

4-2 Recommendations of Guidance on Preparation and at the Time of Operation Start

The CWS and TI are expected to be a modern facility. Works to be done will be versatile and will be classified into categories according to the specialty of individual jobs. Entire factory (workshop) can demonstrate a high performance only when machanics and workers in all elements of the organization gained the required skill in the jobs based on the afore mentioned regulations.

The fact, however, is that at the beginning of operation workers are not familiar with the proper way of doing things. Therefore, it is essential to provide thorough guidance on how things to be done. The guidance in this stage involves the following three factors.

- a. Key mechanics (class 3/2 mechanics and foremen) and some staffs should be trained before the start of operation.
- b. Guidance on installation of repairing machines to be installed and provision on handling instructions to Key mechanics.
- c. Guidance with emphasis placed on the operation after the shop has been started by some advisors and training of how to cope with emergency situation. Each of the above will be described in detail including the requirements and schedule.

4-2-1 Training of Key Personnel

Key mechanics and some staffs to be trained before operation are picked up from such categories that they shall repair most important components of the vehicles utilizing most expensive machineries. Mechanics working in such categories need to have excellent skill on handling machineries and repair work.

A) Selection criteria of trainee

- (1) Age limits 25 - 30, Healthy male employees
- (2) Education: Middle school graduate as standard

Essential requirement: English knowledge

To be able to read and write in English.

To be able to perform addition and subtraction of simple fraction.

- (3) Some experience or knowledge about the jobs to learn.
- (4) Trainees should be selected from applicants and in no case should trainees be admitted for the reason of personal connections.
- (5) The above criteria apply to staff trainees except that applicants should be high school graduates or over.

As a rule, applicants should be BRTC employees.

B) Training courses and subjects

(1) Engine, clutch and transmission course

Engine Boring, crankshaft grinding, valve seat lapping, injection pump, nozzle and general assembly

Clutch Facing replacement and pressure plate finish

Transmission ... Gear and bushing inspection and finish, propeller shaft disassembly, inspection and assembly and final reduction/differential gear adjustment

Disassembly, inspection, correction and reassembly are the main subjects of training.

After CWS completion, those mechanics shall be assigned.

in Engine Sub-division ... Class 2 or 3 mechanics in
Machining group, pump shop in
Attachment group and Engine
Assembly group

in Axle Sub-division Class 2 or 3 mechanics in
Transmission group and
Axle group

(2) Brake course

Brake shoe Lining replacement, finish

Brake system ... Cylinder, booster disassembly, inspection and assembly

Piping inspection and flare fabrication, etc.

After CWS completion, those mechanics shall be assigned.

in Axle sub-division Class 2 or 3 mechanics in
Axle group

and in Heavy maintenance shop and periodical maintenance shop Class 2 or 3 mechanics in Vehicle sub division

(3) Electric course

Dynamo and starter Disassembly, repair and assembly

Relays and regulators .. Same as above

Electric harness fabrication and repair, etc.

After CWS completion, those mechanics shall be assigned.

in Engine sub-division ... Class 2 or 3 mechanics in
Attachment group

and in Heavy maintenance shop and periodical maintenance shop Class 2 or 3 mechanics to be sent to Vehicle sub division from Attachment group.

(4) Parts course

Parts issue, recording, receiving and recording

Housekeeping of existing parts storage

A new parts control system should be introduced. Therefore, candidates for staff position should be trained.

After CWS completion, they shall be assigned as

Staffs or class 3 mechanics in Part Division (Storage group Parts, Control Sub-division)

C) Number of trainees and training period and location

(1) Number of trainees

5 workers/training group

For parts course 12 staffs and 8 workers

(2) Training period 6 months each 5 workers.

(3) Location

Workshop leased to BRTC, BRTC depot and parts storage

D) Technical guidance

Technical guidance shall be conducted by the instructors well versed in the training subjects shown in (1) through (4) above. The following should be taken into account.

(1) Maintenance operation in Bangladesh is generally primitive and there are many inconveniencies as compared to well-equipped workshop in developed countries. Therefore, it is desirable that the instructors have comprehensive knowledge in addition to that in their specific field.

(2) An instructor shall be responsible for a group of 5 trainees and shall train around 20 trainees on the subjects shown in (1) through (4), i.e., 2 years are required for the completion of training courses.

(3) Since the parts course will result in improvement in BRTC works, particularly, in parts control at the depot, the training period shall be 2 years and approx. 20 trainees shall be selected at the beginning. Instructors shall be able to speak English.

(4) Instructors shall stay in Bangladesh for around 2 years.

(5) Instructors are required to read this report carefully before arriving Dacca so as to understand their mission thoroughly.

4-2-3 Training of Candidates of Managers Outside Bangladesh

Training of key CWS managers outside Bangladesh is necessary because there is no modern facilities in Bangladesh. Particularly, the secretary of the Ministry of Transportation of Bangladesh touched on this subject. The qualification of the manager to be trained, training period, etc. will be described below.

A) Executives and directors to be trained, training subjects, etc.

(1) Candidate of Manager and Asst. Manager Total 2

Training subjects	Service shop management techniques, personnel management, service regulation establishment procedure, accounting procedure, etc.
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Qualification	Experience in automotive business. Graduate of University in Bangladesh or other country. Age limit 40 - 45 Sex male. Preferably majored in industrial management.
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Training period	Approx. 6 months
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(2) Candidate of Manager of service division, Manager of heavy maintenance, Manager of periodical maintenance and Manager of body factory Total 4

Training subjects	General study on service shop management, personnel management, general information on business processing, work management/control in particular field, etc.
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Qualification of candidates	Experience in automotive business. Graduate of university in Bangladesh (machinery course, faculty of engineering), age limit 38 - 43.
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Training period	6 - 8 months (to be decided taking into account past career)
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(3) Candidate of Manager of parts division Total 1

Training subjects Parts storage business, personnel management, business processing procedure and work management/control techniques.

Qualification of candidate Experience in automotive business. Same educational background as in (1), age limit 38 - 43, majored in economics or law.

Training period 6 - 8 months (to be decided taking past career into account)

(4) Candidate of leader, inspection group Total 1

Training subjects General study on inspection business (Parts inspection, component inspection, final inspection and preliminary inspection procedures), work management/control and business processing.

Qualification Same as (2).

Training period Same as (2).

(5) Candidate of Manager, Reclamation subdivision Total 1

Training subjects General study on tire recapping including business processing, sheet metal work management/control and parts inspection procedure.

Qualification Same as (2)

Training period Same as (2).

Approximately 9 persons as shown above is considered to be the minimum number required. Prospective trainees should carefully study this report and familiarize themselves with the contents prior to leaving Bangladesh.

4-2-3 Guidance on Installation and Initial Handling of Machineries

As CWS and TI constructions progress in accordance with the annual schedule and repair machines are required to be installed and operated for test run, appropriate handling procedure should be

provided. Details will be given below.

A) Installation

For machines to be installed on the concrete floor in the shop, the floor should be adjusted through additional work to install anchor bolts, power supply unit, etc. This additional work should be performed under guidance.

B) Test run

Upon completion of installation, the machines should be test-operated and checks should be made to find troubles and leaks by introducing solution, etc. The appropriateness of installation should thus be determined. Trouble, if any, should be corrected within the scope of responsibility.

C) Handling

When the result of test run is satisfactory, responsible operators at CWS should be informed of the handling procedure and cautions. Those instructions should be held in the office in written form.

D) Supervisors

Persons who supervise the activities shown in A to C above should be assigned under the following conditions.

- (1) The supervisor shall be appointed by the manufacturer or its representative/agent and shall have supervisory ability.
- (2) The supervisor shall supervise works on site.
- (3) Expenses required for dispatching and keeping supervisors in Bangladesh shall be born by the manufacture concerned or its representative.
- (4) Since the supervisor's stay varies according to the nature of equipment/machine, maker or its representative shall prepare required schedule and obtain BRTC's approval.

E) Tire recapping shop

Tire recapping shop, though small in scale, is a productive plant. Accordingly, the following requirements shall be added to those shown in A through D above.

- (1) Persons stationed at the site shall continue to stay even after the operation start-up to check the operating conditions, examine the work contents and review organizational structure and man power.
- (2) Recommendation shall be given to CWS concerning raw material maker. Survey shall be made on the wear of recapped tires and if the work is being done by the optimum method. Recommendation shall be furnished to CWS as required. Follow-up surveys in this connection shall be conducted by CWS and BRTC and final decision should be given based on those surveys.

4-2-4 Guidance on Shop Operation

After the completion of each factory, it is necessary that a foreign advisors are assigned to the organizational elements that are responsible for control of the shops, for appropriate recommendations relative to general administration and measures to be taken in case of emergencies.

A) Assignments and responsibilities

- (1) Advisor for manager of heavy maintenance/repair Factory

1 advisor

Job description	Field guidance on jobs (component overhaul) in heavy maintenance shop, applied jobs, preparation of standard working procedure, etc.
Qualification	Skilled in the above works. Preferably able to speak English. Versed in application work method. (This is required since there is no similar workshop in Bangladesh)

like CWS, special tools sometimes
required for work must be fabricated)

Period 2 years after shop start

- (2) Advisor for the manager of periodical maintenance

Factory 1 advisor

Job description Same as (1) except the job relates to
periodical maintenance.

Qualification and
period Same as (1).

- (3) Advisor for the manager of body Factory 1 advisor

Job description Same as (1) except the job relates to
those in body Factory.

Qualification and
period Same as (1).

- (4) Advisor for leader, inspection group 1 advisor

Job description Same as (1) except jobs relate to
those inspection.

Qualification and
period Same as (1).

- (5) Advosor for the manager of parts division 1 advisor

Job description Same as (1) except jobs relate to
parts jobs.

Qualification and
period Same as (1).

- (6) Advisor for the manager, Reclamation subdivisions

1 advisor

Job description Same as (1) except jobs relate to
reclamation jobs including tire
recapping.

Qualification and
period Same as (1).

The number of advisors shall be 6 as shown above. Advisors
are requested to carefully study this report and familialize
themselves with the contents.

4-3 Administration and Operation of Annexed Training Institute

4-3-1 Organization and Operation

As to the schooling system in Bangladesh, some mention was made in Chapter (1-2-2), and the system differs considerably from that in Japan, and it seems that the school attendance rate is fairly low in the nation.

While, CWS itself may be called a modern shop, and therefore, the objectives of this Training Institute are:

- i) To improve the scholastic abilities and skills for a short period of time.
- ii) In view of the present situation in Bangladesh, repairing of not only automobiles but also other equipments, which use engines, especially diesel engines, gears and electricity, is very important, therefore, skills and abilities which can cope with such situation should be exhibited accordingly.
- iii) Repairs should be done through accurate processes and by the use of right methods, and efficiently, etc.

With the matters borne in mind, the Survey Team has created a system as described below.

- (1) Trainees must be acquainted with methods for repairing automobile components. Generally speaking, at ordinary training institutes, trainees learn all subjects with no importance placed on any of subjects, however, at this Institute, a course by which the knowledge on some automobile components, function and repairing methods thereof, as well as repairing technics are to be given, is instituted. Thus the scope of learning is limited. The study of matters concerning whole automobiles will have to be made at CWS.
- (2) The study of general common sense, i.e., sociology, etc., is omitted as much as possible; as for mathematics and physics, the study of these curriculums is limited only to

the study useful for automobile maintenance work.

- (3) In practical exercise, importance is placed on basic operations. The trainers shall give guidance to a small number of trainees concerning study and practical exercise.
- (4) Through the life at the Institute and dormitories, the trainees should learn discipline and acquire it for themselves.
- (5) The final place of training for automobiles is CWS.

In order to attain this objective, the establishment of organization and service regulations, etc., are necessary as shown in Paragraph (4-1-4).

In Table 4-14, an organization for training and the number of personnel required are shown.

Table 4-14 Organization of Training Institute

Principal x 1	Training Div.	Engine course	Instructor x 5	Trainee x 20
	Manager, Training Div. x 1	Power Line course	"	"
Secretary x 1	Foreign advisor x 4	Brake and Steering course	"	"
		Electric course	"	"
	Trainees Sub-div.	Welfare group	Staff x 3	Miscellaneous work x 3
	Manager, Trainee Sub-div. x 1	General Affairs group	Staff x 2	Guardman x 5
		Accounting group	Staff x 2	
		Library group	Staff x 3	Miscellaneous work x 1

Personnel and Qualifications (Since the Training Institute is annexed to CWS, the regulations of CWS are used.)

Principal	1	Administrative work group	4th class (Equivalent)
Secretary	1	"	2nd class (")
Training Div.	1	"	3rd class (")
Instructor	4	"	1st class (Group leader)
	16	Technical work group	3rd or (College Graduate) 4th class
Trainees sub-div.	1	Administrative work group	2nd class (Equivalent)
Welfare group	1	Clerical work group	4th class (Clerical)
	2	"	3rd class (")
General Affairs group	2	"	3rd class (")
Accounting group	2	"	3rd class (Clerical)
Library group	1	"	4th class (")
	2	"	3rd class (")
Welfare group			
Miscellaneous workman	3	Spe. work group	2nd class (")
Gen. Affairs group Guard	5	"	2nd class (")
Library group			
Miscellaneous workman	1	"	2nd class (")
Total : 43		Trainees : 80	
Foreign advisor	4		

a. The service regulation of T.I organization

The employees assigned at the Training Institute composed of the Training Div. and Trainees Sub-div. shall have the authority and responsibility equivalent to that stipulated in Paragraph (4-1-4) - The service Regulations of CWS organization.

The service regulation of T.I organization

Article 1: The principal shall receive directions from CWS General Manager, and he, directly instructing Training Div. and

Trainees Sub-div., shall train trainees into competent repair mechanics during the prescribed period of time.

Article 2: The Principal shall determine appointment and dismissal of Manager of division and sub division, and group leader, and obtain approval thereof from the CWS General Manager.

Article 3: If necessary for training purposes, positions of Deputy Manager of division, sub division and Leaders may be instituted. As to appointment to, and dismissal from, such positions, the Principal shall make determination and obtain CWS General Manager's approval.

Article 4: The Manager, Training Division shall exercise general control over all the courses, and in order that training will be conducted perfectly during the prescribed period of time, he shall get the Institute display its function to the maximum. For this purpose, the manager of Training Div. shall exercise his authority as to personnel matters of instructors, appointment and dismissal of course master, assesment of wages, etc., and report the results of such actions to the Principal.

- Article 5: 1) The Training Division is divided into 4 courses and 5 each Instructors are assigned at these courses; of the five, one shall be course master.
- 2) The Engine course shall conduct training for the trainees concerning disassembly, repair, assembly, adjustment and inspection as well as general repair standards, and shall get the trainees exercise such operations practically. Five Instructors, of those one is course master concurrently, are assigned at this course; one each Instructor is engaged in the training of 4 trainees, including practical exercise guidance and lectures.
- 3) The Engine course master shall exercise general

control over his course, and in order that training will be conducted perfectly during the prescribed period of time, he shall get the course display its function to the utmost. For this purpose, the course master shall give guidance to the Instructors under his supervision and evaluate personnel affairs and wages, and report the result of such actions to the manager of Training Division.

- 4) The Power Line course shall conduct training on the same subjects as mentioned in the foregoing Paragraph 2) concerning clutches, transmissions, propeller shaft, and front and rear axles.
- 5) The responsibility of the course master is the same as mentioned in the foregoing Paragraph 3) concerning the function of this course.
- 6) The Brake and Steering course shall conduct training on the same subjects as mentioned in the foregoing Paragraph 2) concerning front and rear brakes, hand brakes and steering system.
- 7) The responsibility of the course master is the same as mentioned in the foregoing Paragraph 5).
- 8) The Electric course shall conduct training on the same subjects mentioned in the foregoing Paragraph 2) relating to dynamo, starters, and relays.
- 9) The responsibility of the course master is the same as mentioned in the foregoing Paragraph 5).

Article 6: The Manager of Trainees sub division shall have the same responsibility and authority concerning the duties of this sub division as mentioned in Article 4.

Article 7: 1) The Trainees sub division shall be responsible for the administration of dining rooms and dormitories, reception of visitors, issuance and acceptance of

documents, calculation and execution of budgets, administration of books and training materials, etc.

- 2) The Trainees sub division is composed of 4 Groups as follows, which shall take partial charge of the business of this sub division.

A) Welfare Group: Responsible for the administration of dining rooms and dormitories, purchase of books, paper, stationery, etc., calculation of budgets of them, purchase of fixtures and fittings for the students' association, etc.

B) General Affairs Group: Reception of visitors, administration of organization, issuance, acceptance and delivery of documents, purchase of fixtures and fittings, requests for repair, etc., as well as guarding of the Institute.

C) Accounting Group: Consolidation of budgets, making a request for budgets to CWS, operation of the budget, handling of cash, checks and promissory notes.

D) Library Group: Administration, lending and purchase of books necessary for studies of Instructors and trainees, such as reference books, engineering books, etc., and administration and procurement of training materials, such as wall maps, projectors, etc.

Additional Rules This Detailed Rules shall be put into practice
as on _____ Date _____.

The Training Institute shall be operated by the above-mentioned service Regulations, and this Institute has inseparable relations with CWS. Since CWS is the sole maintenance shop equipped with modern facilities, machinery and equipment, as to comprehensive practical exercises, this Institute has to rely on CWS. The

principle is that all trainees, upon completion of their course, are to be supplied to CWS.

In this regard, therefore, this Training Institute is placed under the influence of CWS, and expenses will be acquired from CWS.

4-3-2 Training of New Trainees

The training of new trainees is the main object of this Training Institute. Most of what described in Paragraph 4-3-1) is about how training should be conducted for those having no knowledge on automobiles at all.

As to the schooling, ages, periods of training, etc., detailed explanations are made in the school regulations of the Training Institute, therefore, description is here made about training schedules, textbooks, etc. only.

A) Training Conditions for New Trainees

- 1) New trainees shall have been graduated from at least middle school based on the School Regulations of Bangladesh, and they shall be aged 13 and over.
- 2) The period of training shall be one year, of which 9 weeks are for the study of theory at the existing Training Institute in Furbaria, Dacca.
- 3) After that, the theory of maintenance and practical maintenance exercises are learnt at the Training Institute in Joydepur, all trainees shall be accommodated in dormitories.
- 4) Upon completion of training, the trainees shall be given a comprehensive exercise at CWS for a period of 6 months.

B) Training Hours

One year = 365 days = 52 weeks

Holidays for Institute 4 weeks

Bangladesh festival and
flag days 1 week

Removal from existing
Institute to the Training Institute 1 week

Weeks that can be used
actually $52 - 6 = 46$ weeks

Of 46 weeks, weeks used
at the existing Institute 9 weeks - Furbaria

Weeks used at
Training Institute 37 weeks - Joydepur

Lecture hours 50 min, 10 rest

Practical exercise
hours 2 hrs, 5 min rest

" " 3 hrs, 10 min rest

Training hours	8:30 - 12:30	4 hrs
	12:30 - 13:00	Rest
	13:00 - 16:00	3 hrs

Total: 7 hrs

However, 1) 30 min from 8:00 to 8:30 are assigned for morning assembly. Gymnastics, Principal's morning instructions, etc.; 30 min from 16:00 to 16:30 is used for cleaning of the premises by the trainees.

2) The afternoons on alternate Saturdays are used as home room hours, from 13:00 to 14:00; and for cleaning from 14:00 to 14:30.

Accordingly, training unit hours (60 min = 1 hr including rest time)

$7 \text{ hr} \times 6 = 42 \text{ hr}$ (Monday through Saturday)

$7 \text{ hr} \times 5 + 4 = 39 \text{ hr}$ (Monday through Friday - 7 hr;
Sat. - 4 hr excluding home room hrs)

The above hours are the basic training hours.

Now, description is made about a time-table, etc.

i) Existing training institute at Furbaria, Dacca.

Total = 9 weeks 1 week = 42 hr x 5 weeks = 210 hrs

210 x 50/60 = 175 hrs (Net hrs)

1 week = 39 hr x 4 weeks = 156 hrs

156 x 50/60 = 130 hrs (Net hrs)

Total: 305 hrs

Time-table

Hour	MON	TUE	WED	THU	FRI	SAT		MON	TUE	WED	THU	FRI	SAT
1	↓	↓	↓	↓	↓	↓		↓	↓	↓	↓	↓	↓
2	↓	↓	↓	↓	↓	↓		↓	↓	↓	↓	↓	↓
3	↓	↓	Lecture	↓	↓	↓		↓	↓	Lecture	↓	↓	↓
4	↓	↓	↓	↓	↓	↓		↓	↓	↓	↓	↓	↓
	Rest												
5	↓	↓	↓	↓	↓	↓		↓	↓	↓	↓	↓	↓
6	↓	↓	Lecture	↓	↓	↓		↓	↓	Lecture	↓	↓	↓
7	↓	↓	↓	↓	↓	↓		↓	↓	↓	↓	↓	↓

Home
room

No. of lectures: 42

No. of lectures: 39

Home room : 1

ii) Annexed Training Institute in Joydepur

Of total 37 weeks One week 42 hrs - 19 weeks

One week 39 hrs - 18 weeks

In the case of 19 weeks

Lecture Mor. 2 hrs One week 12 hrs
19 weeks 12 x 19 = 228 hrs
Net hr 228 x 50/60 = 190 hrs

Practical exercise

Mor. 2 hrs One week 12 hrs
19 weeks 12 x 19 = 228 hrs
Net hr 228 x 115/120 = 218.5 hrs

Aft: 3 hrs One week 18 hrs
19 weeks 18 x 19 = 342 hrs
Net 342 x 170/180 = 323 hrs

In the case of 18 weeks

Lecture Mon. thru Thu. Mor. 2 hrs
Fri. and Sat. Mor. 1 hr

1 week 10 hrs
18 weeks $10 \times 18 = 180$ hrs
Net hr $180 \times 50/60 = 150$ hrs

Practical exercise Mon. thru Thu.

Mor. 2 hrs One week 8 hrs
18 weeks $8 \times 18 = 144$ hrs
Net hr $144 \times 115/120 = 138$ hrs

Aft. 3 hrs One week 12 hrs
18 weeks $12 \times 18 = 216$ hrs
Net hr $216 \times 170/180 = 204$ hrs

Fri. and Sat.

Mor. 3 hr One week 6 hr
18 weeks $18 \times 6 = 108$ hr
Net hr $108 \times 170/180 = 102$ hr

Friday Aft. One week 3 hr
3 hr 18 weeks $18 \times 3 = 54$ hr
Net hr $54 \times 170/180 = 51$ hr

	MON	TUE	WED	THU	FRI	SAT		MON	TUE	WED	THU	FRI	SAT
1													Lecture
2			Lecture 2 hr					Lecture					1 hr
3								2 hr					Practical
4			Practical					Practical					exercise
			exercise 2 hr					exercise 2 hr					3-hr
5													Home room
6			Lecture 3 hr					Lecture 3 hr					
7													

No. lectures 12
Practical exercise 2 hr

No. lectures 10
Practical exercise 29 hr
Home room 1

When the above time-tables are summed up:

Lecture		No. lectures	Net hr
Existing institute (Dacca)		366	305 hr
	Home room	4	
CWS Annexed Training Institute (Joydepur)		408	340 hr
	Home room	18	
Total		774	645 hr
		Home room	22
Practical exercise			
only T.I. in Joydepur			1036.5 hr

C) Contents of Curriculum

In order to train trainees (graduates from high-school and above) into 1st class maintenance technicians in Japan, as to curriculums to be established in a one-year period of training, the Ministry of Education and the Ministry of Transport of Japan have designated as follows.

	Lecture	Practical exercise	Total
Ministry of Education	160 hrs	640 hrs	800 hrs
Ministry of Transport	400 hrs	800 hrs	1200 hrs

The Survey Team, by making reference to the above description and by taking into consideration the schooling of trainees, determination was made as follows.

Lecture	Practical exercise	Total
645 hrs	1036.5 hrs	1681.5 hrs

Due to Bangladesh domestic circumstances, it may become necessary to effect some revisions, and the hours shown above are the maximum hours. Even if a revision might be effected, the hours should be not less than 1200 hours like the Ministry of Transport, Japan has designated.

As to the contents of lectures, what were adopted by the Survey Team, by referring to the contents at maintenance schools in Japan, are: Sociology, English, mathematics, physics, physical training and automobile engineering shall be studied at the existing institute in Dacca; and the studies of automobile maintenance, materials, measurement, inspections, etc. shall be made at the Annexed Training Institute. As to subjects, contents thereof, hours, etc., description is made as follows.

1) Contents of Subjects and Hours at Existing Institute in Dacca

	Subject	Contents	No. lectures	Net hr
1	Sociology	Relations between automobile and society and history of development of automobiles	18	15
2	English	Automobile terms	54	45
3	Mathematics	Four rules of mathematics Fraction, conversion	54	45
4	Physics	Dynamic terms, simple dynamics and elementary knowledge of electricity	54	45
5	Automobile introduction	Kind of automobiles and summary of automobile construction	18	15
6	Engine introduction	Construction of diesel engine Construction of gasoline engines	48 6	40 5
7	Chassis introduction	Construction of chassis	48	40
8	Electricity	Electric equipment	48	40
9	Physical training	-	18	15
10	(Home room)		(4)	
Total			366	305

ii) Contents of subjects and Hours at CWS Annexed Training Institute

A) Engine Course

Subject	Contents	No. lectures		Net hr
		1st half	2nd half	
1 Engine maintenance	Diesel engine maintenance Gasoline engine maintenance	120 24		100 20
2 Special Mechanism	Injection pump maintenance, cooling system maintenance	36	27	52.4
3 Electric and magnetic science	Basic knowledge of electricity and magnetism; and maintenance of parts utilizing thereof	20	17	30.8
4 Measurement	Method for measuring utilizing various kinds of measuring tool	20	32	43.3
5 Study of materials	Properties of materials and processing methods		34	38.4
6 Inspection	Inspection of engine and chassis		44	36.7
7 Maintenance at CWS	Methods for engine maintenance at CWS		34	28.4
8 (Home room)		(9)	(9)	

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B) Power line Course

Subject	Contents	No. lectures		Net hr
		1st half	2nd half	
1 T/M maintenance	Clutch maintenance T/M " Propeller shaft maintenance	40 62 30		33.3 51.6 25
2 Axle maintenance	Front axle maintenance Rear axle maintenance	45	30	25 37.5
3 Study of electricity and magnetism	Same as Engine Course 3	20	17	30.8
4 Measurement	" " " " 4	23	29	43.3
5 Study of materials	" " " " 5		34	28.4

	Subject	Contents	No. lectures		Net hr
			1st half	2nd half	
6	Inspection	Inspection of power line and chassis		44	36.7
7	Maintenance at CWS	Maintenance of power line at CWS		34	28.4
8	(Home room)		(9)	(9)	

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C) Brake and Steering Course

	Subject	Contents	No. lectures		Net hr
			1st half	2nd half	
1	Brake maintenance	Maintenance of front and rear brake and hand brake	100		83.3
2	Steering maintenance	Maintenance of steering gear case and link	44		36.7
3	Study of electricity and magnetism	Same as Engine Course 3	20	17	30.8
4	Measurement	" " " " 4	20	32	43.3
5	Study of materials	" " " " 5		34	28.4
6	Inspection	Inspection of brake, steering and chassis		44	36.7
7	Maintenance at CSW	Maintenance of brake and steering at CWS		34	28.4
8	Special mechanism	Maintenance of booster, cylinder, etc.	36	27	52.4
9	(Home room)		(9)	(9)	

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D) Electric Course

Subject	Contents	No. lectures		Net hr
		1st half	2nd half	
1 Maintenance of charging and dis-charging circuit	Maintenance of charging circuit	48		40
	Maintenance of dis-charging circuit	48		40
	Maintenance of relays and their circuits	48		40
2 Special mechanism	Maintenance of instrument, wiper, horn, etc.	36	27	52.4
3 Study of electricity and magnetism	Same as Engine Course 3	20	17	30.8
4 Measurement	" " " " 4, and electric measurement	20	32	43.3
5 Study of materials	Same as Engine Course 5		34	28.4
6 Inspection	Inspection of electric equip-ment and chassis	44		36.7
7 Maintenance at CWS	Maintenance of electric equipment at CWS		34	28.4
8 (Home room)		(9)	(9)	

408 340

Hours of practical exercise at Training institute shall be assigned as follows by respective courses.

Exercise item	Hr
Basic processing work	200
Basic machining work	200
Inspection work	86.5
Basic measuring work	60
Disassembly work	180
Assembly work	210
Adjustment work	50
Inspection and test running work	50
Total	1036.5 hr

The above-described contents of subjects and hours shall be differentiated, and respective courses shall prepare charts for conducting lectures and practical exercises, and Instructors shall be assigned according to the differentiated programs. In the hours differentiated, hours required for conducting tests are included.

D) Training Materials and Textbooks

As to training materials and textbooks, some of them will be used for lecturing purposes, and others for exercising purposes. Considering the present circumstances in Bangladesh, determination was made as follows.

i) Training materials and textbooks used in lectures

Consumable training materials: Chalk, printed matters used for explanation purposes

Durable training materials: Materials by which construction can be understood minutely are required such as cut engines, etc.

The kinds are:

1) Engines, 2) clutch, 3) transmission 4) propeller shafts (center bearing, spider, flange yoke) 5) final reduction system 6) brakes 7) steering gear case 8) brake boosters 9) starter and dynamo

The above materials are necessary by all means.

In addition to the above materials, wall maps, projectors are necessary, which are used to explain in what manner operations are made. It is desirable that wall maps be prepared by Instructors.

Textbooks: As textbooks, those being used at similar institutes in Japan are as follows.

1. Issued by Japan Automobile Maintenance Promotion Association: Automobile Maintenance Technics (Vol. 1 and Vol. 2, for junior class maintenance technicians)

2. Issued by Automobile Maintenance School Asso. of Japan: Construction of Chassis, Diesel Engines and Fuels for Internal Combustion Engines, Oils and Greases

The contents of the above mentioned books are of too high degree, these are appropriate for only Instructors, but not for trainees.

In view of such circumstances, to compile textbooks using the above-mentioned textbooks as references on a by-course basis is absolutely necessary. If suitable textbooks are not available, satisfactory results of training can never be expected.

- ii) Training materials and textbooks to be used for practical exercises

Consumable materials: There may be materials of very many kinds:

- a) Oils and greases, fuels, water, compressed air
- b) Materials used for basic work done using tools and machines, and parts.
- c) Materials used for maintenance work. The components mounted on vehicles waiting for maintenance are used. Such components are removed from vehicles at CWS, these are used for exercise and reclamation purposes. For reclamation by exercise, 5 vehicles are used, which means that each group of 4 trainees is engaged in the reclamation of one vehicle.
- d) Durable training materials: Description is made separately.

Textbooks

Practical exercises are conducted at the Annexed Training Institute, and lectures concerning practical maintenance are also given at this Institute, therefore, textbooks

should be such ones as capable of being used for both lectures and exercises. It is essential that textbooks are to be prepared in which trainees can enter the results of their exercises conducted, making it enable for them to compare the results entered with lectures. Basic books will be prepared by using what was mentioned in the foregoing Subparagraph i) and vehicle maker's service manuals. To prepare such books is very important like mentioned in the foregoing Subparagraph i).

The above-mentioned work will be proceeded along with the construction of an Annexed Training Institute, and determination as to what books are to be prepared will be made according to the contents of subjects given at this Institute. To make further breakdown is not possible unless breakdown of contents of subjects is made.

- iii) Practical exercises at CWS will be conducted under the guidance of the group leader or Staff concerned. Textbooks will be prepared by Instructors, while evaluation and marking will be made by the said group leader or Staff and the Instructor. To recognize whether the achievement is satisfactory or not, judgement will be made by the side of the Training Institute.

E) Training Institute School Regulations

In principle, the personnel of the Training Institute should engage in their business abiding by the Shop Regulations mentioned in Paragraph B of 4-1-4), however, a regulation similar to such regulations is absolutely necessary for the administration of trainees. Such regulation will be prepared with the Shop Regulation as a basis, therefore, trainees will surely be benefitted greatly when they work at CWS after their graduation.

The School Regulations of Training Institute

Chapter I - General

(Purpose)

Article 1: This Regulation stipulates matters essential in the schooling of trainees at this Institute, an institute to train trainees into competent automobile maintenance/repair mechanics.

(Priority of Bangladesh domestic regulations)

Article 2: Notwithstanding this Regulation, Bangladesh domestic regulations shall apply when there are provisions signifying otherwise.

(Obligations to observe)

Article 3: Trainees shall observe this Regulation faithfully, and make studies in compliance with the directions of Instructors.

Chapter II - Employment

(Qualifications and Age)

Article 4: Entrance qualifications are as follows.

- A) Those who have graduated from at least middle schools, as designated by Bangladesh regulations, or those who are expected to graduate.
- B) Those who are aged between 13 and 16.

(Entrance examination)

Article 5: Those wishing to become trainees shall be subjected to an intellectual examination, a physical examination and an interview, they shall submit the following documents.

- A) Application for admission One copy
- B) Certificate of graduation from the last school, or certificate showing that one is expected to be graduating One copy
- C) Examination fee TK 50

For the candidates who have gone through the above-mentioned procedures, an examination is conducted and those who have passed the examination shall be admitted to the Institute.

(Entrance procedures)

Article 6: Those who have granted admissions shall go through the following procedures within 30 days after the granting.

- A) Statement showing one's status of life
(including family members) One copy
- B) Certificate signed by guarantors One copy each from
two guarantors
- C) Written oath signed by himself
and two guarantors One copy
- D) Picture taken not before than 6 months
- E) Admission fee TK 100

(Cancellation of admission)

Article 7: Those who have neglected to go through the prescribed procedures and failed to report 15 days before the date of entrance to the Institute shall be cancelled their admissions.

(Certificate of trainee)

- Article 8: (1) A trainee shall be given a certificate of a trainee, he shall carry it with him at all times.
- (2) This certificate shall be returned when he graduates, leaves the Institute before graduation or when he was cancelled his status as a trainee.
- (3) When a trainee has lost his certificate of a trainee or when he has got it stained, he shall submit an application for reissuance and get new one.

(Changes)

Article 9: Whenever any change has occurred in the description of the documents mentioned in Article 6, the trainee shall submit a written report on such change immediately. When he wishes to change his place of residence, he shall submit a written request for permission.

Chapter III - Training Schedule

Article 10: (1) The courses, years of study and the number of trainees are as follows.

Course	No. of trainees	Study term at Dacca	Study term at Joydepur	Study term at CWS
Engine	20	9 weeks	37 weeks	26 weeks
Power Line	20	"	"	"
Brake and Steering	20	"	"	"
Electric	20	"	"	"

(2) Periods of study are as follows.

From 1st week(month)	9 weeks	At Furbaria Institute
From 1st week(month)	37 weeks	At Joydepur Institute
From 1st week(month)	26 weeks	At CWS

(3) Holidays are as follows, however when it deemed necessary, the Principal may change the holidays.

- A) Sundays
- B) Festival and flag days as designated by the Nation
- C) Days as designated by the Principal
- D) During movement from Dacca to Joydepur 1 week
After the 2nd term has passed at Joydepur 3 weeks
After the 3rd terms has passed at Joydepur 1 week

(School Term and hours)

Article 11: (1) Terms of training are as follows.

- A) At Institute in Furbaria, Dacca. 1st term
- B) 1st 18 to 19 weeks at Joydepur 2nd term
- C) 2nd 18 to 19 weeks at Joydepur 3rd term
- D) Practical exercises at CWS 4th term

(2) Training begins and ends as follows.

A) From 1st term to 3rd term

08:00 - 08:30 Morning meeting/assembly

08:30 - 12:30 Lecture - 4 hrs, however, 10 min rest
in every hour

Exercise - 2 hrs, however 5 min rest

3 hrs, however 10 min rest

12:30 - 13:00 Lunch time

13:00 - 16:00 Lecture - 3 hrs, Rest as mentioned
above

Exercise - 3 hrs, Rest as mentioned
above

16:00 - 16:30 Cleaning by trainees

However, every other week:

13:00 - 14:00 Home room }
14:00 - 14:30 Cleaning } on Saturday

B) As to the 4th term, the beginning and closing hours
adopted at CWS are applied.

(Absence and others)

Article 12: (1) Whenever trainees have to be absent from training, late
in attending or have to leave earlier, they shall report
it to the Instructor in advance, and go through the
prescribed procedures. In principle, reports shall be
made before such fact.

(2) When trainees are unable to attend for more than 7 days
consecutively due to illness, they shall submit a physi-
cian's certificate.

(Long absence from training and return)

Article 13: (1) When trainees are expected to be absent from training
for more than one month consecutively due to illness or
other reasons, they shall submit a written request for
permission together with a physician's certificate and
a statement signed by their guarantors.

- (2) When trainees mentioned in the foregoing Paragraph (1) wish to return to training, they can return with Principal's approval.

(Trip and outing)

- Article 14: (1) When trainees wish to go on a trip requiring to stay outside of Institute, or when they wish to go home, they shall submit a written request in advance.
- (2) When trainees accommodated in the dormitory wish to go out, and if they have to stay outside the dormitory, they shall submit a written request as prescribed.

(Leaving training)

- Article 15: (1) When trainees wish to leave training, they shall submit as prescribed a written request signed by their two guarantors.
- (2) Before leaving, they shall return all articles they had borrowed from the Institute and CWS.
 - (3) The Training Institute, when requested, shall issue certificates showing the period and contents of the training and the results of achievement made by them.

(Dress)

- Article 16: (1) In the premises of the Training Institute and CWS, the trainees shall always wear a badge, a name plate, a uniform including cap, as prescribed.
- (2) Trainees, when outcoming, shall wear a hadge.

(Inspection of things possessed)

- Article 17: (1) When trainees take articles other than those possessed usually by them into or take out them from the Training Institute, they shall go through the prescribed procedures and get inspections by the personnel in charge of guard.
- (2) The articles possessed by those accommodated in the dormitory may be inspected as necessities arise.

(Prohibition on political activities)

- Article 18: (1) Trainees shall not engage in political activities or propagation of religion with the premises of the Training Institute and CWS.
- (2) When trainees wish to hold a gathering, make a speech or broadcasting or to post or distribute printed matter, or when they wish to engage in a signature-taking campaign, they shall obtain a permission from the Principal in advance.

(Prevention of accidents)

- Article 19: (1) Within the premises of the Training Institute and at the dormitory, trainees should be most careful in the handling of fire; smoking is not allowed at other places than designated; smoking while walking is prohibited.
- (2) The equipment and machines at the Training Institute shall not be taken out or operated, or any equipment or machines shall not be taken into the Training Institute without permission or directions.
- (3) Whenever any trouble, damage, lost or irregularity has been found on the equipment or machines mentioned in the foregoing Paragraph (2), a report shall be made to an Instructor or a Staff immediately, and receive his directions. The damage and lost shall be compensated for.

Chapter IV - Examinations and Qualification

(Examination)

- Article 20: In order to evaluate the results of learning in both lectures and practical exercises, examinations shall be given to the trainees as to respective subjects as follows.
- (1) Examinations shall be ordinary examinations and final examinations.
- (2) Ordinary examinations shall be given on occasion during the 1st, 2nd and 3rd terms.

- (3) Final examinations shall be given at the end of the 1st, 2nd and 3rd terms or at the end of Subjects.
- (4) Examinations include written examinations and examination in which trainees' skills and capabilities are to be exhibited. Also, attendance to classes and exercises shall be the item of evaluation.
- (5) Attendance to classes and practical exercises shall be recorded by Instructors as to each subject; absences due to mourning, illness and injury, as well as absences approved by the Principal shall not be treated as absence.

In the case of mourning, 3 days are given (the days required for a trip to and from one's home are granted).

To be included in the absence that is not treated as absence is:

- A) A period during which attendance is suspended due to occurrence of contagious disease.
- B) Participation in outside games or matches, meetings, etc. that is approved by the Principal.

(Evaluation)

Article 21: Evaluation shall be made by the 100 point full mark method.

- | | |
|-------------------|-------------------|
| A (80 - 100) | B (70 - 79) |
| C (60 - 69) | D (under 59) |

Over "C" shall be the passing mark.

(Reexamination)

Article 22: (1) For those who have had subjects in which they failed to get the passing mark, they are allowed to receive examinations again provided that they go through the prescribed procedures.

- (2) For those who were unable to get final examinations due to unavoidable reasons such as illness, etc., examinations will be given when such reasons cease to exist, they shall go through the prescribed procedures.

- (3) As to the foregoing Paragraphs (1) and (2), reports on the results of survey or research, etc. may become objects of evaluation.

(Recognition of completion of whole course)

Article 23: Trainees who have completed the whole course of study and come under all of the following Subparagraphs will be recognized as completing the whole course.

- (1) The attendance rate is higher than 80% both in classes and practical exercises.
- (2) Those who have succeeded in the examinations of all subjects both in classes and practical exercises, or those who have recognized their results mentioned in Article 22 as satisfactory. However, in case trainees had subjects of which they failed in getting satisfactory results as to the 1st term, conclusion shall be made at Instructors' meeting.
- (3) Those whose learning attitude has been good, and who can be recognized fully capable as maintenance mechanics.

(Conferment of certificate)

Article 24: (1) Trainees who are recognized as having completed the whole course as mentioned in Article 23 shall be given diplomas by the Principal.

- (2) Even after graduation, the certificate of graduation can be issued under name of Principal on request.

Chapter V - Commendation and Punishment

(Commendation)

Article 25: (1) The Principal may commend trainees when they are recognized to be an example of other trainees.

- (2) Commendation will be done in the following ways.

- A) At the end of the 1st, 2nd and 3rd terms, 5 trainees who have been excellent in learning and conduct will be selected from among the trainees of each course.

Those who have been selected thus will be appointed to team leaders, of 4 trainees and badges will be given to them.

- B) At the end of the whole course, commendation will be done for each course as follows.

Commendation of excellent achievement (excellent learning and conduct) as well as absence rate below 20% 1 or 2 trainees

Commendation of excellent attendance (absence rate below 5% and excellent conduct) 1 or 2 trainees

- (3) For those who prevented occurrence of accidents as mentioned in Article 19, or who have been excellent in behavior, commendation will be effected on occasion.

(Punishment)

Article 26: There are three ways of punishment: admonition, suspense from training and withdrawal from the T.I. Decisions are made by the Principal by taking the opinions of Instructors at meetings into consideration.

- (1) When trainees come under one of the following acts, they shall be admonished.
- A) Acts not complied with the Training Institute School Regulations, neglect in submitting prescribed reports, or failure in submitting such reports.
 - B) Irregular attendance
 - C) Violent acts in the premises of the Training Institute.
 - D) Infliction of damage on the equipment or machines of the Training Institute intentionally or through error.
- (2) When trainees come under one of the following stipulations, they shall be suspended from attending classes.
- A) When no sign of reflection is seen in spite of

repeated admonition.

- B) Due to violent act in the premises of the Training Institute, when a trainee got a injury himself or inflicted a injury on other person.
 - C) When a trainee damaged or lost a building, equipment or a machine in the Training Institute with an intention or through serious error.
 - D) When a trainee caused a fire through carelessness.
 - E) When a trainee acted unfairly in an examination.
- (3) When trainees come under one of the following stipulations, they shall be exiled from the Training Institute.
- A) When there is seen no sign of improvement on the bad character and conduct.
 - B) When scholastic ability is poor and there is no possibility of completing the whole course.
 - C) When attendance is not regular without due reason.
 - D) When a trainee acted against the duty of the trainee outside the Training Institute.
 - E) When a trainee has stolen an article of the Training Institute facilities, or when he attempted to steal.
 - F) Despite that a trainee has been punished with suspension, when there is no sign of repentance.

Chapter VI ~ Dormitory

Article 27: Dormitories are annexed to the Training Institute; all the trainees shall be accommodated in the dormitory during their 2nd and 3rd terms. As to matters concerning administration of the dormitory, stipulations shall be made by the Principal.

Additional Rules

This Regulation shall be put into practice as on Date .

F) Others

In addition to the above Regulation, concerning the administration of the Training Institute, there should be Regulations for Dormitory Residents, Regulations for trainees' Association, etc.

Also, as to reporting documents, it is necessary to define Forms appropriately.

As to the qualifications of Instructors, description was made already, however, they should be a nucleus of guidance for the trainees, therefore, they should be trained in accordance with the detailed description of Paragraph 4-4-1).

4-3-3 On-the-job Retraining

When the personnel of CWS and Depots are retrained utilizing the facilities of the Training Institute, the following conditions shall apply.

- i) Those who are retrained shall be candidates from the Mechanical and Special Work Groups, and all of the candidates shall be promoting to their immediately upper classes.
- ii) All candidates shall undergo and pass scholastic ability examinations. This means that they are possessing the qualifications required for their present classes. All other retraining courses will be conducted at the Training Institute presently existing at Furbaria.

A. Contents of Training

i) Group limited to practical exercise only

Those who receive practical exercises only are mechanics shown in Article 4 of the work grouping classification Regulations; they are:

- | | |
|--------------------------|-------------------------|
| (A) Inspection mechanics | (B) Finishing mechanics |
| (C) Machining mechanics | (I) Art-welder |

Less than 40 persons

ii) Group limited to lectures only

(J) Transporters, (K) Miscellaneous service men belonging to the Parts Dept., and Guard shown in (A) of Special Work Group, (B) Cooks

Less than 40 persons

All personnel other than those described as above shall receive retraining at Furbaria.

iii) Retraining term

The term for retraining shall be the term during which training is being not conducted for new employees. Therefore, the terms covers 9 weeks.

iv) Textbooks, contents and hours

Textbooks used for retraining shall be similar to those used for the training of new trainees. The contents of these textbooks shall become higher-degreed as the classes of trainees advance. In principle, textbooks shall be prepared by the Instructors, however, in the case of special jobs such as cooks, preparation of textbooks is required to outside authorities.

Schedules for training will be prepared in nearly the same way as for those applied to the training of new trainees.

v) Also, as to the operation of general matters, the stipulations made for new trainees' training will mostly be applied, however, retrainees shall act in compliance with the CWS Shop Regulations, excepting lecture hours.

Upon completion of the retraining course, the retrainees shall undergo examinations, only those who have succeeded in the examinations shall be promoted. Those who have failed in the examination should wait for the opportunity of next retraining course.

4-4 Recommendations of Technical Guidance to T.I

Same considerations as shown in 4.2 should be given to the technical guidance to T.I. The method shown in 4.2 shall be followed.

4-4-1 Instructor Training

Main job of the instructor is to train trainees for required techniques and skill and the instructors shall be selected from those of technical work group. Prior to assignment to the position of instructor, the candidate himself shall learn instruction techniques.

A) Selection criteria for candidate of instructors

- (1) Age limit 30 - 35, sex male
- (2) Educational background: High school graduate or higher. Able to speak and read English. Preferably technical high school (machinery course-engine, power line and brake courses or electrics course) graduate or higher.
- (3) Experience in similar works as those given in training.
- (4) Candidate of instructors shall be selected from applicant and shall not be selected on the basis of personal connection.

B) Training subjects and contents

Same as shown in 4-2-1, B. (Parts is omitted and steering is added)

C) Number of trainees, training period and location

- | | | |
|------------------------|--|----------|
| (1) Number of trainees | Each course 5 | Total 20 |
| (2) Period | 6 months | |
| (3) Location | Workshop leased to BRTC, BRTC depot. etc. | |
| (4) Others | At the end of training, test shall be conducted. One who showed the highest performance in written test and skill will be promoted to the course master, and will be sent for overseas training at appropriate | |

time and will be assigned to the course master.
(One for each course. Total 4)

D) Technical guidance

Foreign national instructors well versed in the training subjects shall be used for technical guidance of candidate of instructors. The following shall be noted in this connection.

- (1) Since there are many inconveniences in the maintenance works in Bangladesh because of the lack of facilities, it is desirable that instructors have broad knowledge in addition to those in their specialized field.
- (2) An instructor shall train 5 candidate of instructors of each course. Even after the school is opened, the instructor shall stay for 2 years at T.I for technical guidance. Accordingly, it is preferable that the instructor can speak English.
- (3) Instructors shall examine this report prior to leaving their country and capture what are involved in the instruction at an automotive maintenance school for the better understanding of the assigned tasks.

4-4-2 Oversea Training for Candidate of T.I. Managers

Oversea training of T.I managers is critical for the country such as Bangladesh where the fund for education is scarce and education system has not been developed. At least the T.I. principal and manager of training division should receive the training.

A) Training subjects for candidate of T.I. principal

General administration of and operation of training institute, personnel management, service regulations and general accounting.

Qualification	Experience in education related to automobiles or relevant subjects. Age limit 40 - 45, male.
---------------	---

Educational background Graduate of university in Bangladesh or other country or higher

Training period 6 - 8 months. Final decision shall be done based on past career.

B) Training subjects for candidate of manager of training division

Training subjects Study on entrance examination, practice, lecture, graduation examination, qualification of trainee, etc. and study on application of these methods in Bangladesh.

Qualification and period Same as A.

4-4-3 Guidance on installation and handling of machines/equipment to be installed in the training Factory. 4-2-3) shall applies to the guidance on the installation and handling of equipment in the training Factory, however, persons eligible to receive this guidance shall be instructors.

5 . ECONOMIC EVALUATION

CHAPTER V. ECONOMIC EVALUATION

As described in detail in the following Paragraph 5-1-1 Estimated - Demand for Maintenance Repair Work, the demand for maintenance work during some years after the start of CWS operations will double against ordinal capacity of CWS. Therefore, there is no fear concerning the rate of operation, and profit, which are usually unstable on the transition period of operation.

- (A) BRTC is planning to increase vehicles during the years 1978 through 1984 and when its present low maintenance ability are considered, the demand for heavy maintenance in 1984-1985 will exceed heavy repair capacity of CWS even after heavy repair factory is completed under 1st phase construction plan.

Because heavy repair factory has capacity to cope with 1200 vehicles in a year and vehicles waiting for heavy repair from 1981 are much more than this capacity. Therefore, two-shift work or hard overtime work will be required for several years after 1981.

- (B) Also, as for the periodical maintenance, the demand is expected to exceed the periodical maintenance ability because in the 1st half period of depreciation, the factory will have to maintain two times of vehicle of its maintenance capacity, also during 2nd half period, the factory will have to maintain an unexpected number of vehicles due to extension of vehicle life by systemized maintenance.

Consequently, providing maintenance/repair to the private vehicles may be impossible for some years after the start of operation.

(C) After the maintenance system is built, care-taking of vehicles need heavy maintenance/repair and those feasible to be rehabilitated, which had been accumulated and awaiting treatment for long, will become mandatory for several years after the commencement of CWS operation. CWS, therefore will be able to continue operation with a profit of more than 24% of its investment in the operating aspect. On the other hand, reduction of foreign currencies by more than 700 Lakh TAKA/year may be expected through extension of vehicle life.

(D) Calculations were made for maintenance costs utilizing the market price, and the price lower than such market price by 20%, which was employed considering that CWS is a national enterprise.

As a result of calculation, in the case of maintenance at the market price, a benefit-cost ratio of over 1.6 is obtained with adjustment of present value by 15% forward rate. In the same manner, a benefit-cost ratio of more than 1.0 was obtained when a 24% forward rate was used.

While, as a result of study using a 20% less than the market price, the ratios of 1.2 and 0.8 were obtained respectively; it is considered even in this case that a profit may be earned through reclamation efforts.

(E) A tire recapping factory to be built in the 1st phase will play the most important role in the reclamation of the parts mentioned above, and it is expected that this factory will earn profits immediately after the commencement of operation with 2-shift working.

As to the aspect of profit, this factory, like a heavy maintenance factory, a periodical maintenance factory, etc., is one of the most important factories able to earn profits.

(F) As described above, the CWS operation will be able to earn profits by saving foreign currencies as a result of extension of vehicle life, by earning profit even under high forward rate of 24% and the maintenance cost of 20% less than market

price. Therefore, it is desired that these profits will be utilized for the improvement of the treatment of employees, and for the perfection of the facilities and education.

(G) Lastly, as it will be clear through analysis of which description will be made later on, only by the construction and operation of CWS, BRTC can pass a big fleet of 2400 vehicles and can operate them under serviceable condition after 1984. Therefore it is hoped that the establishment of CWS and its operation may serve to help the development of Bangladesh and BRTC.

(H) After completion of this draft, a delegation was sent to Dacca from Japanese government on 5th Sept. 1978, and members of delegation together with counter part members had explained, discussed, and exchanged opinions.

Finally, all members concluded to change the construction schedule of Tire Recapping, Casting/Forging Factory from Phase 3 to Phase 1, due to big contribution of foreign currency curtailment.

By this alternation, it is apparent that economical status of CWS operation will be much improved than mentioned in this chapter. Therefore, economic evaluation of CWS operation after said factory is completed in Phase 1 has been abbreviated.

5-1 Profitability of CWS Operation at Initial Stage

5-5-1 Estimated Demand for Maintenance Work

In making estimation of maintenance demand for CWS, preconditions were instituted as follows.

(A) The maintenance ability of BRTC is very poor at the present, as mentioned in the interim report, therefore, the Bangladesh Government is considered very eager to request to the Japanese Government of support to push forward this project, i.e., working out CWS designs, training and education of CWS personnel, etc. Since a long time is required for the

establishment of CWS and for its smooth operation, unless the Bangladesh Government gives a perfect assistance to BRTC in charge of the construction and operation of CWS together BRTC's effort by itself, there will be no remarkable improvement on the maintenance situation. By this reason, all efforts of officials concerned shall make their best in accordance with this final report throughout the stages before, during and after the establishment of CWS.

- (B) According to BRTC, the heavy maintenance ability of existing work shop is said 20 vehicles per month. While, of the 237 buses under operation shown in Table 5-1, 10% (24) are considered necessary to have heavy maintenance.

Consequently, 20 of the 24 buses may be taken care at the present WS, and 4 buses are being placed in operation at Depots, even they need heavy repair.

The time necessary for engine overhaul at the existing WS requires more than 3 months after Chittagon Depot. for instance.

Based on the foregoing data, if the theory of queue is applied: 20 (Number of vehicles awaiting maintenance) x 3 months = 60 vehicles

$$\frac{\rho}{1 - \rho} \leq 60 \quad \rho: \text{Service Ratio}$$

From above, $\rho \geq 0.98$ can be obtained.

In case $\rho = 1$, awaiting queue is the infinite, and $\rho = 0.98$ shows that the queue is already long in 1978. Therefore, before 1981 (the year when completion of 1st phase construction of CWS is estimated), one can see a scene where vehicles are compelled to park long time at Depots waiting for the completion of establishment of CWS.

By the way, the 204 vehicles (heavy maintenance are necessary) shown in Table 5-1 are capable of being rehabilitated.

Table 5-1 Nos, and Condition of Buses of Each Depot

Unit	Road- worthy	Major repair	Total
Motijheel Depot	33	46	79
Kallyanpur "	34	43	77
Pabna "	10	5	15
Mirpur-13 "	48	16	64
Joarshahara "	21	20	41
Bogra "	5	4	9
Chittagong "	14	12	26
Double Decker	12	13	25
Narayngonj "	6	9	15
Wangail "	8	5	13
Rhulna "	3	6	9
Rohdpur "	12	15	27
Kanikgonj "	7	1	8
Comilla "	8	3	11
Norsingdi "	7	2	9
Faridpur "	8	4	12
Org. Instt. "	1	0	1
	<u>237</u>	<u>204</u>	<u>441</u>

Truck Division

Unit	Road- worthy	Awaiting rehabili- tation
Dacca	36	23
Chittagong	32	30
Rhulna	26	16
Bogra	<u>21</u>	<u>12</u>
	<u>715</u>	<u>81</u>

BANGLADESH ROAD TRANSPORT CORPORATION

Detail schedule of year-wise acquisition of vehicles
for the years 1978-85 showing the cost of bus.

SL. No.	Year	Type of vehicles Bus	Fleet position			Total No. of vehicles in fleet posi- tion at the end of the year.	Remarks
			Existing (Bench mark position)	No. of vehicles likely to be condemned.	New acqui- sition		
1	2	3	4	5	6	7	8
1	1978		500	100	140	540	
2	1979		540	110	170	600	
3	1980		600	120	220	700	
4	1981		700	25	200	875	
5	1982		875	30	250	1095	
6	1983		1095	50	325	1370	
7	1984		1370	80	460	1750	

BANGLADESH ROAD TRANSPORT CORPORATION

Detail schedule of year-wise acquisition of vehicles
for the years 1978-85 showing the cost of Truck.

SL. No.	Year	Type of vehicles	Fleet position			Total No. of vehicles in fleet position at the end of the year.	Remarks
			Existing (Bench mark position)	No. of vehicles likely to be condemned.	New acquisition		
1	2	3	4	5	6	7	8
1	1978		317	180	80	247	
2	1979		247 (787)	95 (205)	100 (270)	252 (852)	Figures in () is shown as Truck + Bus.
3	1980		252	50	110	312	
4	1981		312	30	120	402	
5	1982		402	42	125	485	
6	1983		485	55	130	560	
7	1984		560	60	140	640	

Table 5-4 Estimated Nos. of Vehicles Requiring Maintenance and Nos. of New Vehicles at the Time When CWS Operation is Commenced.

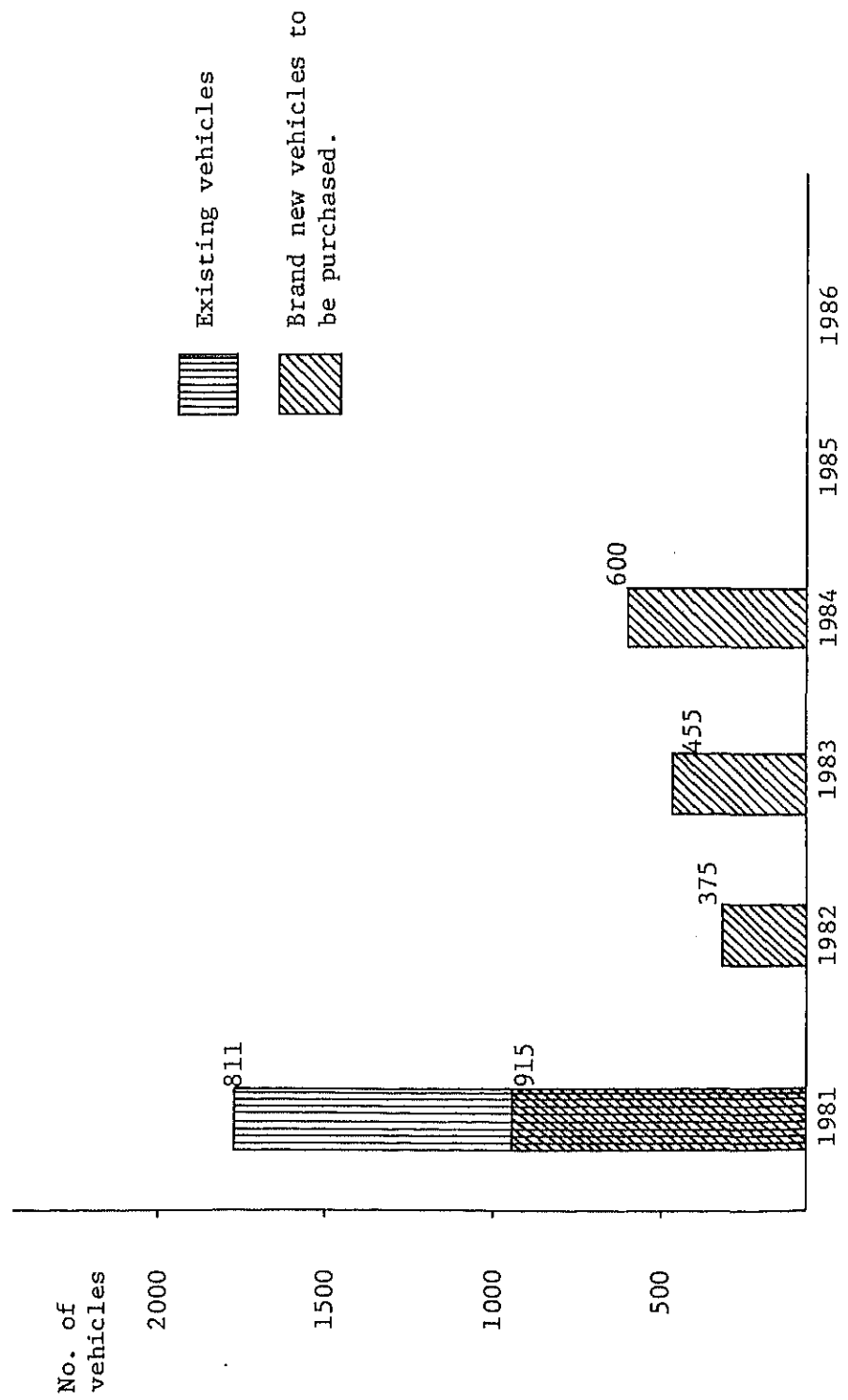


Table 5-5 Table of Heavy Maintenance Demand

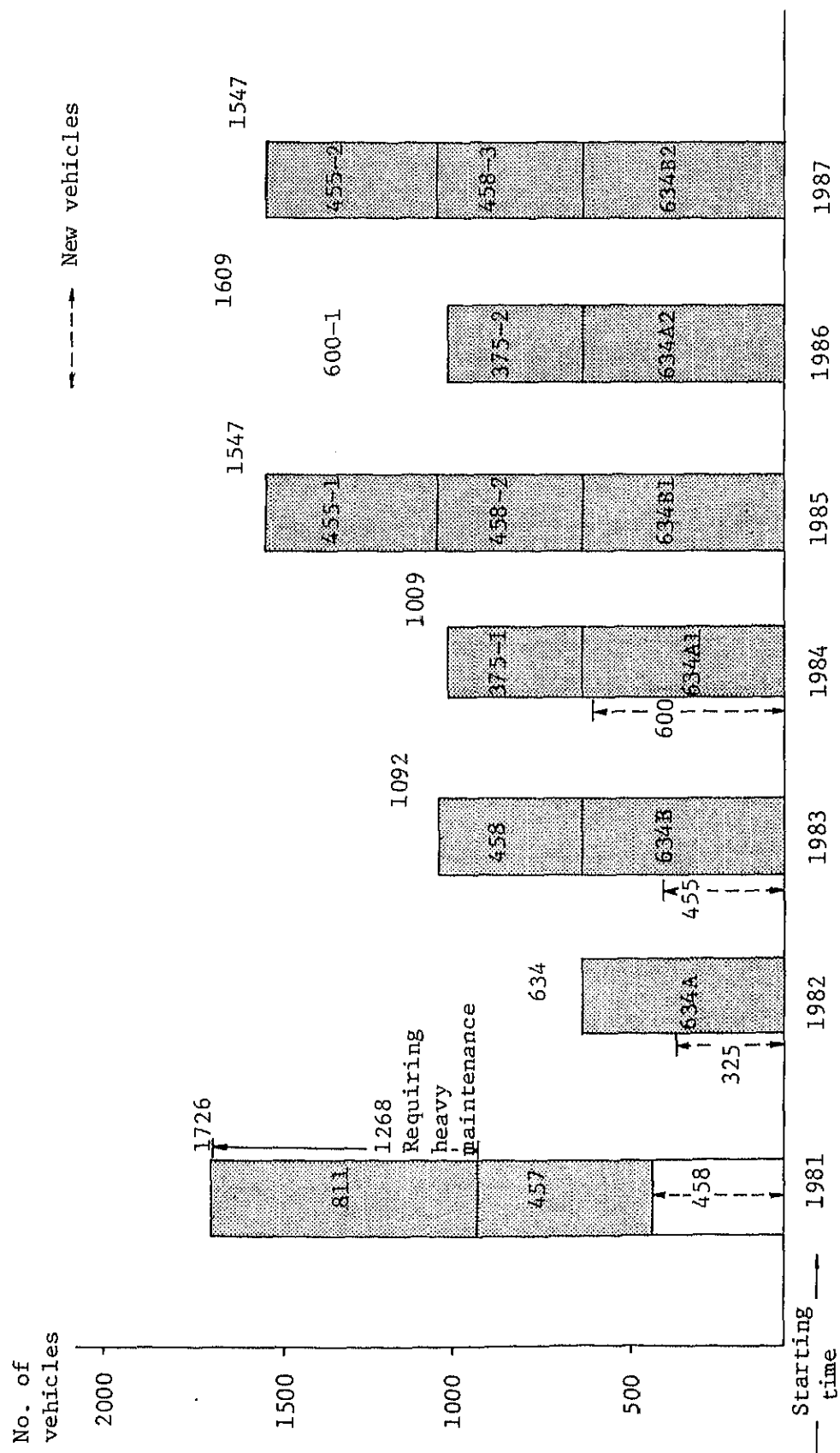
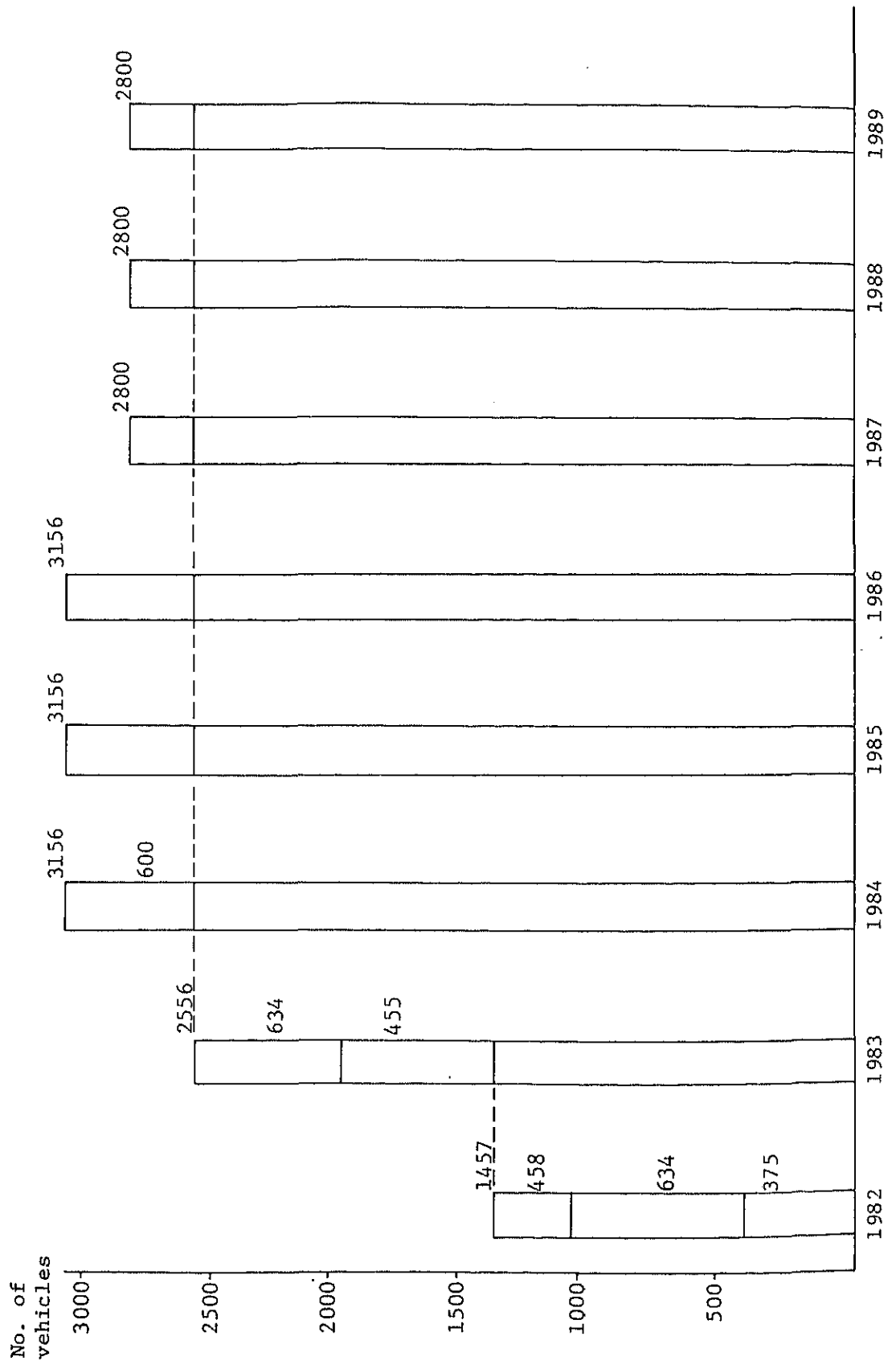


Table 5-6 Table of Periodical Maintenance Demand



- (C) The vehicles requiring heavy maintenance at the time of CWS completion are not received systemized maintenance mentioned in this report, accordingly most of these vehicles are under fatal conditions, therefore, the time required for their heavy maintenance is assumed to be double of the time required for the maintenance of vehicles with systemized maintenance.
- (D) At the point of this time, all vehicles in CWS to receive maintenance are assumed to have body repair in addition to receive scheduled maintenance.
- (E) According to BRTC, a total schedule for the buses in operation and off service has worked out as shown in Table 5-2, based on the status in 1978. This table shows that total amount of buses likely condemned during the years from 1978 to 1980 is 330 units, but half of them are feasible for being rehabilitated, because existing WS is thought to be utilized for maintenance of rather new vehicles purchased after 1978 and WS has no room to maintain those 330 units.

On the other hand, 204 units of maintenance waiting vehicles shown in Table 5-1 are feasible for being reclaimed.

The same situation of trucks is shown in Table 5-3.

However, as to the trucks to be condemned, determination has been made that such trucks have due reasons for being disused, thus they are not treated as being maintenance awaiting vehicles.

Based on the above-mentioned preconditions, estimation is made on the number of vehicles needing maintenance at the end of 1987, a formula can be obtained as below. However, Table 5-1 was utilized as an initial condition.

$$N + S + R = M + n + w$$

$$\therefore M = N - \{n + w - (R + S)\} \quad \dots\dots\dots (1)$$

$$L = n + w \quad \dots\dots\dots (2)$$

M : Nos. of vehicles necessary maintenance

n : Nos. of new vehicles purchased within
2 years (as in 1981)

w : Existing WS ability

N : Total No. of vehicles in service
(BRTC planned)

S : No. of disused vehicles x 1/2

L : Estimated Nos. of vehicles in service

R : Nos. of vehicles waiting maintenance/
repair before 1978.

From the Formulas (1) and (2):

i) Bus (See Table 5-2)

n : 220 (to be purchased in 1980) + 200 (to be
purchased in 1981) = 420

w : 200 x 0.75 = 150 (Estimated capacity of
maintenance of existing WS, since it must be
returned to the government, its capability
must be shared step by step to the vehicles
belonging to other government agency.

N : 875 (1981 plan)

S : (100 + 110 + 120) x 1/2 = 165

R : 204 (Table 5-1)

$\therefore M : 875 - \{420 + 115 - 204 - 165\} = 674$

L : 420 + 150 = 570

ii) Truck (See Table 5-3)

n : 120 + 110 = 230

w : 115 (all vehicles are assumed to being received
maintenance at private shop or Truck depot)

N : 402 (1981 plan)
 S : 0
 R : 80 (Table 5-1)
 $\therefore M = 402 - \{230 + 115 - 80\} = 137$
 L = 345

Consolidation:	Bus	Truck	Total
The number of vehicles operating during the 2nd half period of 1981 ... L	570	345	915
The number of vehicles necessary to have heavy maintenance during the 2nd half of 1981 M	674	137	811

Shown in Table 5-4 are the estimated number of vehicles to be repaired and the number of new vehicles to be replenished at a time when CWS starts its operation of 1st phase.

5-1-2 Basic Data for Economic Evaluation

- Premise 1 : The Bangladesh fiscal year system (July - June) is employed, however, for actual construction, the Japanese fiscal year system (April - March) is employed, therefore, a delay of 3 months is produced.
- Premise 2 : The Bangladesh system of economic analysis is employed.
- Premise 3 : One Lakh TAKA (100,000 Takas) system is employed as a monetary unit.
- Premise 4 : Conversion Rate of 1 Tk = 15 yen, US 1\$ = 15 Tk is employed.

A) Investment Items

1. Land

The purchase of the land shall be done by BRTC's fund and no depreciation shall be effected.

Breakdown:	Area of land	19 acres
	Cost of land	TK 9.43 Lakh
	Reclamation of land	TK 20, + 25, Lakh

2. Building

Year	1st phase	2nd phase	3rd phase	Total, Lakh TAKA
1979	990.697			990.697
1980	990.697			990.697
1981		146.533		146.533
1982		170.140		170.140
1983			193.746	193.746
	(1,981.394) A	(219.799) B	(290.618) C	2,491.813

Amount the money
to be spent

1979-year : 1st phase x 1/2

1980-year : 1st phase x 1/2

1981-year : 2nd phase x 2/3

1982-year : 2nd phase x 1/3 + 3rd phase x 1/3

1983-year : 3rd phase x 2/3

Transcription with depreciation, etc. is made on a division
basis as mentioned above.

Year	Lakh	Principal to be depreciated.	Amount of money to be depreciated at the Ratio of 2.5% of investment.
1979	990.697	990.697	
1980	990.697	1,981.394	49,535
1981	146.533	2,177.462	54,440
1982	170.140	2,402.042	60,050
1983	193,746	2,655.839	66.396

2,722.235

$$2,722.235 \div 40 = 68.056$$

Note 1 : From 1980 depreciation shall start with the rate of
2.5% until commencement of CWS operation and transfer
to the principla is effected.

Note 2 : From the time of full operation (1984), depreciation will be imposed within 40-years on a per capita basis.

3. Machinery and equipment

Year	1st phase	2nd phase	3rd phase	Lakh
1979				
1980	689.730 1st half			689.730
1981				
1982		94.011 2nd half		94.011
1983			340.743	340.743

1,124.484

Year	Lakh	Principal to be depreciated	Depreciation, 8.5%
1979			
1980	689.730		58.63
1981			
1982	94.011	842.368	71.60
1983	340.74	1,254.708	106.65

1,361.35

Note 1: From starting in 1981 till full operation of CWS, depreciation are made at the rate of 8.5% and transfer into the principal is effected.

Note 2: Commencing the time when full-operation is started (1984), depreciation is imposed within 15-years on a per capita basis (originally, duration is 12 years).

4. Others

10% of construction expenses shall be premised.

5. Interest

Machinery, Buildings and Others

Year	Total investment	Previous year's principal	Interest	Principal
1979	1,089.767			1,089.767
1980	1,779.494	1,089.767	98.079	2,967.343
1981	161.186	2,967.343	267.060	3,395.589
1982	281.165	3,395.589	305.603	3,982.357
1983	553.864	3,982.357	358.412	4,894.633/15
		Yearly return		Interest
1984	4,894.633 -	326.308 = 4,568.325		411.149
1985		" = 4,242.017		381.781
1986		" = 3,915.709		352.413
1987		" = 3,589.401		323.046
1988		" = 3,263.093		293.678
1989		" = 2,936.785		264.310
1990		" = 2,610.477		234.942
1991		" = 2,284.169		205.575
1992		" = 1,957.861		176.207
1993		" = 1,631.553		146.839
1994		" = 1,305.240		1,117.472
1995		" = 978.937		88.104
1996		" = 652.629		58.736
1997		" = <u>326.335</u>		<u>29.370</u>

Note : Until full-operation is commenced, the interest (9%) is transfered to the principal.

Consolidation

Construction Expenses (including machinery and facilities)

Year \ Item	Land	Construction expenses	Machinery and facilities	Others	Total
1976	9.430				9.430
1977					
1978	45.000				45.000
1979		990.697		99.070	1,089.767
1980		990.697	689.730	99.070	1,779.497
1981		146.533		14.653	161.186
1982		170.140	94.011	17.014	281.165
1983		193.746	340.743	19.375	553.864
	54.430	2,491.813	1,124.484	249.182	3,919.909

B) Expenses

1. Wages

1st phase

Factory	Taka	Training institute	Taka
1800	x 1 = 1800		
1700	x 1 = 1700	1700 x 1 = 1700	
1500	x 5 = 7500	1500 x 4 = 6000	
1200	x 1 = 1200		
1000	x 11 = 11000		
950	x 9 = 8550		
850	x 33 = 28050	850 x 40 = 34000	
700	x 44 = 30800		
500	x 85 = 42500		
450	x 51 = 22950		
400	x 93 = 37200		
350	x 3 = 1050		
300	x 121 = 36300		
200	x 169 = 33800		

627 264400 Taka
personnel

45 41700 Taka
personnel

2nd phase

1200	Taka	x	1	=	1200
1100		x	1	=	1100
850		x	4	=	3400
700		x	28	=	19600
500		x	2	=	1000
450		x	13	=	5850
400		x	27	=	10800
350		x	2	=	700
300		x	76	=	22800
200		x	100	=	20000

254 86450 Taka
Personnel

3rd phase

1200	Taka	x	1	=	1200
1100		x	1	=	1100
1000		x	1	=	1000
950		x	1	=	950
850		x	5	=	4250
700		x	12	=	8400
500		x	7	=	3500
450		x	11	=	4950
400		x	24	=	9600
300		x	44	=	13200
200		x	35	=	7000

142 55150 Taka
Personnel

	Personnel	Yearly Total (Taka)	
1st phase			
Factory	627	528,811.8	1,029,229.8
Training institute	45	500,418.0	
2nd phase	254	1,037,386.8	
3rd phase	142	661,799.52	
Total	1,068	2,728,416.12	

Actual payment is supposed 10% higher than expected.

Wages				Lakh
Year	1st phase (heavy maintenance)	2nd phase (Periodical maintenance)	3rd phase (Body and parts reclamation)	Total
1981	11.322			11.322
1982	11.322	5.706		17.028
1983	11.322	11.411	3.640	26.373
1984	11.322	11.411	7.280	30.373
1985	11.322	11.411	7.280	30.373
1986	11.322	11.411	7.280	30.373

Wages decided finally as shown below, after attention paid on the transition period which causes temporary increase in the mechanics, and had overtime etc.

Wages

Year	1st phase (overtime)	A	2nd phase (overtime)	B	3rd phase (overtime)	C	A+B+C
1981	11.322 x 2	22.644					Lakh 22.644
1982	11.322 x 2	22.644	5.706 x 2	11.412			34.056
1983	11.322x1.7	19.247	11.411x1.7	19.398	3.640 x 2	7.280	45.925
1984	11.322x1.7	19.247	11.411x1.3	14.834	7.280 x 2	14.560	48.641
1985	11.322x1.3	14.718	11.411x1.3	14.834	7.280 x 2	14.560	44.112
1986	11.322x1.3	14.718	11.411x1.3	14.834	7.280 x 2	14.560	44.112
1987	11.322x1.2	13.586	11.411x1.2	13.693	7.280 x 2	14.560	41.839
1988	11.322x1.2	13.586	11.411x1.2	13.693	7.280 x 2	14.560	41.839
1989	11.322x1.2	13.586	11.411x1.2	13.693	7.280 x 2	14.560	41.839

C) Sales

(1) Estimation of Sales - Plan 1

This Plan 1 is worked out based on the market price.

Year	Heavy maintenance	Periodical maintenance	Body	Tire recapping	Total
1981	634x2x(40,000 Taka +10,000 Taka) = 6,340				Lakh 634.000
1982	(634x2+458)x 50,000 Taka = 8,630	1,467x70%x7/2 x 10,000 Taka x 2 = 7,188.3			1,581.830
1983	1009 x 50,000 Taka = 5,045	2,556x70 x7/2 x 10,000 Taka = 6,262.2	384x20,000 Taka = 768	8000x1000 Taka= 800	1,287.520
1984	1,547x50,000 Taka = 7,735	3,156x70 x7/2 x1= 7,732.2	473x2= 946	8000x1000 Taka= 800	1,721.320
1985	1,609x50,000 Taka = 8,045	3,156x70 x7/2 x1=7,732.2	473x2= 946	8000x1000 Taka= 800	1,752.320
1986	1,547x50,000 Taka =7,735	3,156x70 x7/2 x1=7,732.2	473x2= 946	8000x1000 Taka= 800	1,721.320
1987	1,400x50,000 Taka =7,000	2,800x70 x7/2 x1=6,860	473x2= 946	8000x1000 Taka= 800	1,560.600
1988	1,400x50,000 Taka	2,800x70 7/2 x1	473x2= 946	8000x1000 Taka= 800	1,560.600
1989	1,400x50,000 Taka	2,800x70 x7/2 x1	473x2= 946	8000x1000 Taka= 800	1,560.600

Plan 2 (20% less than the market price) Unit: Lakh

1981	634.000	507.200
1982	1,581.830	1,265.464
1983	1,287.520	1,030.016
1984	1,721.320	1,377.056
1985	1,752.320	1,401.856
1986	1,721.320	1,377.056
1987	1,560.600	1,248.480
1988	1,560.600	1,248.480
1989	1,560.600	1,248.480

Note 1: Market price in Dacca

Engine overhaul	40,000 Taka
Periodical maintenance	10,000 Taka
Body	20,000 Taka
Tire recapping	1,000 Taka/one tire

Note 2: For 15 years after commencement of full-operation, there are no changes in sales amounts.

Note 3: In years when demand increases, operation shall be accomplished on a 1.5 to 2 shift basis.

(2) Parts

Year	Heavy maintenance	Periodical maintenance	Body	Tire declamation	Total (Lakh)	
1981	634 x 15,000 Taka=95,100				95.100	76.080
1982	1,092x15,000 Taka= 163,800	3,594x4,000 Taka= 143,760			307.560	246.048
1983	1,009x15,000 Taka= 151,350	6,262x4,000 Taka= 250,480	384x1,000 Taka= 3,840	8,000x37 Taka=2,960	408.630	326.904
1984	1,547x15,000 Taka= 232,050	7,732x4,000 Taka= 309,280	473x1,000 Taka= 4,730	8,000x37 Taka=2,960	549.020	439.216
1985	1,609x15,000 Taka= 241,350	7,732x4,000 Taka= 309,280	473x1,000 Taka= 4,730	8,000x37 Taka=2,960	558.320	446.656
1986	1,547x15,000 Taka=232,050	7,732x4,000 Taka= 309,280	473x1,000 Taka= 4,730	8,000x37 Taka=2,960	549.020	439.216
1987	1,400x15,000 Taka=210,000	6,860x4,000 Taka= 274,400	473x1,000 Taka=4,730	8,000x37 Taka=2,960	492.090	393.672
1988	1,400x15,000 Taka=210,000	6,860x4,000 Taka= 274,400	473x1,000 Taka=4,730	8,000x37 Taka=2,960	492.090	393.672
1989	1,400x15,000 Taka=210,000	6,860x4,000 Taka= 274,400	374x1,000 Taka=4,730	8,000x37 Taka=2,960	492.090	393.672

Note 1: As components, parts, like electric equipment, injection pumps, tires, etc. can be rehabilitated, therefore, manhours was chiefly taken up.

Note 2: The curtailment of the expense for parts through rehabilitation ability is estimated by 20% against ordinary expense.

D) Others

Year	Lighting, heating, communication and printing expenses	Repair expenses	Uniform expenses	Training expenses	Total
	Lakh	Lakh	Lakh	Lakh	Lakh
1981	2.264		1.257	0.400	3.921
1982	2.835		0.508	0.400	3.741
1983	2.747			0.400	3.147
1984	4.012	49.840	0.284	0.400	54.536
1985	3.560	49.840		0.400	53.800
1986	3.560	49.840		0.400	53.800
Note	10% of wages	1. After full-operation (1984) 2. 2% of construction expenses (TK 2491.813 Lakh)	1. Shall be given in the 1st year only. 2. Training Institute is excluded. 3. 200 Taka per trainee	1. 500 Taka yearly per trainee	

E) Depreciation

Year	Building	Machinery
	Lakh	Lakh
1980	49.535	58.630
1981	54.440	
1982	60.050	71.600
1983	66.396	106.650
1984	68.056	
	Continued	Continued

Production expenses, Total

Year	Wages	Parts		Depreciation		Interest	Total (Lakh)
				Building	Machinery		
1981	22.644	76.080	3.921	49.535	58.630		210.810
1982	34.056	246.048	3.741	54.440			338.285
1983	45.925	326.904	3.147	60.050	71.600		507.626
1984	48.641	439.216	54.536	66.396	106.650	411.149	1,126.588
1985	44.112	446.656	53.800	68.056	106.650	381.781	1,101.055
1986	44.112	439.216	53.800	68.056	106.650	352.413	1,064.247
1987	41.839	393.672	53.800	68.056	106.650	323.046	987.063
1988	41.839	393.672	53.800	68.056	106.650	293.678	957.695
1989	41.839	393.672	53.800	68.056	106.650	264.310	928.327
1990	41.839	393.672	53.800	68.056	106.650	234.942	898.959
1991	41.839	393.672	53.800	68.056	106.650	205.575	869.592
1992	41.839	393.672	53.800	68.056	106.650	176.207	840.224
1993	41.839	393.672	53.800	68.056	106.650	146.839	810.856
1994	41.839	393.672	53.800	68.056	106.650	117.472	781.489
1995	41.839	393.672	53.800	68.056	106.650	88.104	752.121
1996	41.839	393.672	53.800	68.056	106.650	58.736	722.753
1997	41.839	393.672	53.800	68.056	106.650	29.370	693.387
1998	41.839	393.672	53.800	68.056	106.650	0	664.017

Asumption Table of yearly profit

Lakh

Year	Sales		Production cost	Profit	
	Plan 1 (A)	Plan 2 (B)		(A) - (C)	(B) - (C)
1981	634.000	507.200	210.810	126.800	296.390
1982	1,581.830	1,265.464	338.285	1,243.545	924.179
1983	1,287.520	1,030.016	507.626	779.894	522.390
1984	1,721.320	1,377.056	1,126.588	594.732	250.468
1985	1,752.320	1,401.856	1,101.055	651.265	300.801
1986	1,560.600	1,337.056	1,064.247	496.353	272.809
1987	1,560.600	1,248.480	987.063	573.537	261.417
1988	1,560.600	1,248.480	957.695	602.905	290.785
1989	1,560.600	1,248.480	928.327	632.273	320.153
1990	1,560.600	1,248.480	898.959	661.641	349.521
1991	1,560.600	1,248.480	869.592	691.008	378.888
1992	1,560.600	1,248.480	840.224	720.376	408.256
1993	1,560.600	1,248.480	810.856	749.744	437.624
1994	1,560.600	1,248.480	781.489	779.111	466.991
1995	1,560.600	1,248.480	752.121	808.479	496.359
1996	1,560.600	1,248.480	722.753	837.847	525.727
1997	1,560.600	1,248.480	693.387	867.213	555.093
1998	1,560.600	1,248.480	664.017	896.583	584.463

Table of Present value of profit adjusted by 15% and 24%
forward rate, Based on Plan I.

Lakh

Year	Deprecia- tion + interest	Profit	Total	Present value of profit (15%)		Present value of profit (24%)	
1981	108.165	126.800	234.965	0.750	176.223	0.650	152.727
1982	54.440	1,243.545	1,297.985	0.675	876.139	0.534	693.123
1983	131.650	779.894	911.544	0.592	539.634	0.423	385.583
1984	584.195	594.732	1,178.927	0.513	609.789	0.341	402.014
1985	556.481	651.265	1,207.752	0.432	521.748	0.275	332.131
1986	527.119	496.353	1,023.472	0.376	384.825	0.222	227.210
1987	497.752	573.537	1,071.289	0.337	361.024	0.170	182.119
1988	468.384	602.905	1,071.289	0.284	309.246	0.141	151.051
1989	439.016	632.273	1,071.29	0.247	264.608	0.116	124.269
1990	409.648	661.641	1,071.289	0.215	230.327	0.094	100.701
1991	380.281	691.008	"	0.187	200.331	0.076	81.417
1992	350.913	720.376	"	0.163	174.620	0.061	65.348
1993	321.545	749.744	"	0.141	151.051	0.049	52.493
1994	292.178	779.111	"	0.123	131.768	0.040	42.851
1995	262.810	808.479	"	0.107	114.627	0.032	34.281
1996	233.442	837.847	"	0.093	99.629	0.026	27.853
1997	204.076	867.213	"	0.081	86.774	0.021	22.497
1998	174.616	896.583	"	0.076	81.411	0.017	18.210

5,303.774

3,095.878

Table of present value of profit adjusted by 15% and 24%
forward rate, Based on plan 2.

Lakh							
Year	Deprecia- tion + interest	Profit	Total	Present value of profit (15%)		Present value of profit (24%)	
1981	108.165	296.390	404.555	0.750	303.416	0.650	262.960
1982	54.440	927.179	981.619	0.675	662.592	0.534	524.184
1983	131.650	522.390	654.04	0.592	387.191	0.423	276.658
1984	584.195	250.468	834.663	0.513	428.182	0.341	284.620
1985	556.481	300.801	857.288	0.432	370.348	0.275	235.754
1986	527.119	272.809	799.928	0.376	300.772	0.222	177.584
1987	497.752	261.417	759.169	0.337	255.839	0.170	139.058
1988	468.384	290.785	759.169	0.284	215.603	0.141	107.042
1989	439.016	320.153	759.169	0.247	187.514	0.116	88.063
1990	409.648	349.521	759.169	0.215	163.221	0.094	71.361
1991	380.281	378.888	759.169	0.187	141.964	0.076	57.696
1992	350.913	408.256	759.169	0.163	123.744	0.061	46.309
1993	321.545	437.624	"	0.141	107.042	0.049	37.199
1994	292.178	466.991	"	0.123	93.377	0.040	30.366
1995	262.810	496.359	"	0.107	81.231	0.032	24.293
1996	233.442	525.727	"	0.093	70.602	0.026	19.738
1997	204.076	555.073	"	0.081	61.492	0.021	15.942
1998	174.616	584.466	"	0.076	57.690	0.017	12.904

4,011.82

2,401.731

Present value of construction expenses (lands are excluded)

Lakh

Year		15% forward rate		24%	
1979	1,089.767	1.000	1,089.767	1.000	1,089.767
1980	1,779.497	0.890	1,548.162	0.806	1,434.274
1981	161.186	0.756	121.856	0.650	104.770
1982	281.165	0.675	189.786	0.534	150.142
1983	553.864	0.592	327.887	0.423	234.284
		3,277.458		3,013.237	

Plan 1

$$15\% \quad \frac{5,303.774}{3,277.458} \times 100 = 162 \%$$

$$24\% \quad \frac{3,095.878}{3,013.237} \times 100 = 103 \%$$

Plan 2

$$15\% \quad \frac{4,011.82}{3,277.458} \times 100 = 122 \%$$

$$24\% \quad \frac{2,401.731}{3,013.237} \times 100 = 80 \%$$

