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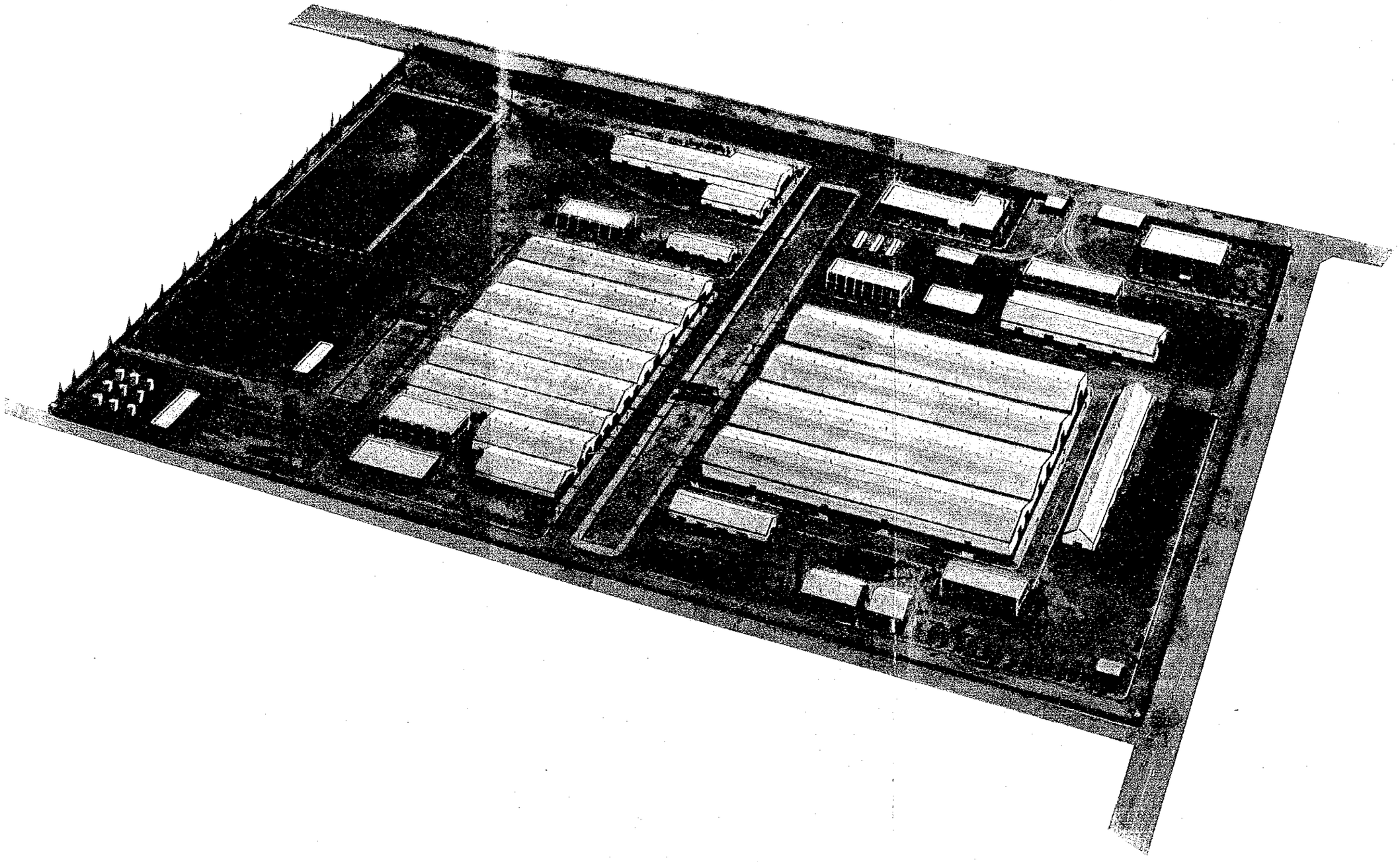
THE PEOPLE'S REPUBLIC OF BANGLADESH

REPORT OF FEASIBILITY STUDY ON ESTABLISHMENT OF RAILWAY CARRIAGE AND WAGON MANUFACTURING PLANT SUMMARY

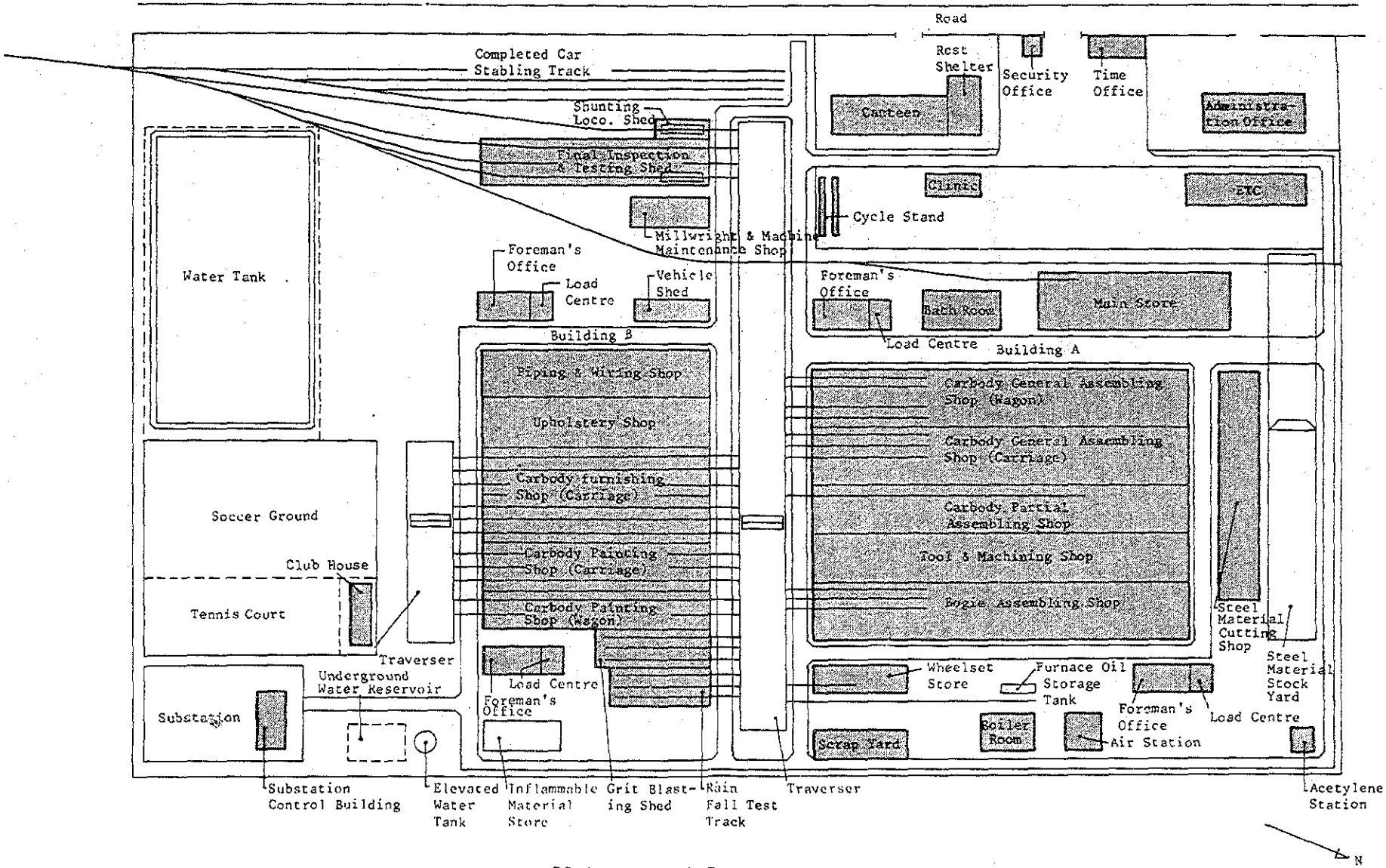
NOVEMBER 1985

JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)



BIRD'S EYE VIEW OF CARRIAGE

AND WAGON MANUFACTURING PLANT



Overall Layout of Factory

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1. BACKGROUND OF THE PROJECT

Since railway transport plays an important role in thriving a national economy and uplifting round the country, the Government of Bangladesh decided to improve its railway traffic capacity. The present state of said capacity cannot be characterized as efficient or adequate. One of the traffic difficulties, which has been a primary cause of inadequate service is a shortage of rolling stock. To alleviate the shortage, and to achieve the self-sufficiency of rolling stock, the Government of Bangladesh has planned to establish a carriage and wagon manufacturing plant. This plant will not only furnish rolling stock, but also contribute to regional development and technological progress. Given these circumstances, and in response to a request from the Government of Bangladesh, a Feasibility Study for this Project is conducted by the Japan International Cooperation Agency, the official agency responsible for the implementation of the technical cooperation programmes of the Government of Japan.

Based on investigative data obtained during three fortnights stay in Bangladesh, and after a thorough scrutiny of the Interim Report and the Draft Final Report, the Study Team completed the Final Report in November 1985, approximately one year after the commencement of the Study. The report depicts the feasibility of the Project using economical and financial analyses.

2. SOCIO-ECONOMIC FRAMEWORK AND DEMAND FORECAST

(1) Socio-economic framework

1) Analyses of present condition

The growth of population in Bangladesh (which had a population of about 87 million in 1981) showed an annual increase of 2.3% in 1982. The ratio of urban population to total population reached 15% and will continue to increase every year.

2) Economic growth in Bangladesh (which had a GNP of about 310 million Taka in 1984) showed an average annual increase of 3.7% over the last 6 years. The shares of industrial classification in 1984 were 46% in primary industries (agriculture), 16% in secondary industries and 38% in tertiary industries.

3) Socio-economic plan

The fundamental socio-economic policies in Bangladesh have been published in the Third Five-Year Plan (TFYP) as a draft guideline. The objectives of the TFYP focus on decentralization of administrative organizations and improvement of their quality for the construction of a new nation.

In order to achieve the above objectives some new policies have been established. This survey of demand forecast was performed on the basis of the TFYP.

4) Target years of demand forecast

The target years for the future socio-economic framework and traffic demand forecast have been established as 1992 and 2020.

5) Population frame

Future population, has been forecast by the Study Team using the investigated growth rate, as follows:

1981 (actual) : 87.12 million people
2020 (assumption): 154.2 "

The above population is assumed on the basis of the future regional population in each district and also the future urban population in each district.

6) Economic frame

The future economic growth of Bangladesh is estimated at an annual increase of 4% based on past records. According to the estimation, the future economic scale is assumed (with 1982 prices) to be the following:

	1982 (actual)	1992 (assumption)	2020 (assumption)
GNP	256,947 mil. Taka	380,300 mil. Taka	1,140,000 mil. Taka
GDP	264,994 "	390,600 "	1,176,000 "
INDEX	100	147	444

Future GDP in each industrial classification, future agricultural yields in each district and future outputs in each manufacturing classification are assumed on the basis of the above economic frame.

(2) Traffic demand forecast

1) Present situation

The number of railway passengers has been increasing over a long period of time. An average of 290,000 passengers per day in 1983 were transported. This number of passengers showed an increase of 17% over the previous year. On the other hand, railway

freight has remained at the same level. Due to an increase of road freight transportation in Bangladesh, railway freight tends to decrease in relation to all other freight transportation modes.

2) Forecast procedure

The passenger traffic forecast is assumed in proportion to the population in each district i.e. zone of the country using the gravity model method.

Freight traffic volume is assumed in proportion to the amounts of agricultural yields, manufacturing production, export and import freights.

Future forecasts are induced by the increase in population and the concentration tendency (towards urban area) for passenger traffic, and by the increase in the GNP's economic scale for freight traffic.

The ratio of railway transport to other systems' transport is estimated from past statistics and the present trend.

3) Forecast result

The calculated volumes for the present year, 1992 (plant operation start) and 2020 (end of the Project) are as follows.

	Present	1991/1992	2019/2020
Passengers (per day)	265,371	594,881	835,514
index	1.00	2.25	3.15
Freight (tons per day)	37,355	46,714	82,828
index	1.00	1.20	2.13

3. RAIL TRANSPORTATION PLAN

To ensure that the transportation plan satisfies the future traffic demand, the following items related to train operation were studied and forecasted.

(1) Operating speeds

It was assumed that the maximum operating speeds could be increased as shown in the Maximum Operating Speeds of Trains.

Maximum Operating Speeds of Trains

(Unit: km/h)

Item / Year	MG		BG	
	Passenger train	Goods train	Passenger train	Goods train
1982	72	32	80	32
1992	72	32	80	32
2020	90	60	120	60

(2) Number of trains

If the capacity of intercity transport is increased with increases in traffic demand and the loading factor in MG section is reduced from 100% to 85% by 2020, the number of trains required are as shown in the Planned Number of Trains.

Planned Number of Trains

(Unit: trains/day)

Gauge	1982	1992	2020
BG	91	102	122
MG	279	350	420

(3) Rolling stock required

The required rolling stock was estimated for passenger trains considering traffic demand, loading factor, day-car kilometer and car idling ratio, and for goods trains considering traffic demand and car idling ratio. The results are summarized in the Required Number of Rolling Stock.

Required Number of Rolling Stock

Type	Gauge	1982	1992	2020
Carriages	BG	366	734	894
	MG	1,274	2,320	2,996
	Total	1,640	3,054	3,890
Wagons	BG	5,116	5,716	8,073
	MG	15,406	18,784	27,707
	Total	20,522	24,500	35,780

4. ROLLING STOCK CONSTRUCTION PLAN

(1) Rolling stock inventory

As of June 30, 1983, BR owned 1,640 carriages (MG + BG) and 20,522 wagons (MG + BG) which are used in diesel locomotive hauled trains.

Their physical conditions are generally not good; some are deteriorated badly due to body corrosion, and 148 carriages and 950 wagons have passed the economic life.

(2) The number of rolling stock to be constructed

The number of rolling stock to be constructed can be determined by summing the number of additional rolling

stock required to satisfy future traffic demand estimated in Chapter 3 and the number of old rolling stock which will be replaced. The number of rolling stock to be replaced was determined based on their economic life, 35 years for carriages and 45 years for wagons, with adjustment to maintain the annual construction at a constant rate.

As a result, it is estimated that 120 carriages and 900 wagons will be constructed annually.

(3) Types of rolling stock to be constructed

At present, BR owns a wide variety of rolling stock. New rolling stock to be constructed should be standardized as far as possible for parts interchangeability and ease of procurement. As for carriages, Third class accounting for half of the carriages currently owned by BR), Second class and Third class with luggage and brake van will be standardized through new construction. As for wagons, Covered wagons (accounting for most of the wagons currently owned by BR), Open wagons and Flat wagons will also be standardized.

These carriages and wagons will be designed with improved running and braking performances to withstand high-speed operation. It should be noted, however, that proper operation and maintenance of the brake system are essential in achieving the desired speed (some of the existing rolling stock are not in condition of proper operation and maintenance of their brake systems).

Maximum operating speeds of the new rolling stock are as follows:

Maximum Operating Speeds

(km/h)

Carriage	MG	90
	BG	120
Wagon	MG	60
	BG	60

5. PRODUCTION PLANNING

(1) Plant scale

The recommended scheme of manufacture in the proposed project is to establish an integrated plant, comprising the full-scale installations for producing carriages and wagons, and its auxiliary facilities. Merits of the integrated plant yield a lower plant cost and a lower fixed cost of production for the proposed scheme than the scheme for two separate plants. The plant should not be split to achieve feasibility.

(2) Precondition for production capacity

It is presumed that the number of rolling stock to be produced in this plant is as follows:

Carriages: 120 cars/year
Wagons : 900 units/year

Both carriages and wagons are to be manufactured for BG and MG at the rate of 25 to 75.

(3) Standard production process

In general, a standard production process is designed taking into consideration production technology level as well as facilities, equipment and jigs. The standard

processes take 110 days for carriage and 70 days for wagon.

(4) Phased transition of production scale

For a large-scale carriage and wagon manufacturing plant such as proposed, immediately full-scale production should not be attempted for reasons mentioned below. It will take a long time to acquire a considerable number of qualified engineers and skilled workers required for the manufacture of carriages and wagons. Moreover a phased investment in facilities and equipment is advisable from the view point of investment efficiency. Consequently the percentage of production should be allowed to grow gradually. To establish modernized efficient production system, domestic production should be started with a Semi-Knocked Down (SKD) phase then progressed to Complete Knocked Down (CKD) and Raw Material (RM) phases as the technical level rises.

(5) Domestic production plan

Other principal industrial concerns in Bangladesh are all semi-governmental. Bangladesh Steel and Engineering Corporation is considered to be closely concerned with the production of carriages and wagons. Utilization of domestically produced materials and parts is introduced in this Report. The domestic production plan is broadly classified into two categories; the whole car body without bogies and with the bogies. The former is to be accomplished in the last year of Phase II for the total number of carriages and wagons produced annually; the latter is to be accomplished in the last year of Phase III for the bogies.

6. CONSTRUCTION PLAN

(1) Site selection

The proposed plant sites to be investigated are stipulated in the Scope of Work agreed upon between MOC and JICA, that is for the new plant, Kumira to the north of Chittagong City and Parbatipur in Dinajpur District, and for the expansion of the existing Workshop, Saidpur. The proposed sites are evaluated from the viewpoint of land conditions such as area, earth bearing force and embankment; utility resources including water supply; cost estimation; transport of procurement and product; recruitment; introduction of up-dated system; and effect on up-lift plan.

Judging from a technical and quantitative comparison in cost obtained through the investigation, the Study Team recommended the Parbatipur site, Parbatipur South site in particular, as the most appropriate site for this Project. After the acknowledgement by MOC, this selectd site will be studied further.

(2) Plant construction

1) Site preparation

The site is roughly square, 800 m east-west and 850 m north-south, having an area of some 680,000 m2. It is adjacent to Parbatipur station to facilitate the construction of tracks to the plant.

The plant site will be located on the station side (380 m × 630 m) with the colony on its east side (200,000 m^2).

Since the flood level at the site is 109.5 m above sea level according to level survey maps, an average filling of 1.5 m is required.

2) Building plans

The general layout of the main building and related facilities is shown on page S-1.

Assembly work is accommodated in Building A and upholstering/Furnishing work in Building B. In addition, an administration building, supplemental work buildings, power supply facilities, warehouses, a site office, welfare facilities and so on will be planned.

3) Machinery plan

Principal equipment and machines for manufacturing are as follows:

- Machines for cutting, forming and processing steel materials
- Welding jigs for partially assembling car bodies
- Equipment for machining bodies
- Equipment for surface-treating steel plates
- Inspection and testing facilities
- Equipment and machines for maintenance, repair, material handling and transportation

4) Electrical installation

Substations, load centres, emergency standby generators, such communication equipment as a telephone system and fire alarm system are installed in the plant.

5) Utilities

Water supply facilities will consist of a deep well, an underground water tank, a temporary water storage tank and an elevated water tank.

(3) Construction schedule

1) Project schedule

The following shows the date of each project stage.

October	1985	Submission of Fianl Report by JICA
September	1987	Tender Notice
March	1988	Tender Close
July	1988	Site Preparation
September	1988	Selection of Contractor
January	1989	Start of Construction (for Phase I)
July	1992	Commencement of Commercial Operation

2) Construction schedule

For Phase I, production facilities will be constructed by the end of 1991, and housing by the end of 1990 for the training at the site beforehand.

For Phase II, the housing will be constructed by the end of 1993.

For Phase III, the remaining portion of plant and housing will be constructed by the end of 1996.

(4) Construction cost

The construction cost is estimated as follows.

Site preparation	1,121.7 LAKH Taka
Plant direct cost	11,209.7
Housing colony	3,746.7
Total	16,078.1

7. STAFFING AND PLANT ORGANIZATION

(1) Organization

The plant will be organized into three assistant managers and 12 sections, which are supervised by a plant manager. The plant manager will be responsible for financial, technical and personnel aspects of plant operation.

The production line wil be divided into nine sections, which are operated under the foremen. The foremen will be directly supervised by a production manager.

Material procurement/control, production facility maintenance and power supply will be supervised by managers.

The training centre manager will be responsible for education and training.

(2) Staffing

Total number of plant workers is estimated to be 1,500 in the initial stage of operation, 3,200 in Phase II and 4,000 in Phase III. Required workers for the plant will be transferred mainly Saidpur Workshop, along with new employment.

(3) Education and training

A specialized training centre will be established in the plant to provide education and training on management and technical skills required to operate the plant.

Education and training related to the Project are as follows:

1) Education and training in foreign country(ies).

   ° Instructors

2) Education and training at the training centre

- Engineers and administrative staffs
- Technicians
- Education for new employees

New employees will be assigned to BR Workshops during the initial stage of operation

3) The number of instructors and trainees

The number of trainees sent to foreign country(ies) is 90.

In the initial stage of operation, 30 instructors will be sent from foreign country(ies) for instruction.

(4) Other related items

To minimize adverse effects of job transfer, the basic cycle of personnel change will be extended from the present 2 to 3 years to 6 to 10 years, with measures to promote efficiency of plant operation.

In addition to all engineers and administrative staff, 30% of workers will be assigned to colony housing.

8. PROJECT COST ESTIMATES & FINANCING PLAN

(1) Major assumptions in estimating project cost

In estimating the project cost of the railway carriage and wagon manufacturing plant, the followings are assumed as the base conditions:

o Project implementation schedule

Commencement of consulting service	Jan. 1, 1986
Tender close for construction contract	Mar. 31, 1988
Commencement of site preparation	Jul. 1, 1988

Start of construction Jan. 1, 1989
Commencement of commercial operation Jul. 1, 1992

o Project life

33 years from commencement of construction work

o Foreign exchange rate (as of the end of Dec. 1984)

$1 U.S. = 26.0 Bangladesh Taka
= 251.4 Japanese Yen

o Shadow exchange rate used for defining economic prices

$1 U.S. = 29.5 Bangladesh Taka (Import Permit Rate)
= 251.4 Japanese Yen

o Price escalation factor for escalated project cost estimation

Foreign currency: 4% per annum
Local currency : 11% per annum

However, economic and financial evaluation are made on a constant term basis.

o Base date for project cost estimation

End of December 1984

o Taxes and duties

32% tax and duty, (compounded from 10% sales tax and 20% import duty), for imported materials.

Corporate tax: Exempted from tax on project profits.

(2) Project cost estimate

The project cost is estimated in accordance with the following cost items.

A. Land Acquisition and Site Preparation
B. Plant Direct Costs
C. Services
D. Consulting and Technology Transfer
E. Pre-operational Expenses
F. Initial Working Capital

The total estimate amounts to 31,711.4 Taka in Lakh, including physical contingency and duty for imported materials.

(3) Financing plan

- o Estimate to be 51.5 percent foreign loans and 48.5 percent equity in local currency, which cover the foreign and local portions of the project cost, respectively.
- o Long-term foreign loans are assumed to be at an interest rate of 1.25 percent per annum, with 20-year repayment in equal installments (after a 10-year grace period).

(4) Production, inventory and revenue schedule

- o A 12-month inventory of production materials is assumed.
- o Selling prices are assumed to be 68.27 Taka in Lakh for each carriage, and 10.65 Taka in Lakh for each wagon. Economic prices of these "without" project are estimated to be 58.93 Taka in Lakh and 9.20 Taka in Lakh, respectively.
- o Variable costs are estimated in accordance with the progress of the phased manufacturing.
  Fixed costs are estimated from labour costs, overhead and maintenance costs.

9. ECONOMIC ANALYSIS

(1) With/without project definition

"With" project is defined as the execution of the envisaged project for railway carriage and wagon manufacturing, "Without" project is the importing of carriages and wagons of quantity and quality identical to those to be manufactured "With" project.

(2) Economic internal rate of return (EIRR)

The EIRR determined by economic cost comparison between the "With" and "Without" cases is 9.42%.

(3) Foreign exchange savings

To review the effect of expected foreign currency savings by this project, the total balance of foreign exchange outflow-inflow is analysed.

(4) Other non-quantitative benefits

o Creation of employment opportunities

Employment opportunities will be created during plant construction and operation.

Permanent employment is expected to be approximately 1800 in Phase I of the operation; 3500 in Phase II; and 4000 in Phase III.

o Contribution to regional development

Investment in, and operation of, this project will cause regional development (including employment of local manpower, various commercial activities, public investments, education and so forth).

o Industrial technology transfer

This project's investment and operation will contribute to the transfer of related industrial technologies. Those technologies will include all the aspects of railway carriage and wagon that are scheduled to be improved through the phased production programme. Bangladesh Railway will achieve high competence in resolving carriage and wagon maintenance problems by enhancing its maintenance skills and by manufacturing maintenance spare parts.

o Impacts on other industries

This project's investment and operation will impact other industrial sectors including materials and components manufacturing, maintenance service and supplies, transportation of supplies, industrial construction, and supplies of other local equipment and materials.

10. FINANCIAL ANALYSIS

(1) The financial internal rate of return (FIRR) is estimated at 10.01% for the case in which the 32% tax-and-duty is imposed on all imported materials for the construction of the projected plant, and at 10.65 percent for the case in which the above mentioned tax-and-duty is exempted.

(2) Financial indicators are calculated and proved to be reasonable with provisions of working capital for the initial stage and with maintaining the inventory at a reasonable level.

11. COMPREHENSIVE EVALUATION

Judging from the result of the economic and financial analyses in addition to the technical assessment, the envisaged project is concluded to be worthy of implementation.

Thereat it must be noted that the project incorporates so many significant economic benefits such as regional development and self-sufficiency of rolling stock beside that which is presented by quantitative methods.