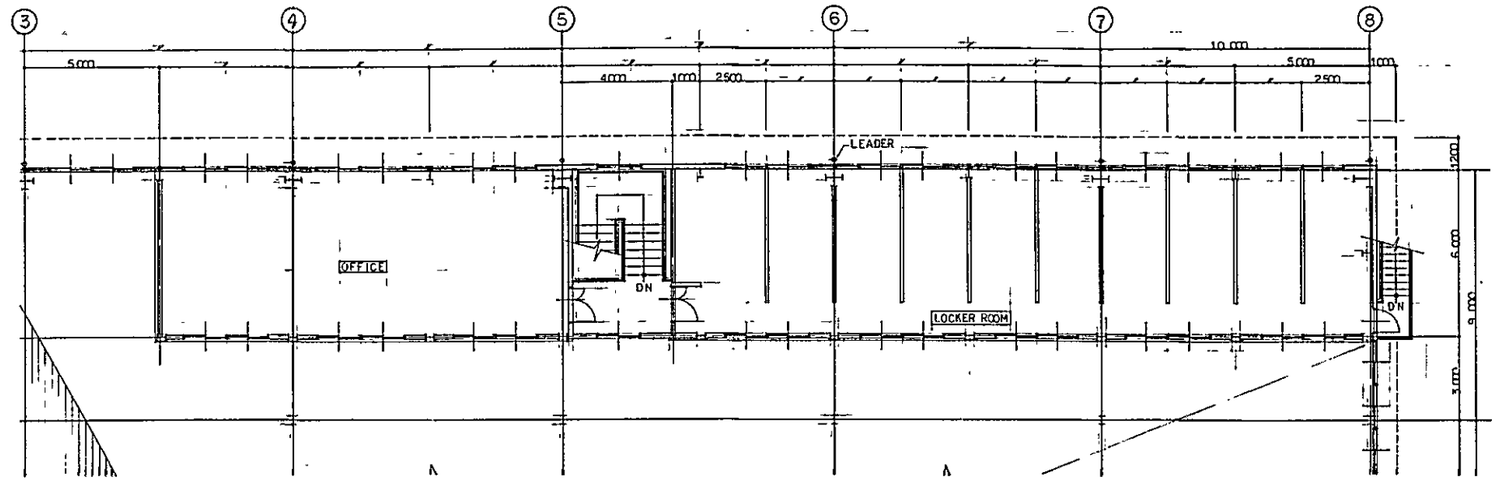
1 PLOT PLAN



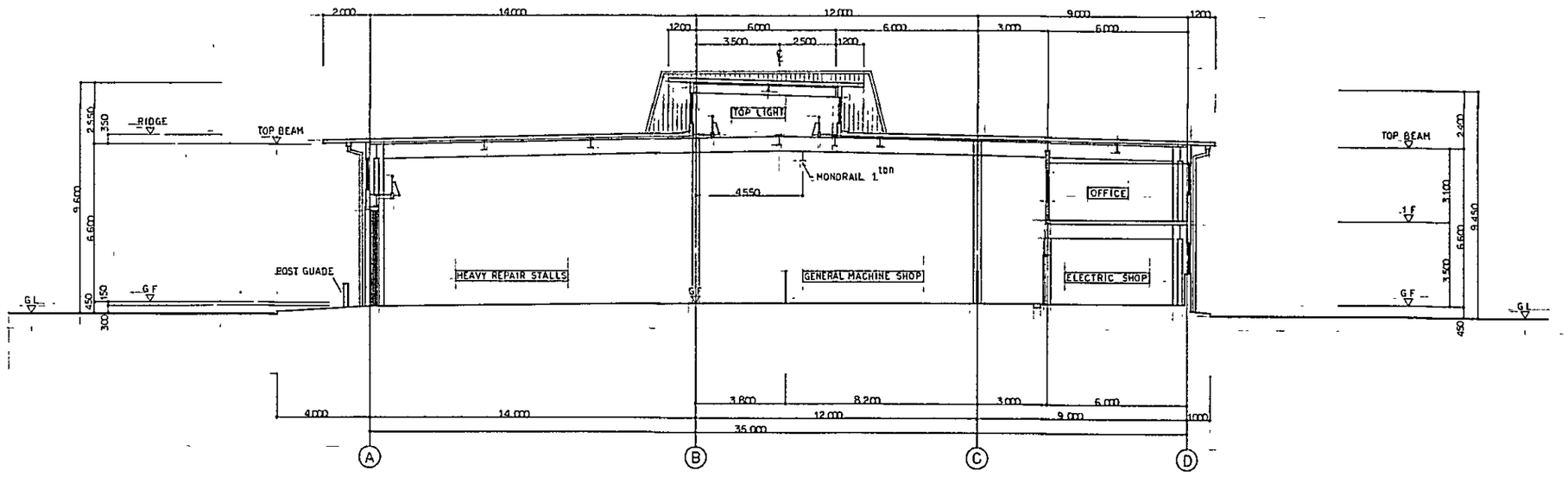

N

GROUND FLOOR PLAN OF HEAVY REPAIR FACTORY

# 2-1 HEAVY REPAIR FACTORY

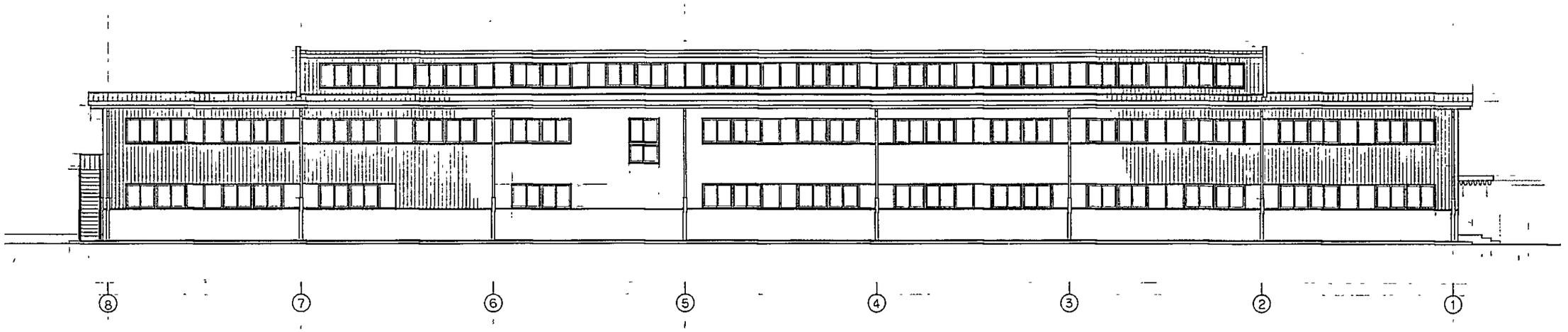



ROOF 1 F PLAN OF HEAVY REPAIR FACTORY S=1:200

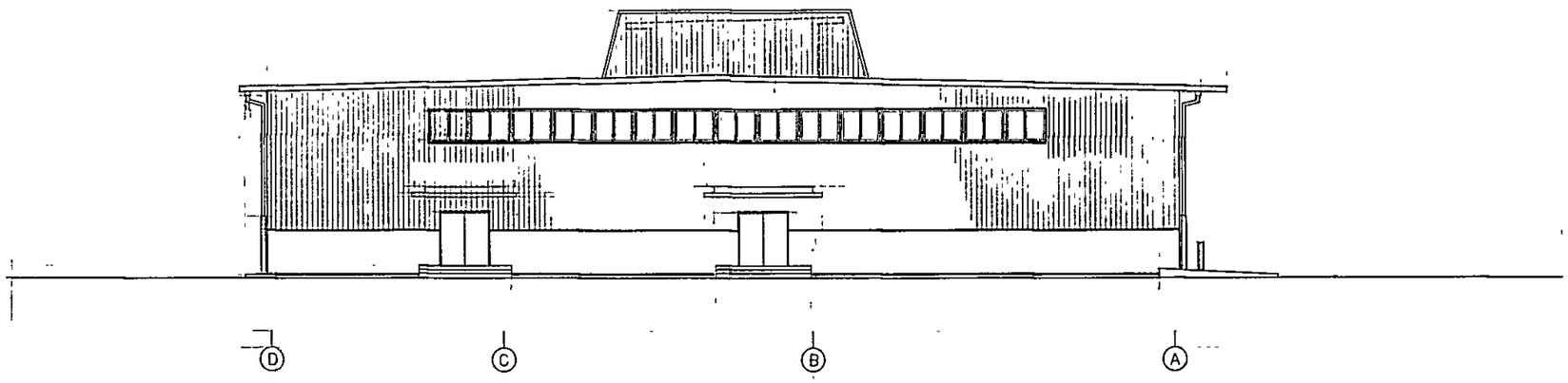



B — B SECTION OF HEAVY REPAIR FACTORY

## 2-2 HEAVY REPAIR FACTORY

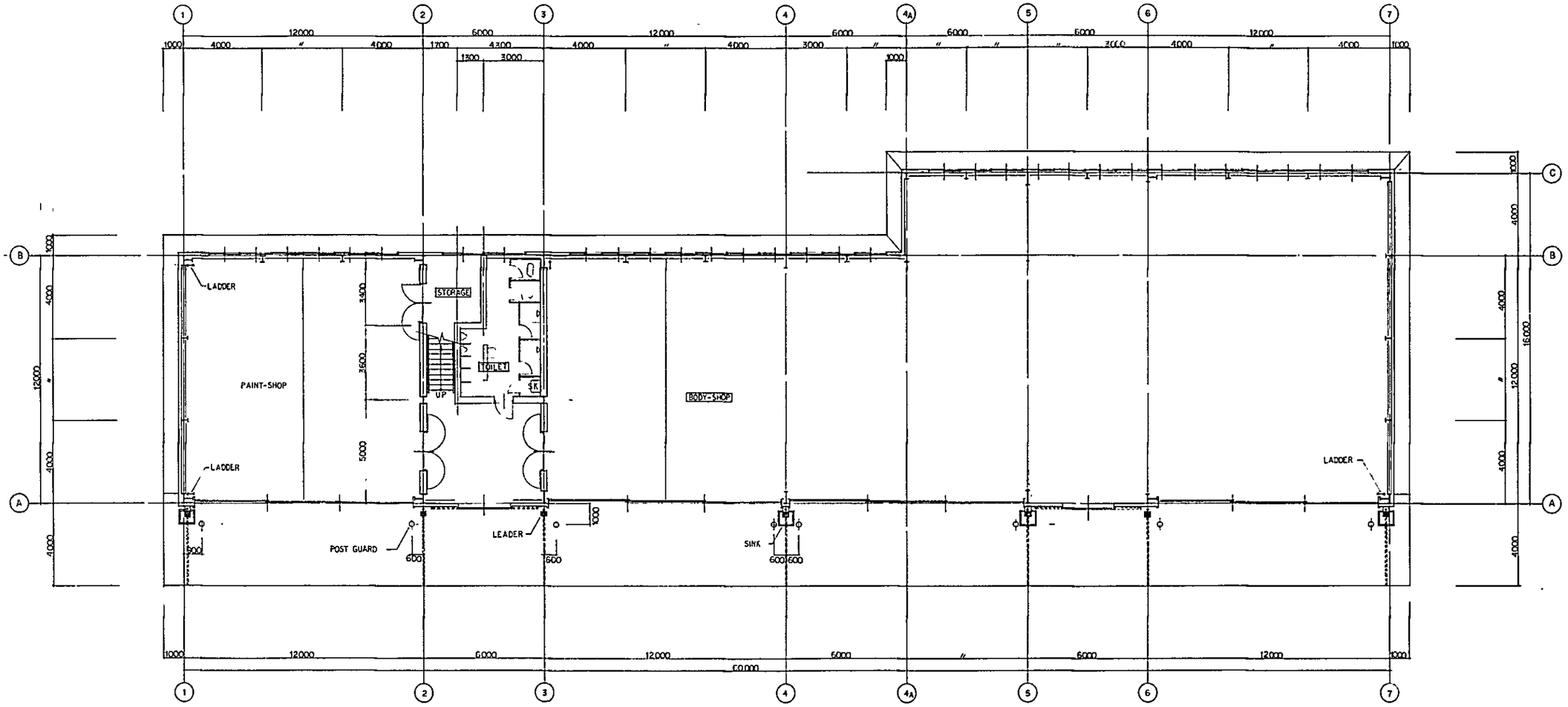



NORTH ELEVATION OF HEAVY REPAIR FACTORY

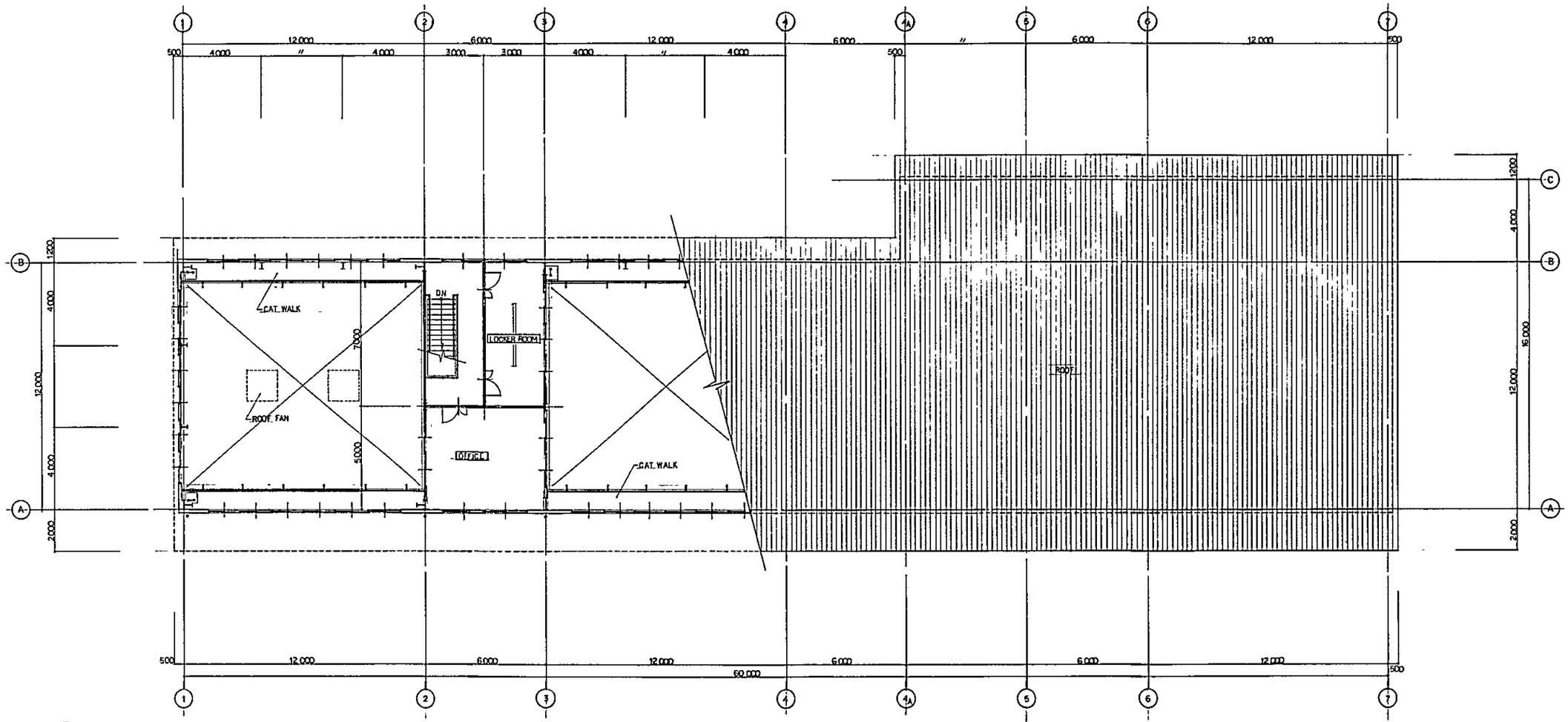



WEST ELEVATION OF HEAVY REPAIR FACTORY

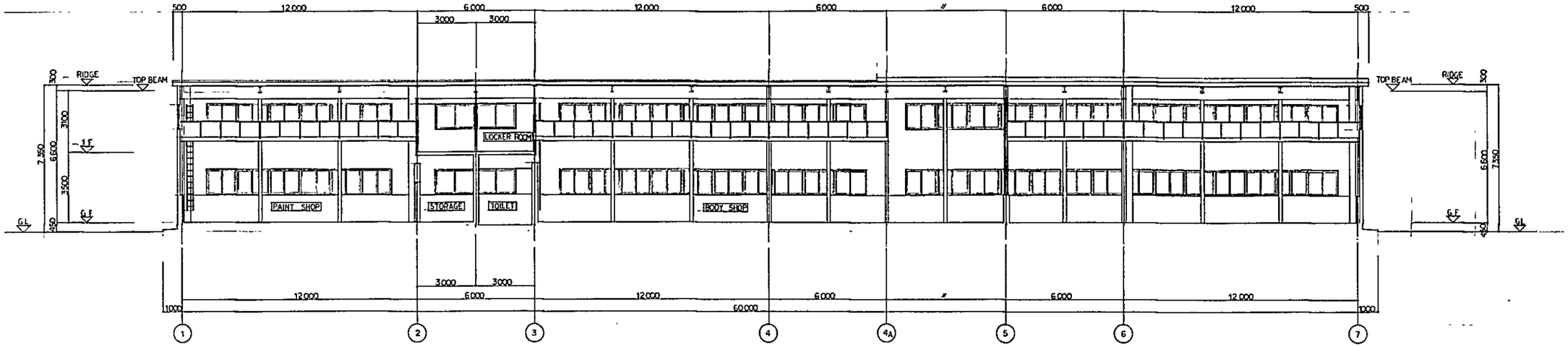
## 2-3 HEAVY REPAIR FACTORY



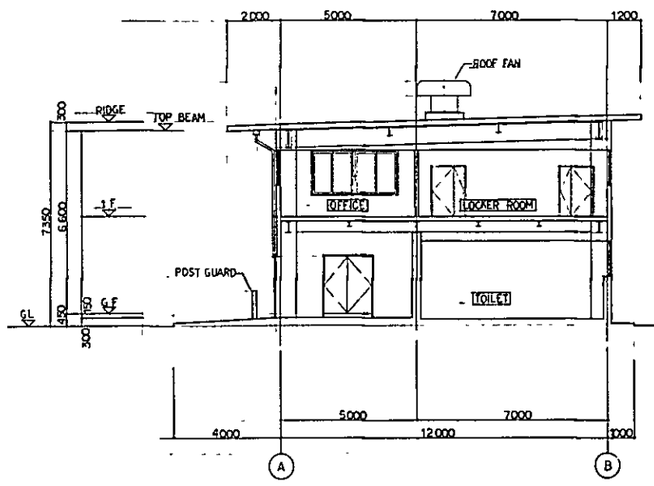

GROUND FLOOR PLAN OF PAINT BODY FACTOPY



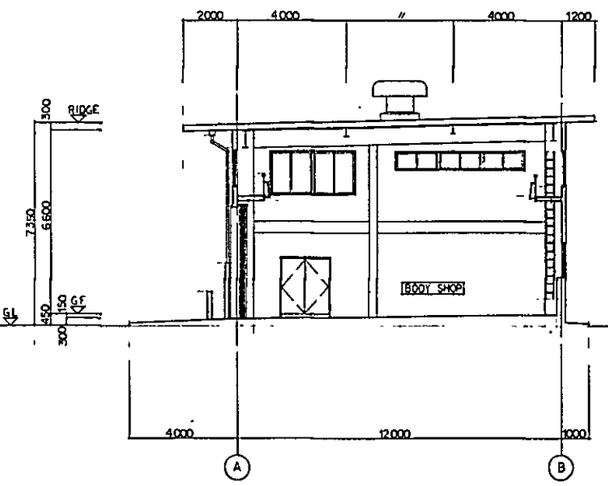

1st FLOOR PLAN OF PAINT BODY FACTORY



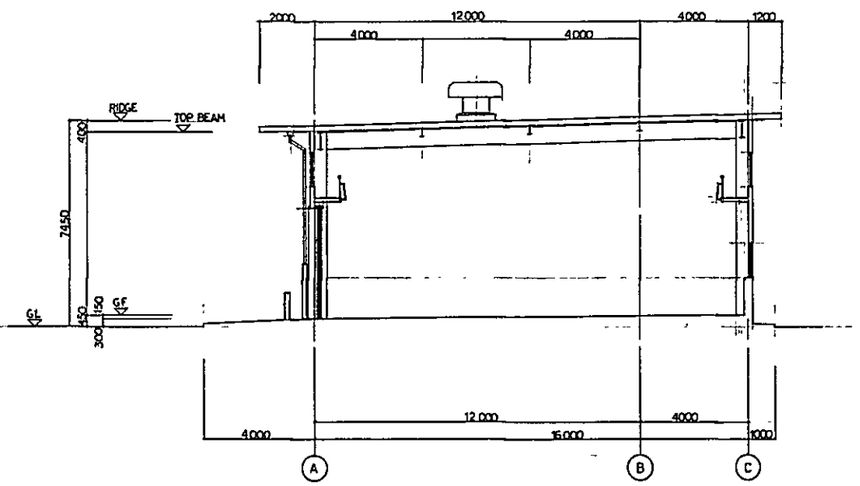

A-A SECTION OF PAINT BODY FACTORY



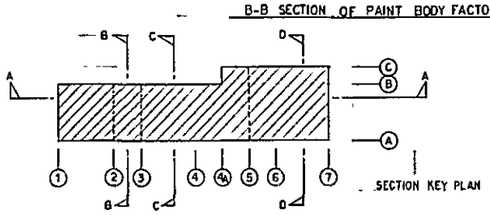

B-B SECTION OF PAINT BODY FACTORY



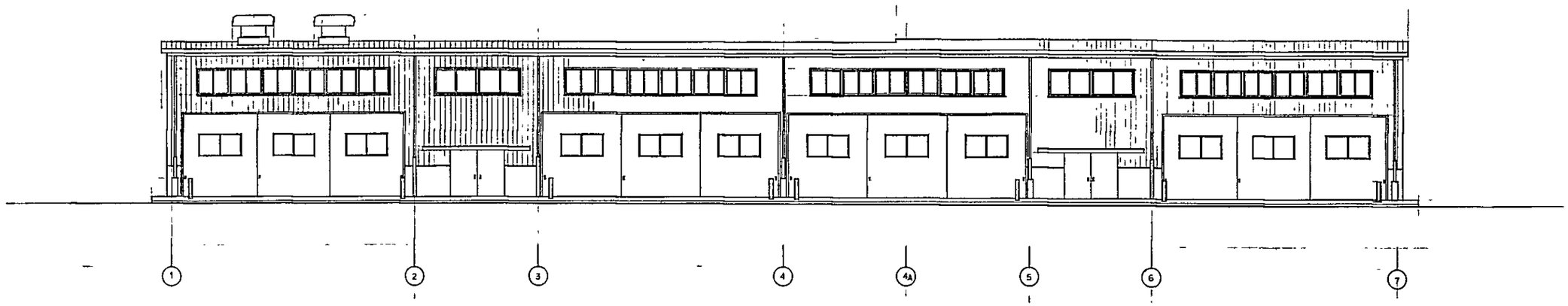

C-C SECTION OF PAINT BODY FACTORY



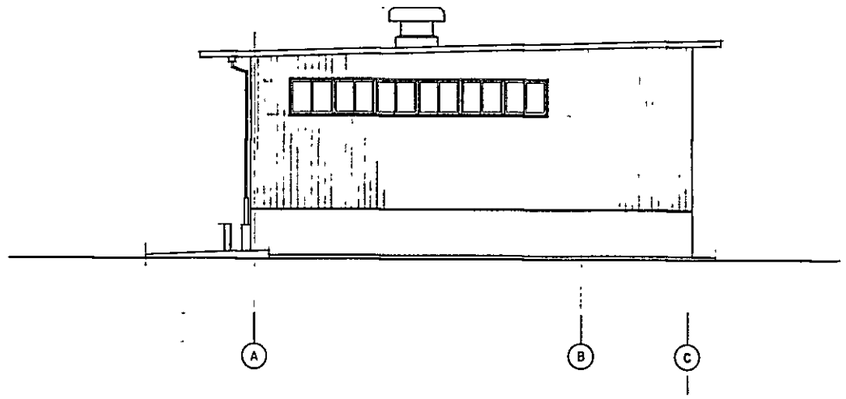

D D SECTION OF PAINT BODY FACTORY



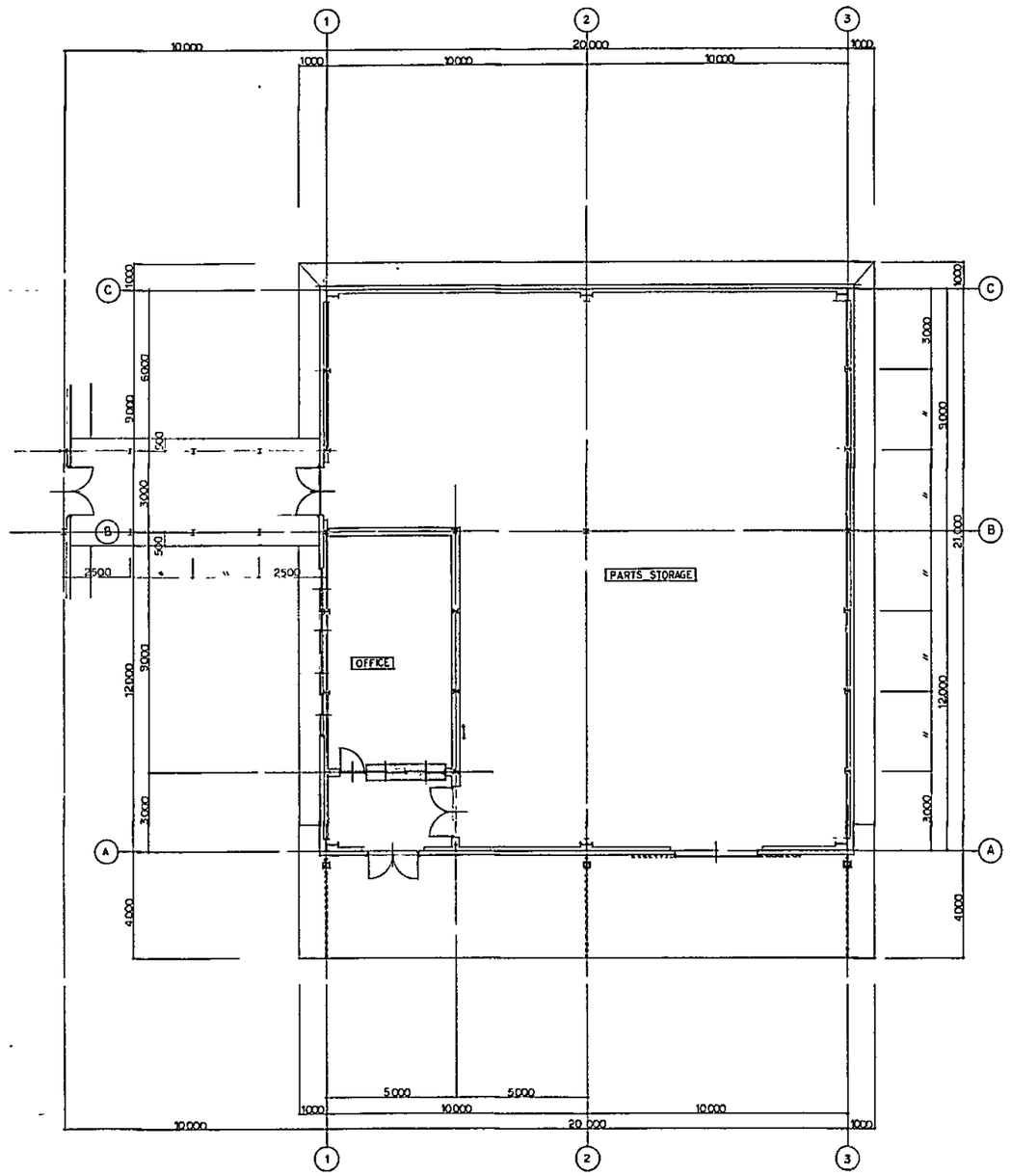

# 3-3 PAINT BODY FACTORY

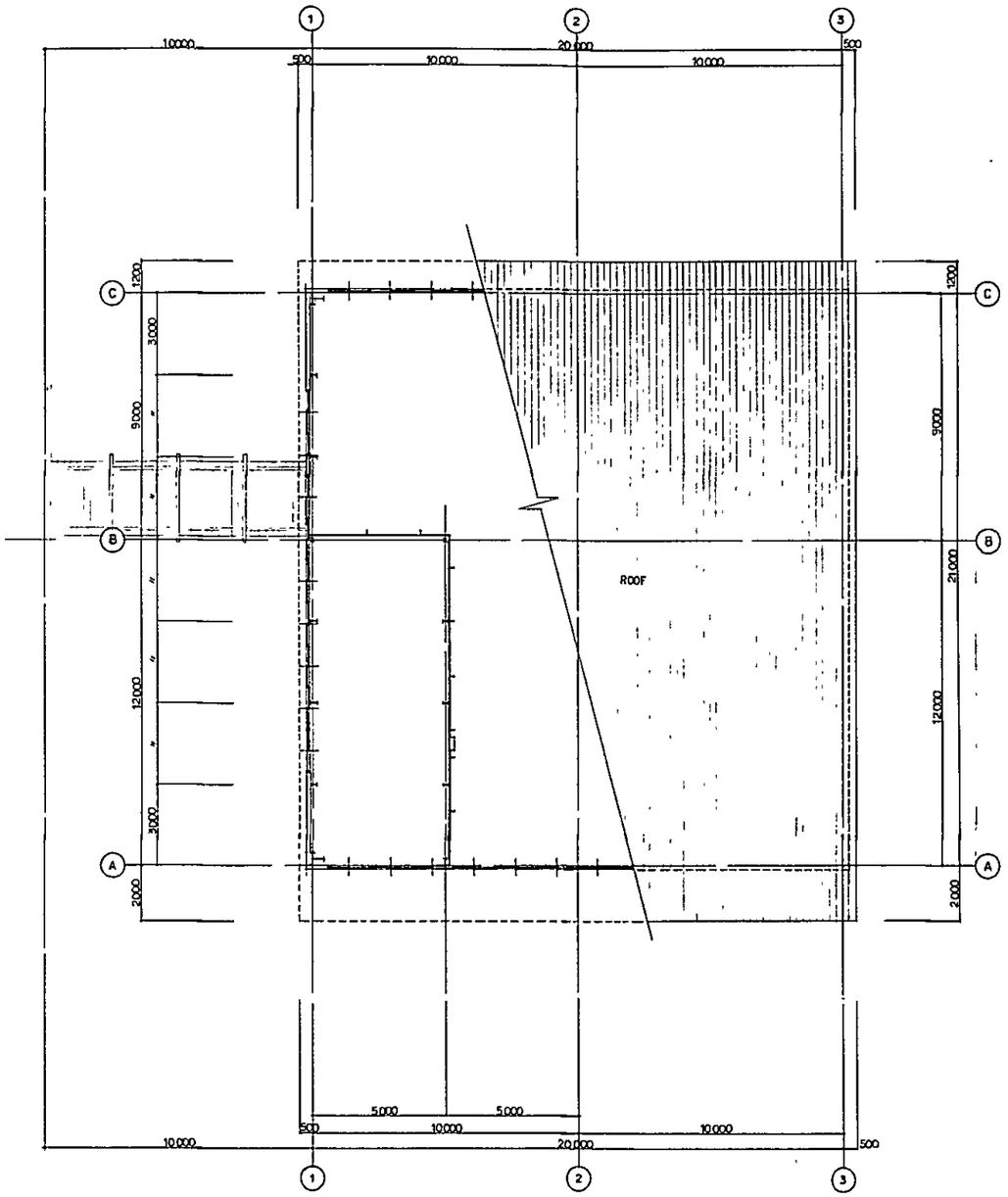



NORTH ELEVATION OF PAINT BODY FACTORY



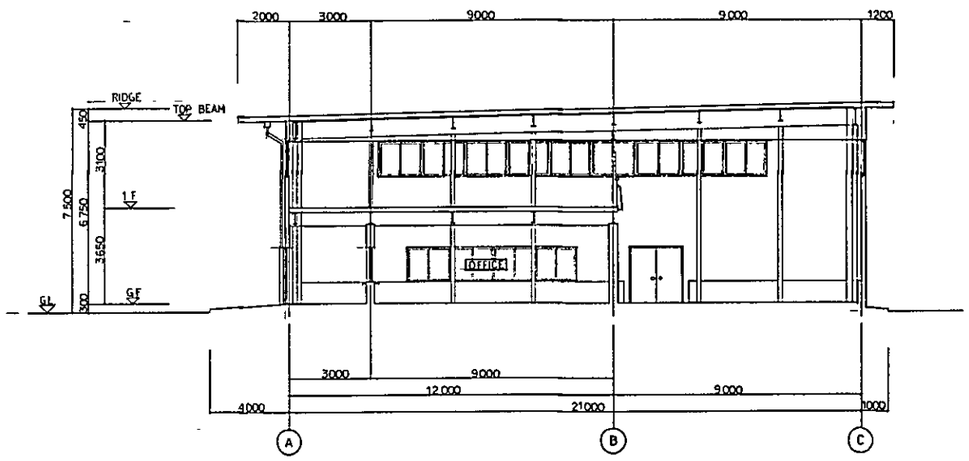

WEST ELEVATION OF PAINT BODY FACTORY



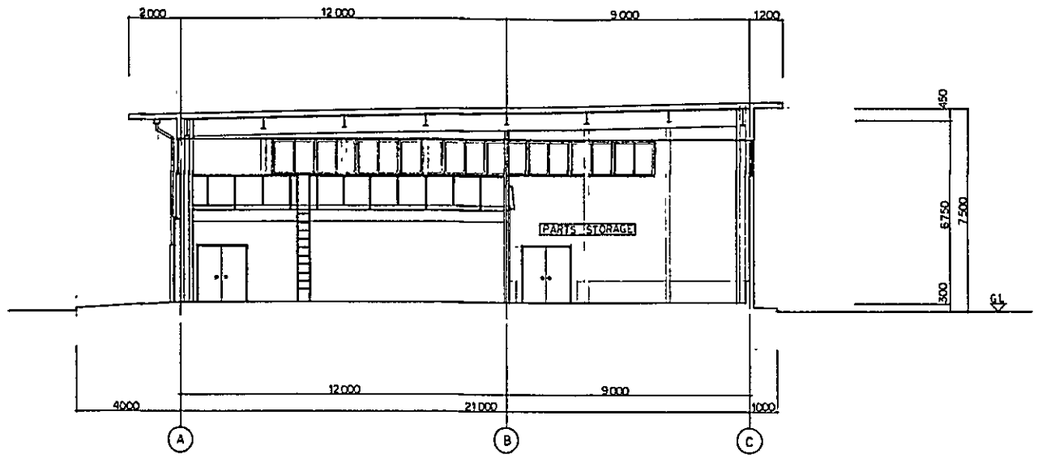




PLAN OF PARTS STORAGE

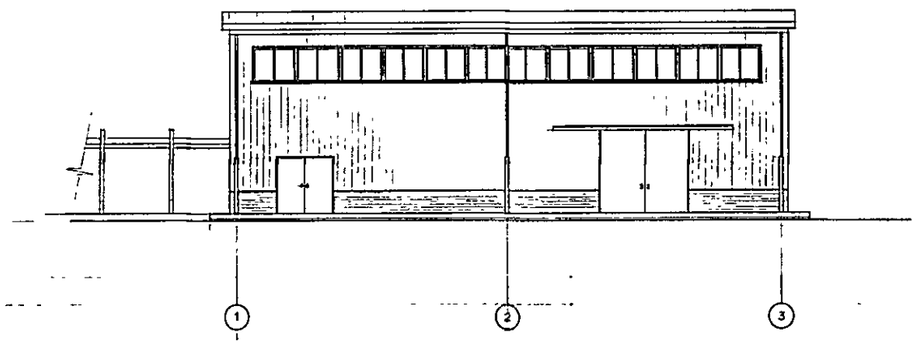
# 4-1 PARTS STORAGE



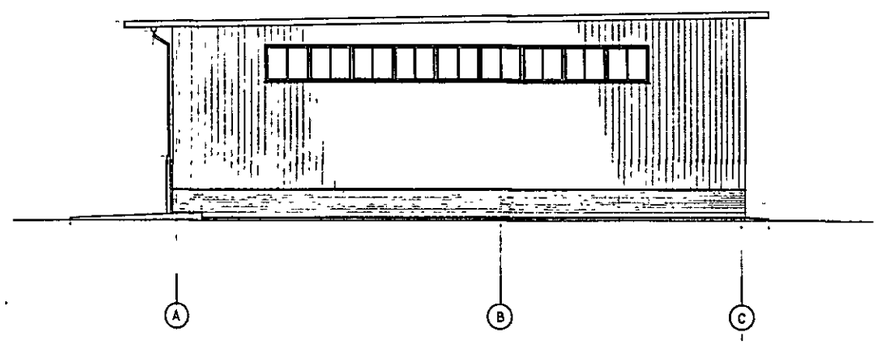

A-A SECTION OF PARTS STORAGE




B-B SECTION OF PARTS STORAGE

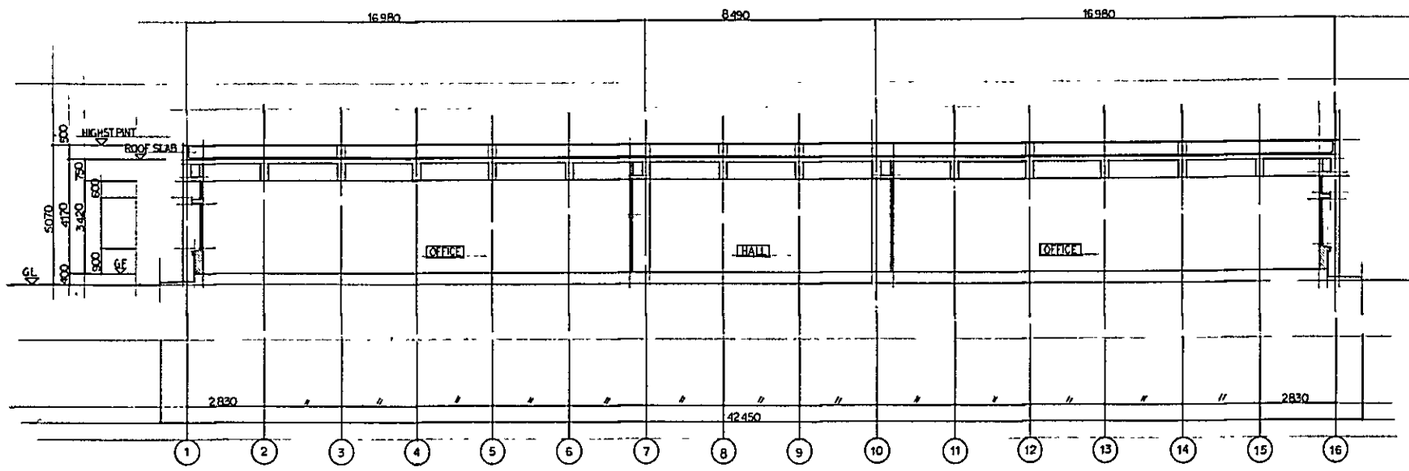



EAST ELEVATION OF PARTS STORAGE

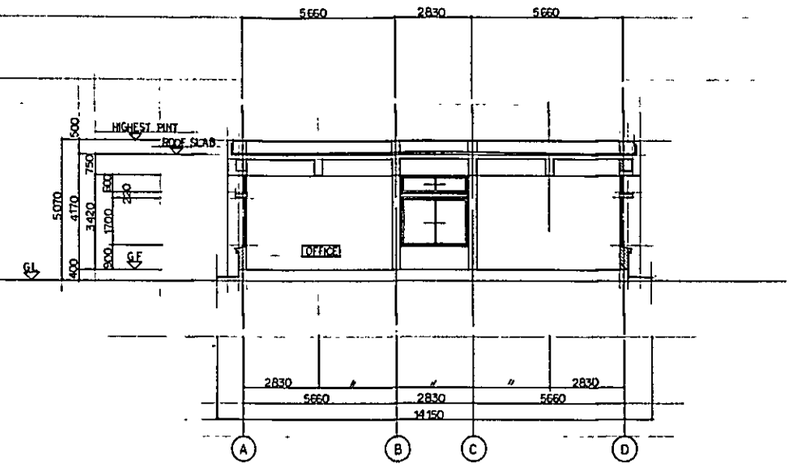



NORTH ELEVATION OF PARTS STORAGE

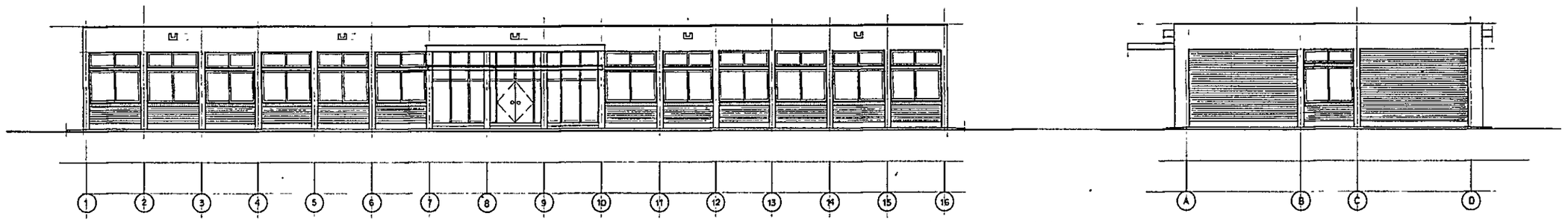
# 4-2 PARTS STORAGE




A-A SECTION OF GENERAL OFFICE

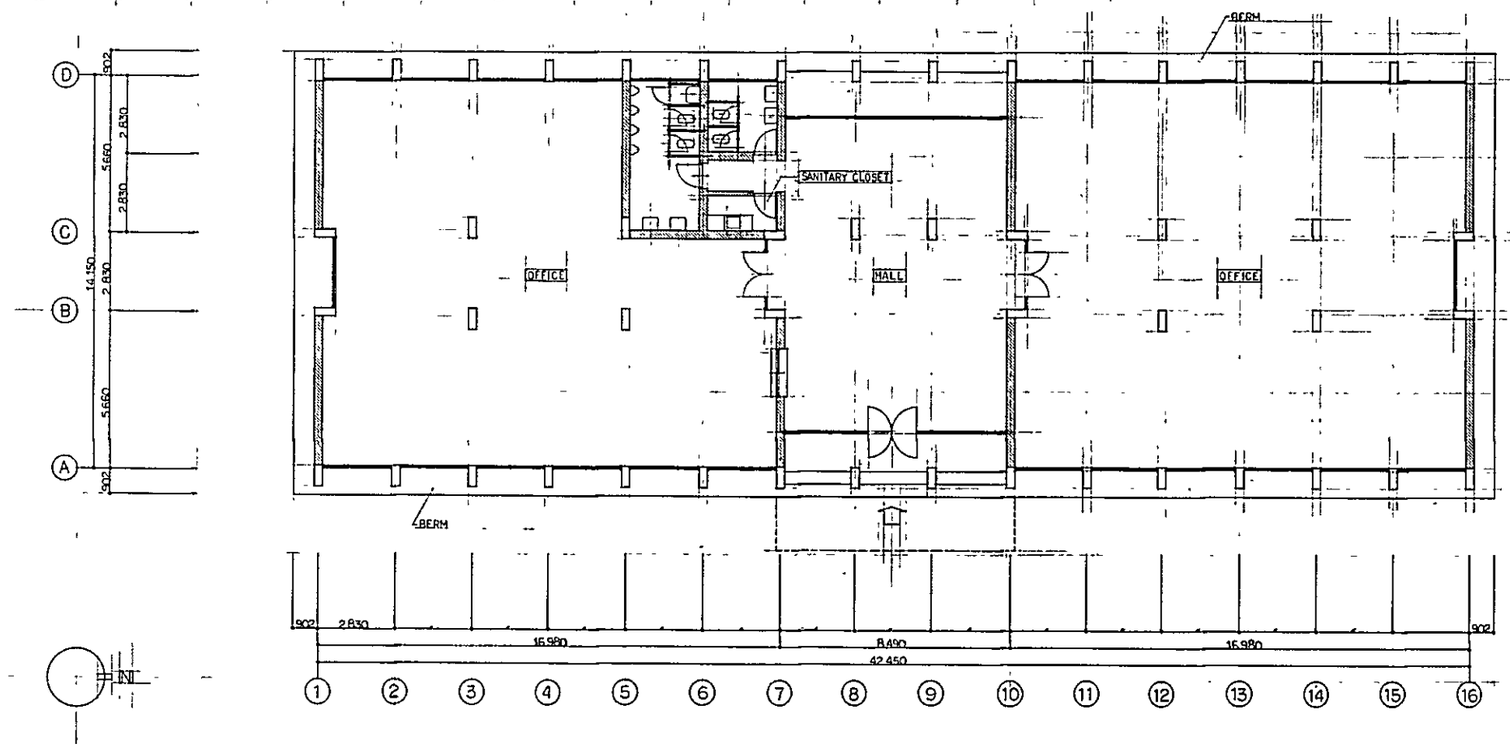



B-B SECTION OF GENERAL OFFICE



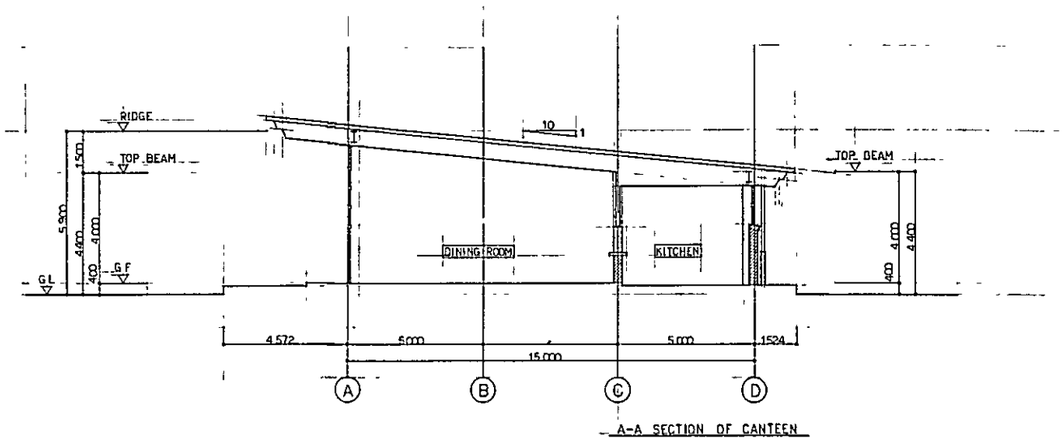




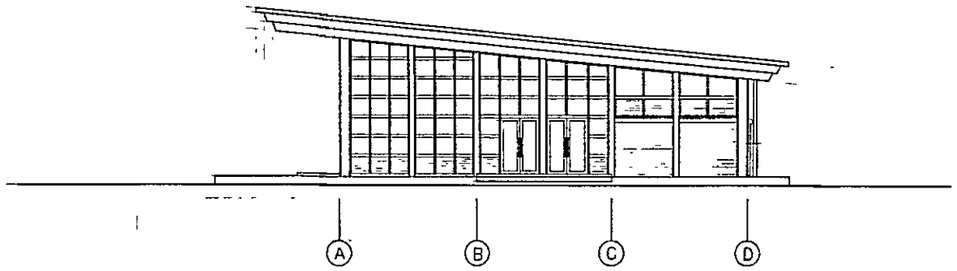



GROUND FLOOR PLAN OF GENERAL OFFICE

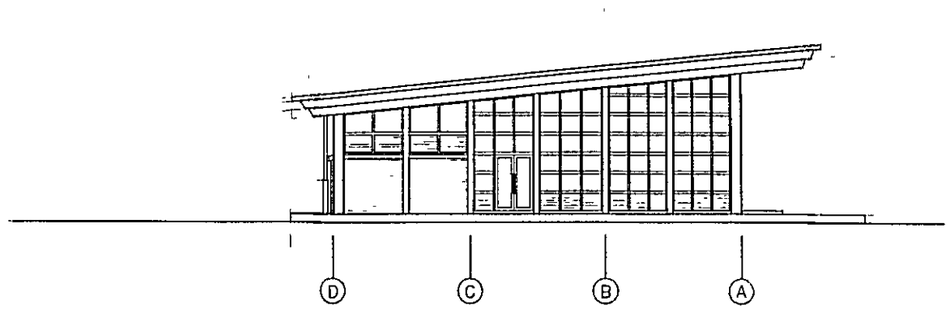
# 5 GENERAL OFFICE



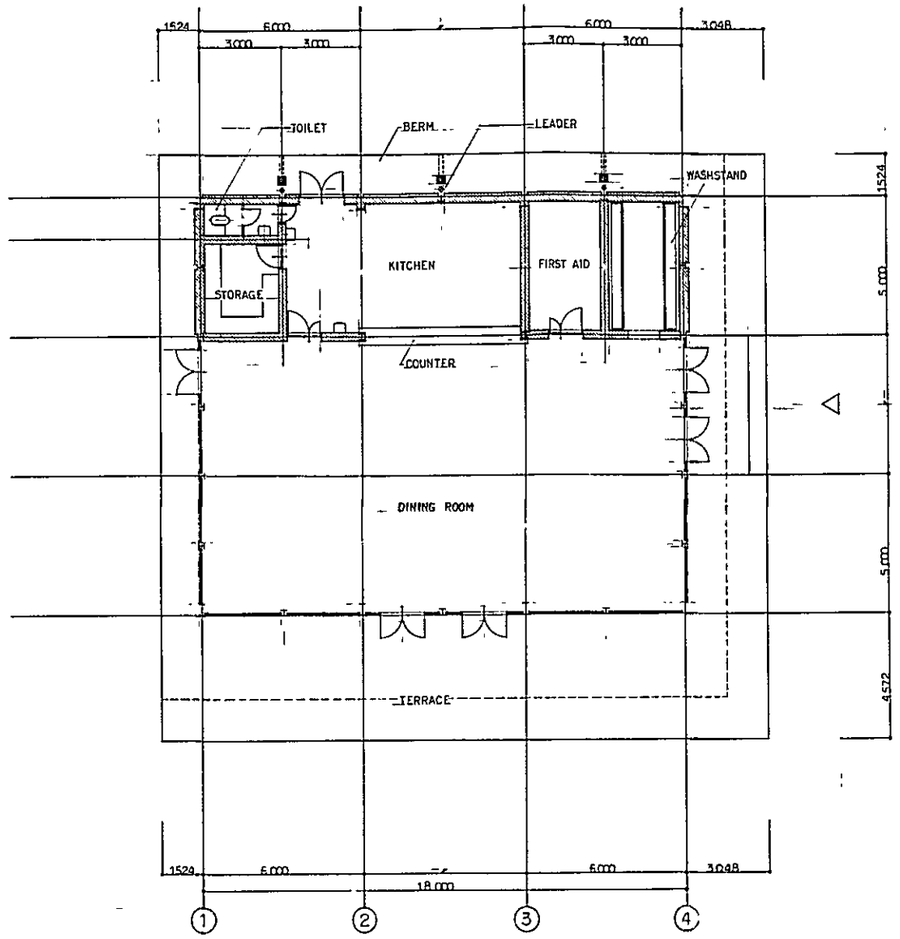

A-A SECTION OF CANTEEN



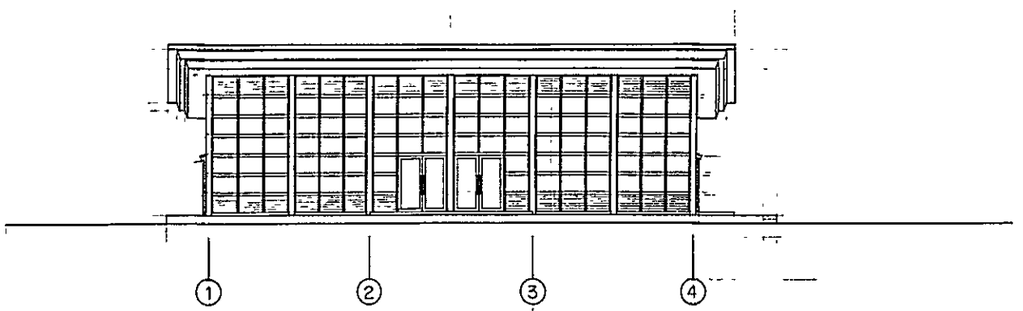

EAST ELEVATION OF CANTEEN




SOUTH ELEVATION OF CANTEEN

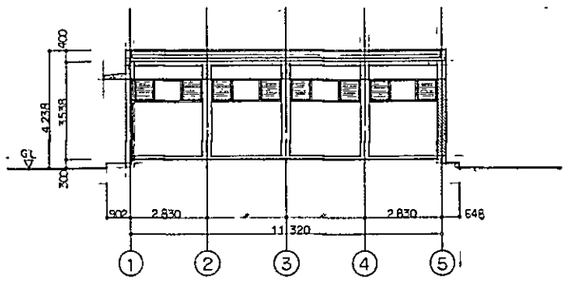



PLAN OF CANTEEN

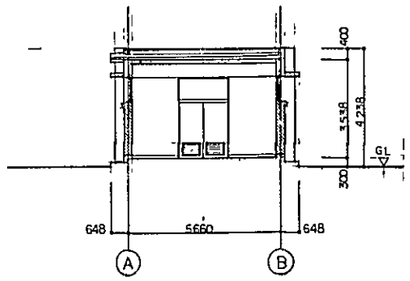



EAST ELEVATION OF CANTEEN

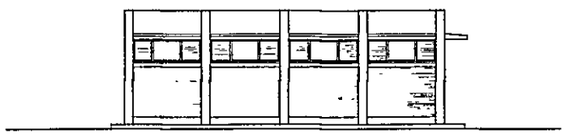
# 6 CATEEN



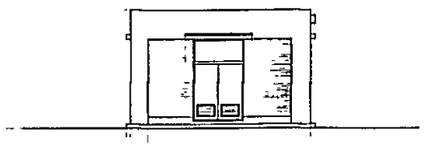

A-A SECTION



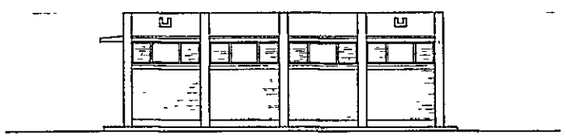

B-B SECTION



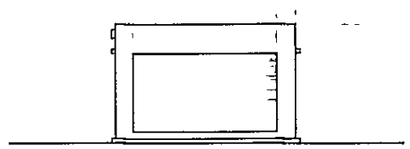
WAST ELEVATION



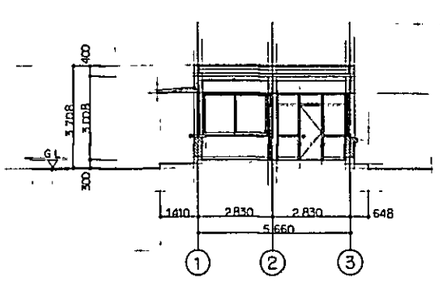
SOUTH ELEVATION



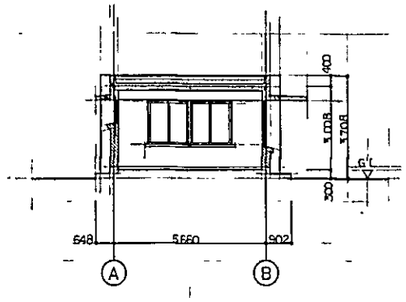
EAST ELEVATION



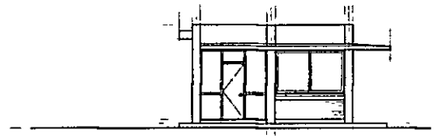
NORTH ELEVATION



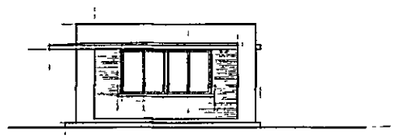

A-A SECTION



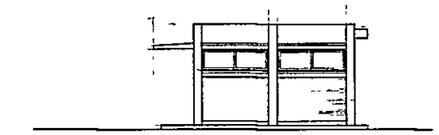

B-B SECTION



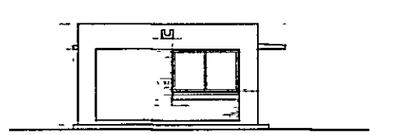
WEST ELEVATION



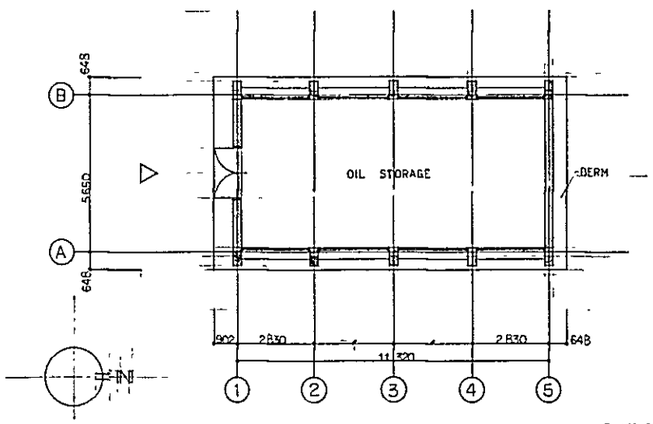
SOUTH ELEVATION



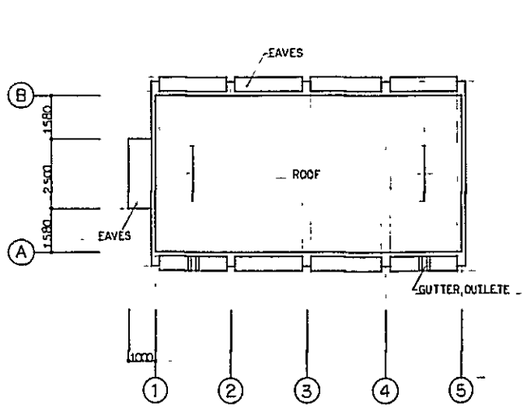
EAST ELEVATION

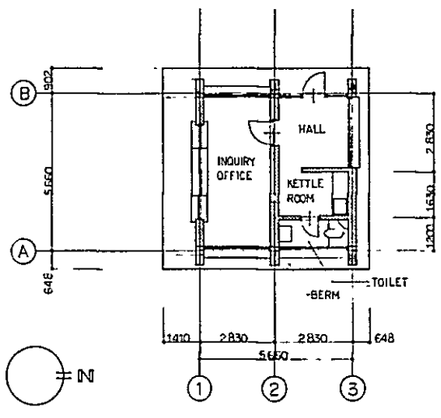


NORTH ELEVATION

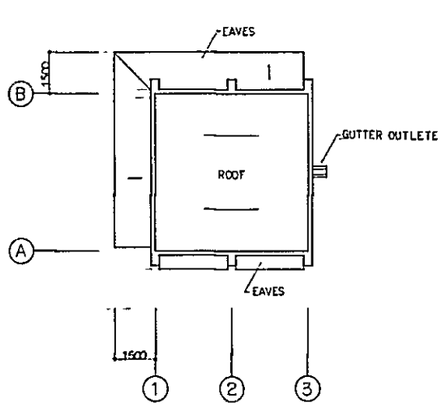



PLAN OF OIL STORAGE

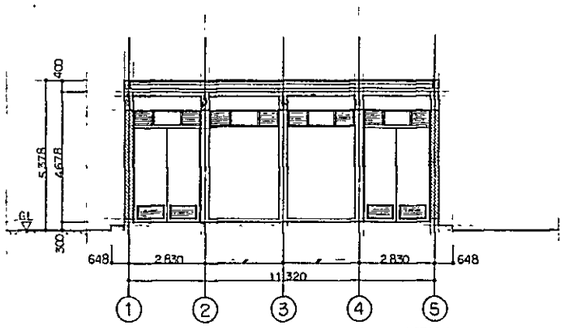


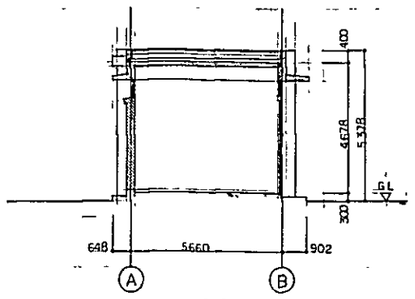

PLAN OF CHECK GATE



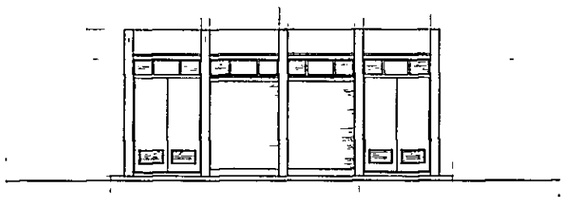

# 7 OIL STORAGE, CHECK GATE



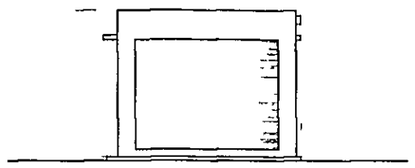

A-A SECTION



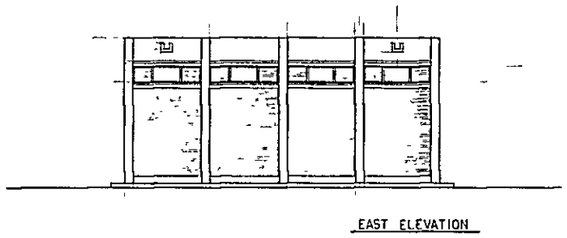

B-B SECTION



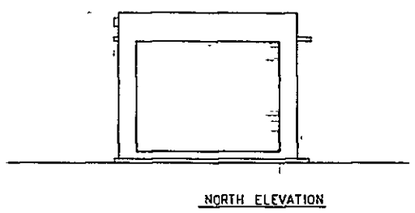
WAST ELEVATION



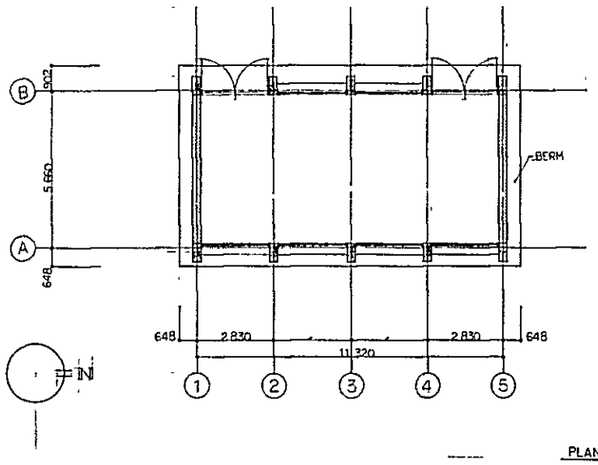
SOUTH ELEVATION



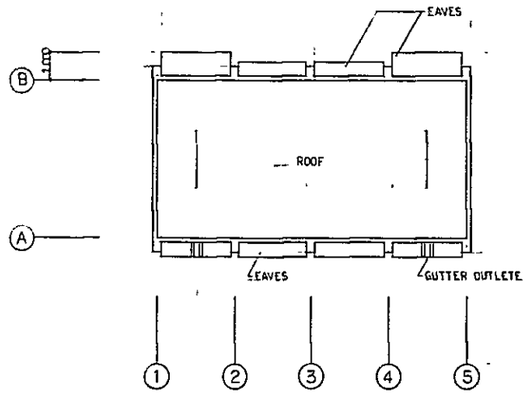
EAST ELEVATION



NORTH ELEVATION




PLAN OF SUBSTATION




# 8 SUB-STATION


JICA