4.3 Liability Insurance for the Container Terminal

4.3.1 Concept

Generally speaking, container insurance is a type of blanket insurance consisting of the three undermentioned insurance policies:

(1) Container Itself Insurance

"All Risks" insurance in respect of or loss of damage to container itself and handling equipment owned or operated by the member.

(2) Container Owner's Third Party Liability Insurance

Insurance against liability to third parties.

(3) Container Operator's Cargo Indemnity Insurance

Insurance in respect of liability for loss of or damage to cargo.

This insurance indemnifies the insured party such as container owners or container operators.

However, in a vast container terminal, it is possible for the terminal owners or operators to damage a third party's personnel and property due to accident such as mishandling of cargo handling machines, collapse of stacked containers, etc.

As this kind of damage can easily be very costly, it is necessary for the terminal owners or operators to arrange for third-party liability insurance to protect themselves from liability.

This insurance should indemnify the insured (container terminal operators) against legal liability for damage in terms of bodily injury or to property of any third party due to accidents arising from structural and management defect of the facilities or from faults during execution of their business such as manufacturing, sales, service, etc., carried out outside/inside of the premises.

4.3.2 Container Terminal Owner's Third Party Liability Insurance

Container terminal owners or operators (hereinafter called "the Insured") are indemnified by an insurance company (hereinafter called "the Insurer") by making a contract for a general liability insurance policy with special conditions for premises owners & tenants liability.

(A) General Condition of General Liability Insurance

Article 1. Liability of the Insurer

The Insurer, subject to the terms, conditions and exclusions hereinafter contained, indemnifies the Insured against losses arising out of assuming legal liability for damage because of bodily injury (including death resulting therefrom) sustained by any third party or loss, damage or destruction of any third party's property (hereinafter referred to as "loss"), due to an accident as specified in the Special Conditions (hereinafter referred to as "the accident").

Article 2. Indemnification and Limit of Liability of the Insurer

The indemnification by the Insurer is made only for damages which the Insured is legally obligated to pay to the injured party after deducting the sum for which the Insured may be subrogated by the compensation, and for expense(s) specified in Article 11.

The Insurer indemnifies the Insured, within a limit of liability provided for in the policy, only for such portion of the amount of loss as exceeds the deductible specified in the policy for any one accident save the expense(s), as referred to in paragraphs 2 and 3 of Article 11.

Article 3. Period of Insurance

The period of insurance commences at 4 o'clock in the afternoon of the first day (unless otherwise stated in the policy) and terminates at 4 o'clock in the afternoon of the last day of the period of insurance.

The Insurer shall not indemnify the Insured for any loss arising out of the accident that may occur before payment of the premium.

Article 4. Exclusions - Part 1

The Insurance afforded under this policy does not apply to any loss arising out of the Insured' assuming directly or indirectly:

(1) liability due to willful misconduct of the Insured and/or the person who effects the insurance,

(2) liability arising out of war (whether declared or not), insurrection, civil commotion, riot or labour disturbances,

(3) liability arising out of earthquake, volcanic eruption, flood, tidal wave or any other natural phenomena of like kind, or

(4) liability towards any member of the family with whom the Insured resides.

Article 5. Exclusions - Part 2

The insurance afforded under this policy does not apply unless otherwise specially agreed, to any loss arising out of the Insured's assuming directly or indirectly:

(1) liability for bodily injury (including death resulting therefrom) sustained by any of the employees of the Insured while being in the course of employment,

(2) liability towards any person having the lawful right to the property owned by, used by or in the care, custody and control of the Insured, because of loss, damage or destruction of such property,

(3) liability aggravated by any agreement or contract on liability concluded between the Insured and other person, or

(4) liability imposed in connection with drainage or ventilation (including smoke).

Article 11. Expenses

The Insurer reimburses the Insured the expense(s) which the person who effects the insurance or the Insured incurred:

(1) necessarily and effectively for taking procedure of action as referred to in item 3 of paragraph 1 of Article 9 (the Insured must take all necessary procedure for preserving or exercising the right of recourse against the third person or any other action necessary to prevent or mitigate further loss):

(2) for taking such emergency action as first-aid medical treatment, escort to a hospital and any other expense(s) paid with written consent of the Insurer, out of the expenses incurred necessarily and effectively by the Insured in taking action of preventing or mitigating loss upon occurrence of the accident, in the event it has been decided afterwards that the Insured is free from any liability for such an occurrence.

2. The Insurer reimburses the Insured the expense(s) incurred by the Insured with the written consent of the Insurer in connection with litigation concerning the liability of the Insured, provided, however, that in cases where the amount of loss except the expenses mentioned in this article exceeds the Limit of Liability of the Insurer, the Insurer

reimburses the Insured the expense(s) in such a proportion as the Limit of Liability of the Insurer bears to such amount of loss.

3. The Insurer reimburses the Insured the expense(s) incurred by the Insured in making cooperation required by the Insurer.

(B) Special Condition for Premises Owners & Tenants Liability

Article 1.

The "accident" as termed in Article 1 of General Conditions of General Liability Insurance means in these Special Conditions any such accident as may occur while the insured owns, is using or taking care of the premises as mentioned in the section of Descriptions of Premises below (including any and all movables located in the premises) for the purpose of carrying out the business as described in section entitled Business below.

Article 2.

The Insurer is not bound to indemnify the insured for any such loss as may be incurred in assuming, directly or indirectly, liability for damages caused by:

(1) destruction, damage or soiling to the property from such steam , water or other substance as may leak out of or overflow from the plumbing, air conditioning system, humidity control system, fireplugs, spinklers or other industrial or domestic appliances; (But the Insurer indemnifies the Insured under the contract of special insurance)

(2) destruction, damage, or soiling to the property from such raindrops, snowflakes, etc., as may come in by, between or through roofs, gutters, doors, windows, ventilating funnels, etc.;

(3) work done in building a new building, repairing or remodeling or pulling down a house within the premises;

(4) ownership, use and/or taking care of aircraft without the premises (not including those to be worked principally by manpower) or animals,

(5) intentional or grossly negligent violation of law or ordinance by the Insured.

Article 3.

The Company is not bound, unless otherwise specially agreed, to indemnify the insured for any such loss as may be incurred in assuming,

directly or indirectly, liability for:

(1) damages caused by commodities, food and drink that have already ceased to be in the insured's possession or other property that has already ceased to be in the insured's possession and in now located outside the premises;

(2) damages resulting from business completed or given up after the completion or giving up thereof (in case delivery of objects of the business is required, after the delivery thereof);

(3) damages caused by ownership, use, or taking care of vehicles outside the premises (not including automobiles and other vehicles that can move principally by manpower)

a. Descriptions of Premises (stated by the Insured)

(1) Name

(2) Location

(3) Structure & Size

(4) Owner, tenant or caretaker

b. Description of Business (stated by the Insured)

4.4 The process of Modernizing the Trading System

During the study and the interview with the cargo consignee, the Clearing & Forwarding agent (C & F agent) and the Customs officers, the study team found out the following:

a) The consignees and the C & F agent say that it ordinarily takes about one month to complete the Customs clearance though the Customs officers say it is about 2 or 3 days.

b) The main reasons insisted by the Customs officers for delay of the clearance are the improper handling of the cargo in the port area and frequent presentation of incorrect and imperfect documents by the importers or the C & F agents.

c) However, the importers and C & F agents accepted the above-mentioned fact but lay blame for this on the lack of guidance from the Customs officers as to the correct procedures to follow, a situation they claim is made worse by the over-zealous and often pedantic attitude of Customs officers in appraising goods and assessing value for duty purposes.

d) Under the current regulation,the importers and the C & F agent must fill up so many items in seven copies of the Bill of Entry by manual.

e) Many importers and exporters representing several organization lack the knowledge concerning the procedure of the trading system. These importers, exporters and C & F agents fail to complete necessary details in the documents. Thus, the incomplete documents cause a serious delay in the trading process.

f) At the same time, the Customs Department and the Port Authorities give wrong information about procedures to the personnel of various organizations in the trading system.

g) In the course of clearing both import and export cargoes, companies do encounter serious delays and inevitable cost due to complex customs procedures. Rules and regulations are not flexible to speed up the procedure. For instance, if the importers, exporters or C & F agents fill in a trivial form incorrectly, they have to correct it before proceeding to the next step.

From the above, the Study Team considers that the present trading system needs to be developed and simplified in order to facilitate a rapid growth in international trade.

(1) The Recommended System

The Study Team suggests that the modernized system of trade documentation and information flow in other developed countries could be adopted appropriately in order to process essential document and paper work efficiently. The process of modernizing the trading system in Bangladesh could be divided into 3 phases.

Phase 1 :

a) The Customs Department should organize training course to their personnel concerning the Customs procedures. This will enable them to advise the importers, exporters and C&F agents correctly.

b) The educational institutes in cooperation with Customs Department, Port Authority, commercial banks, C&F agent Association have to organize training courses to importers, exporters, and C&F agents to acquaint them of the system of trading and procedures.

c) The institute should be established in order to facilitate the trading procedure.

Phase 2 :

a) Form a working group of personnel from various organization in the trading system to study and analyze the whole process and to simplify the procedures.

b) The Customs Department and the Port Authorities should utilize the computer in order to process procedures effectively and efficiently.

Phase 3 :

a) Establish an integrated system among organizations in the trading system.

b) Train all the personnel in the trading system to utilize this system effectively.

(2) Benefits of the New System

a) A cut down of paperwork, formalities and similar procedural obstacles will be eliminated.

b) Reduction of administrative work and better utilization of personnel in the trading system.

c) The new system will be compatible with modernized system in the developed countries and will speed up the international trade.

(3) Possible Problems in Developing the New System

The problems that may be envisaged in developing the new system in Bangladesh are as follows.

a) Lack of sincere cooperation among various organizations.

The work of each organization is not a synchronized system. It is the duty of the government to ensure that this project is implemented and conscientiously monitored.

b) Lack of qualified personnel

To modernize and simplify the present system, they need qualified personnel in relative fields to work as a team in order to achieve a befitting result.

c) Resistance to Change

The personnel in each organization in the trading system may resist to change, since such employee fears the risk of losing his or her job, etc.

(4) Key Success in Developing the New System

There are number of basic requirements before any systematic trade simplification work is likely to succeed. The followings points are required:

a) Political Will

The key to succeed is political will. The modernized system that simplify trading procedure needs to be a component of government policy. It can be linked to a policy of export, import, port facilities, and so on. Inertia and resistance to this policy must be overcome.

b) Resource

It has rarely been possible to modernize a system movement without qualified and competent staff. This project should be funded by government, trade association and so on, including the cooperation from both public and private sectors with respect to decision-making.

c) Short-cut Method

It is a better way to use a short-cut method by studying a modernized system in foreign country and adopt it when appropriate to speed up the whole process of simplification of international trade procedures.

(5) Suggestion for Further Research

The result of study indicates the needs of an in-depth study in the following area:

a) Detailed study of each piece of information in a document whether it is mandatory or not.

b) The purpose of each piece of information in each document should be identified.

c) The time need to complete each step of trading system e.g. clearance time, cargo handling time and so on.

CHAPTER 5 ECONOMIC ANALYSIS

5.1 Purpose and Methodology of the Economic Analysis

The purpose of this chapter is to appraise the economic feasibility of the Short-term Plan for the Container Terminal at Dhaka Port explained in Chapter 2.

The economic evaluation of a project should show whether the project is justifiable from the economic point of view by assessing its contribution to the national economy.

Thus, the basic purpose of this chapter is to investigate the economic benefits as well as the economic costs that will arise from the project, and to evaluate whether the net benefits exceed those which could be derived from other investment opportunities in Bangladesh (the opportunity cost of Capital).

The economic internal rate of return (EIRR) based on cost-benefit analysis is used to appraise the feasibility of the project. In estimating the costs and benefits of the Short-term Plan of Container Terminal at Dhaka Port, "economic pricing" is applied. "Economic pricing" here means the appraisal of costs and benefits in terms of international prices (border prices). Fig 5-1 shows the process of the economic analysis in this study.

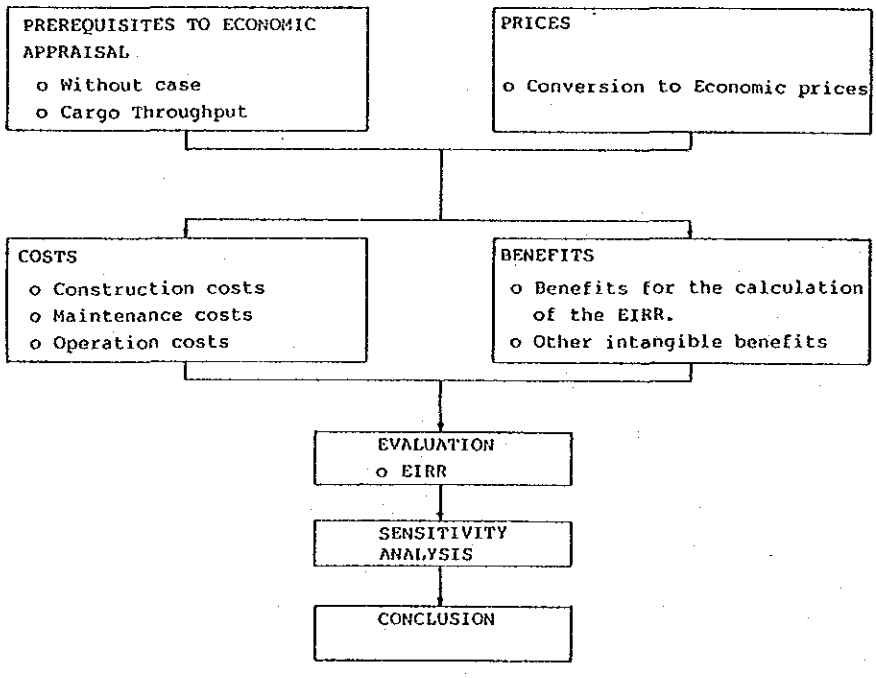


Fig. 5.1 Process of Economic Analysis

5.2 Prerequisites of the Economic Analysis

5.2.1 "With" Case

In an economic analysis, benefits are mainly brought about by improvements in productivity. In this study it is possible to improve productivity by construction of a container terminal at Dhaka Port and by building new container ships that will be operated between Chittagong and Dhaka and between Mongla and Dhaka. Therefore, we assume that all improvement in productivity is the result of the "With" case.

5.2.2 "Without" Case

A cost-benefit analysis is conducted on the difference between the "With" and "Without" investment cases. In other words, benefits and costs arising from the proposed investment are compared, and it is determined whether or not the net benefits generated by the project exceed the opportunity cost of capital in Bangladesh. Therefore, determining the "Without" case is one of the key points of the economic appraisal. In this study, the following conditions are adopted as the "Without" Case after various possibilities are discussed:

1) No investment is made for this project.

2) The container cargo between Dhaka and the seaports in Bangladesh will be transported by rail and road.

3) The capacity of Kamalapur ICD for railway dos not exceed the Fourth Five Year Plan.

5.2.3 Base Year

The "base year" here means the starting year of the economic evaluation and, therefore, 1991 is set as the base year for this study.

5.2.4 Project Life

The economic service lives of the gantry cranes, the wharves and the buildings are 15 years, 30 years and 50 years, respectively, while that handling equipment such as the straddle carriers is 5 years.

Therefore, the economic cost/benefit evaluation is carried out starting in 1991 and ending in 2025 (the 35th year from the engineering service starting year, 1991).

5.2.5 Foreign Currency Exchange Rate

The exchange rate used in this study is as follows:

US $1 = TK 34.06 = ¥140.50(as of September 1990)

5.2.6 Cargo Throughput

(1) "With Case"

The cargo volume under the With Case at the container terminal at Dhaka Port during the planning period is forecast in Chapter 8 in Part 1 and Chapter 1 in Part 2.

(2) "Without Case"

All container cargo will be transported by land transportation between Dhaka and Bangladesh's seaports.

Therefore, there is no-container cargo at Dhaka Port.

The cargo throughput under the Without Case in shown in Table 5-1.

Table 5.1 Container Cargo through under the Without Case

Case	Port	Year	Import				Export
			IWT	Railway	Road		Total
					Trailer	Truck	
			(1000 TEU)	(1000 TEU)	(1000 TEU)	(1000tons)	(1000 TEU)
With case	Chittagong	1995	28	17	0	320	-
		2000	46	35	21	258	-
	Mongla	1995	7	0	0	0	-
		2000	11	0	0	0	-
	Total	1995	34	17	0	320	76
		2000	57	35	21	258	134
Without case	Chittagong	1995	0	17	0	633	-
		2000	0	35	43	532	-
	Mongla	1995	0	0	0	73	-
		2000	0	0	0	122	-
	Total	1995	0	17	0	706	71
		2000	0	35	43	633	129

5.3 Economic Pricing

5.3.1 Methodology

The purpose of the economic analysis is to examine the value of a project, that is to see if it represents an efficient allocation of resources. The values of goods quoted at a given market price do not always represent the true value of those goods to the nation. Thus, planners often use "economic pricing" to examine the costs of labour, capital, and imported goods, as well as the benefits of development, to evaluate a project from the economic viewpoint.

All the costs and benefits examined usually have been calculated based on domestic market prices. Thus, in this report, for tradable goods, the domestic market prices are changed to border prices by subtracting customs duty, development surcharge tax, sales tax, import permission fee and advanced income tax from the domestic market prices. For non-tradable goods and labour costs, the market prices are changed to border prices using various conversion factors. (Refer to Appendix 2.5.1.) In general, these border prices are intended to represent the international market value, or world prices, of these goods and services.

Table 5.2 shows the concept of economic pricing.

Table 5.2 The Concept of Economic Pricing

Border price	Conversion facter
Skilled labour	Conversion facter consumption(CFC)
Unskilled labour	(Ratio of the shadow wage rate) x (CFC)
Tradable goods	(Domestic market price) - (Taxes & Duty)
Non-tradable goods	Standard conversion facter(SCF)

5.3.2 Standard Conversion Factor (SCF)

Import duties and export subsidies create a price differential between the domestic market and the international market.

The standard conversion factor makes up for this price difference. The standard conversion factor is obtained by the following formula.

$$SCF = \frac{\text{(Total Amount of Imports)} + \text{(Total Amount of Exports)}}{\left\{\begin{pmatrix}\text{Total Amount of}\\ \text{Imports}\end{pmatrix} + \begin{pmatrix}\text{Total Amount of}\\ \text{Imports Duties}\end{pmatrix}\right\} + \left\{\begin{pmatrix}\text{Total Amount of}\\ \text{Export}\end{pmatrix} - \begin{pmatrix}\text{Total Amount of}\\ \text{Exports Duties}\end{pmatrix}\right\}}$$

In this report, the average SCF from 1982 to 1988 is adopted for the analysis.

The Standard Conversion Factor is calculated as 0.898. (Please refer to Appendix 2.5.2.)

5.3.3 Conversion Factor for Consumption (CFC)

This factor is used for converting the prices of consumer goods from market prices to international prices.

In particular, this is required to convert labour costs from market prices to international prices.

The Conversion Factor for Consumption is usually calculated in the same manner as the Standard Conversion Factor, replacing total imports and total exports by imports and exports of consumer goods.

However, due to the lack of required data, the Conversion Factor for Consumption cannot be directly calculated in this report. Thus, it is assumed to be 0.915, which is based on 1984.

5.3.4 Conversion Factor for Labour

(1) Skilled Labour

For skilled labour, assuming that the market mechanism is functioning properly, actual market wages are used. But as the data are in domestic prices, they are converted to international prices by multiplying by the conversion factor for consumption.

The Conversion Factor for Skilled Labour	=	Local market wage rate	x	(CFC)

= 1.0 x 0.915

= 0.915

(2) Unskilled Labour

For unskilled labour, the economic costs are calculated based on a simplified measure of the opportunity cost. As the wages paid to unskilled

laborers by a project are usually above the opportunity cost, these market wages should not be used for the calculation of the economic value of the unskilled labour.

In this report, the marginal productivity of an unskilled laborer is assumed to be equal to the per capita GDP of the agriculture, livestock and fisheries sector (hereafter referred to as the agricultural sector).

The conversion factor for unskilled labour is calculated using the formula given below:

$$\text{Conversion Factor for Unskilled Labour} = \frac{\text{Per Capita GDP of Agricultural Sector}}{\text{Nominal Wage for Unskilled Labour}} \times (\text{CFC})$$

In this report, the data of calculation of the above conversion factor is from 1984, The most recent year for which data on working days of agricultural workers in Bangladesh are available.

The conversion factor for unskilled labour is calculated as 0.713. (Please refer to Appendix 2.5.3.)

5.4 Benefit

5.4.1 Benefit Items

As benefits brought about by the Short-term Plan of the container terminal at Dhaka Port, the following items are identified;

1 Savings on transportation costs of container cargo between Dhaka and Bangladesh's seaports.
2 Reduction in damage, accidents and pilferage.
3 Maintaining the transportation of container cargo during devastating floods.
4 Increase in employment opportunities.
5 Increase in income due to port-related industrialization.
6 Other intangible benefits.

It is difficult to evaluate some of the above-mentioned benefits (item 2 - item 6) in strictly monetary terms.

In this report the first benefit (item 1) which can be evaluated monetarily is considered as a countable benefit.

5.4.2 Savings on Transportation Costs of Container Cargo between Dhaka and Bangladesh's Seaports

(1) General

The volume of container cargo for transportation between Dhaka and Bangladesh's seaports is increasing year by year.

At present, almost all container cargo are carried out loading to / stripping from container boxes at seaports area. However, a very small percentage of container cargo volume are coming to and from Dhaka area by railway. Then, these almost container cargo is transported by truck.

In future, transportation of these loads will shift from trucks to container semi-trailers after the construction of bridges on the main roads between Dhaka and Bangladesh's seaports.

The major benefit of this project stems from the difference in transportation costs by road and by inland waterway between Dhaka and the seaports.

For rail transportation, the container throughput under the " without case" consists of the same number of containers as under the " with case"

because it is assumed that the capacity of the Kamalapur ICD for railway will not exceed the capacity under the Forth Five Year Plan during the planning period of the Short-term plan.

The formula used to calculation this benefit is as follows:

Savings on the transportation costs	=	The difference of the transportation costs between Dhaka and the seaports by road and by the IWT	×	The container throughput by the IWT under the"with" case

The transportation cost of each transportation mode is constructed from the operation cost of the transportation such as the operation cost of the vessel, the truck, etc., and the terminal cost of each transportation mode such as the container terminal for IWT at Dhaka, the ICD for semi-trailer at Dhaka, etc..

The transportation cost of load transportation, which consists of trucks and semi-trailers includes other costs, including the road maintenance changes and the cost of improving roads for container semi-trailer.

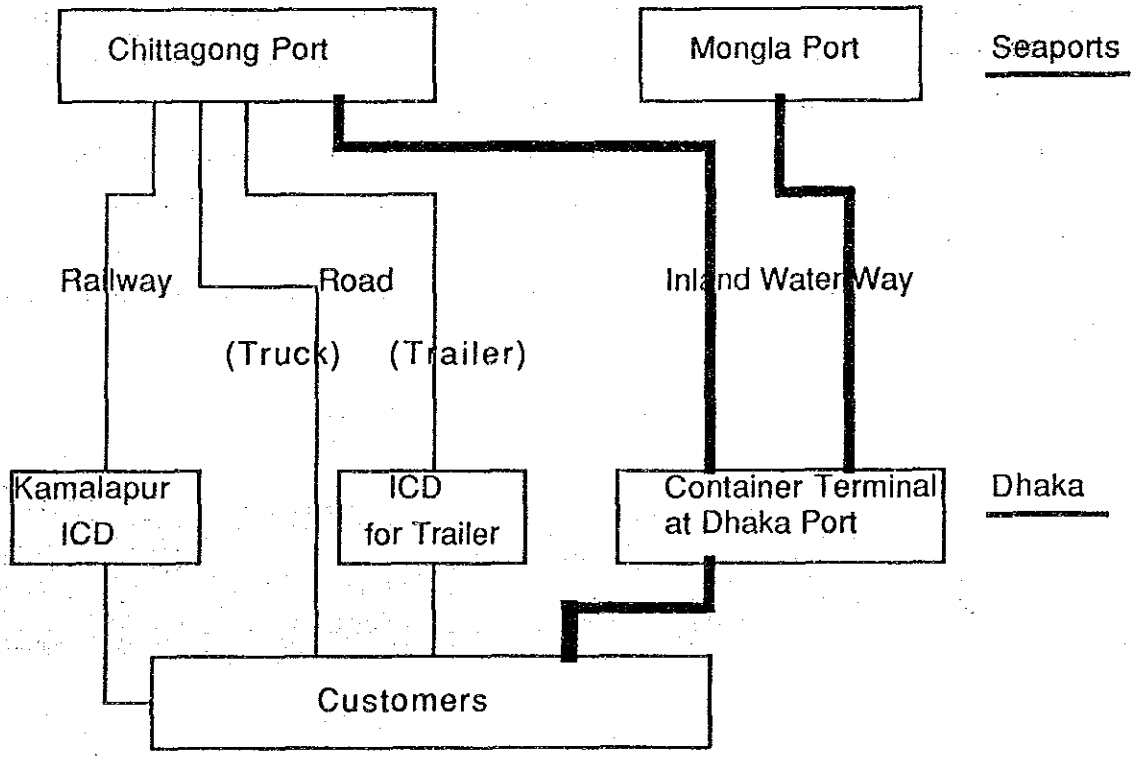


Fig. 5.2 With Case

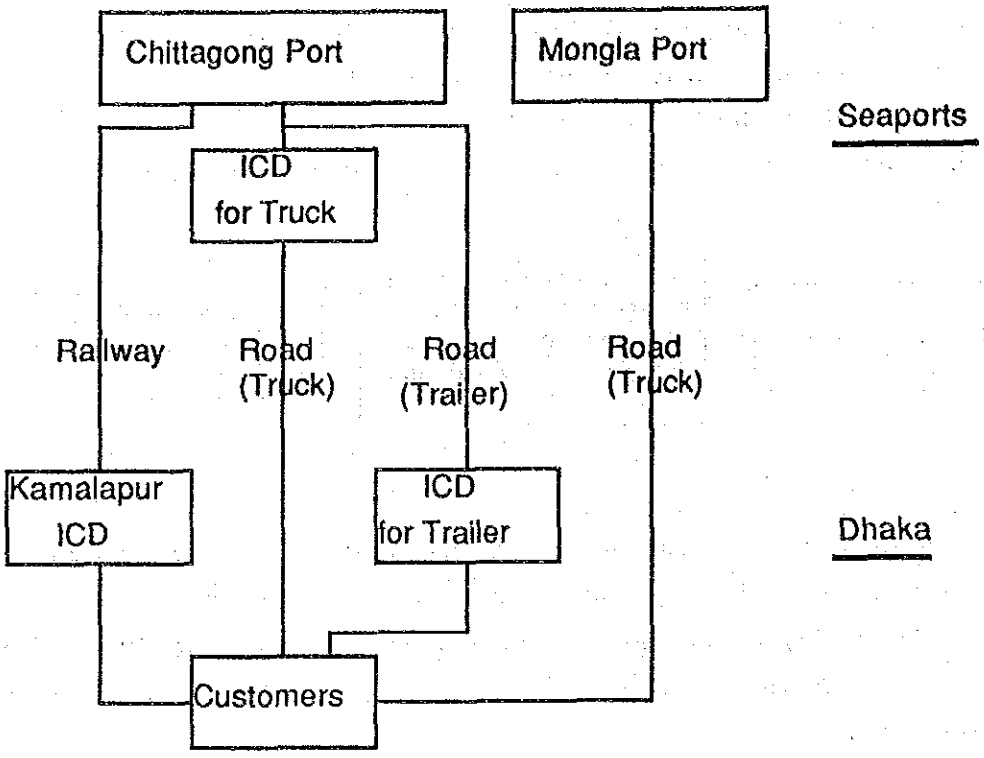


Fig. 5.3 Without Case

(2) Operation cost by Transportation Mode

The operation costs of container transportation between Dhaka and Bangladesh's seaports by road and IWT at economic prices are estimated based on the calculation of these operation costs at financial prices in Chapter 9 of Part 1 and Chapter 1 of Part 2.

The operation costs of the transportation mode consist of the fuel cost, depreciation cost, repair and maintenance cost, insurance, and personnel cost.

The results of the estimation are shown in Table 5.3.(Refer to appendix 2.5.4, 2.5.5 and 2.5.6)

Table 5.3 Operation Cost by Economic Price

(Unit:1000 TK)

Year	With case				Without case				Benefit
	IWT	Truck	Trailer	Total	IWT	Truck	Trailer	Total	
1995	46.784	220.012	0	266.796	0	496.656	0	496.656	229.861
1996	46.784	212.857	18.316	277.957	0	511.475	37.833	549.308	271.351
1997	46.784	211.919	38.402	297.105	0	516.777	79.257	596.035	298.930
1998	58.494	205.996	62.240	326.730	0	511.864	128.355	640.219	313.488
1999	58.994	194.702	89.910	343.606	0	495.911	185.266	681.177	337.571
2000	58.698	177.727	121.460	357.886	0	468.264	250.066	718.331	360.445

(3) Terminal Cost by Transportation Mode

The terminal costs of container transportation between Dhaka and Bangladesh's seaports by road and IWT at economic prices are estimated based on the calculation of those terminal costs at financial prices in the same chapter as mentioned in (2).

The terminal costs of each mode consists of the depreciation cost, maintenance cost, repair cost, operation cost and personnel cost.

The result of the estimation of terminal costs is shown in Table 5.4. (Refer to Appendix 2.5.7)

Table 5.4 Terminal Cost at Economic Cost

(Unit:1000 TK)

Year	With case				Without case				Benefit
	IWT	Trailer	Truck	Total	IWT	Trailer	Truck	Total	
1995	206,736	0	94,522	301,258	0	0	166,044	166,044	-135,214
1996	209,974	81,514	84,202	375,690	0	168,028	151,084	319,113	-56,577
1997	208,760	93,755	77,161	379,676	0	193,264	136,452	329,716	-49,960
1998	207,549	104,488	70,138	382,175	0	215,369	121,875	337,244	-44,931
1999	206,341	115,702	63,131	385,174	0	238,439	107,354	345,793	-39,380
2000	205,136	126,898	56,140	388,174	0	261,449	92,890	354,338	-33,836

(4) Other costs

Other costs of each mode consists of the road transportation cost for the delivery and the receiving of container cargoes and road costs which include the project costs of the Comilla-Daudkand Highway and the maintenance cost of the Dhaka-Chittagong Highway. These costs are estimated in the same way as (2) and (3).

The results of the calculation are shown in Table 5.5.

Table 5.5 Other Cost

(Unit:1000 TK)

Year	With case				Without case				Benefit
	IWT	Trailer	Truck	Total	IWT	Trailer	Truck	Total	
1995	45,147	0	50,559	95,706	0	0	103,609	103,609	7,904
1996	52,845	5,861	51,068	109,774	0	12,086	104,652	116,738	6,964
1997	58,424	12,374	51,134	121,933	0	25,501	104,789	130,290	8,357
1998	64,055	20,258	50,499	134,812	0	41,726	103,486	145,212	10,400
1999	69,697	29,667	49,056	148,420	0	61,071	100,528	161,599	13,179
2000	75,319	40,808	46,642	162,769	0	83,957	95,582	179,539	16,770

(5) Benefits of This Project

The benefits of this project are calculated by summing up the results of the estimation from (1) to (4).

The benefits of this project are shown in Table 5.6.

Table 5.6 Calculation the Benefit

(Unit:1000 TK)

Year	With case				Without case				Benefit
	IWT	Trailer	Truck	Total	IWT	Trailer	Truck	Total	
1995	298,666	0	365,093	663,759	0	0	766,310	766,310	102,550
1996	309,603	105,692	348,126	763,421	0	217,948	767,211	985,159	221,738
1997	313,968	144,530	340,215	798,713	0	298,023	758,018	1,056,041	257,327
1998	330,099	186,986	326,633	843,717	0	385,449	737,225	1,122,675	278,958
1999	335,032	235,279	306,888	877,199	0	484,775	703,794	1,188,569	311,370
2000	339,153	289,167	280,509	908,829	0	595,472	656,736	1,252,208	343,379

5.5 Costs

Construction, maintenance and operation costs as included in repair and administration costs are considered in this section.

5.5.1 Construction Costs

Construction costs, estimated at domestic market prices, are shown in Chapter 3 of Part 2. These costs are divided into such categories as tradable goods, non-tradable goods, skilled labour, unskilled labour and others.

The cost of tradable goods at financial prices are changed to economic prices by subtracting customs duty, development surcharge, sales tax, import permission fee and advanced income tax from the financial price.

The cost of non-tradable goods and others at financial prices are changed to economic prices by multiplying by the standard conversion factor.

The cost of skilled labour and unskilled labour at financial prices are changed to economic prices by multiplying by the conversion factor for skilled labour and the conversion factor for unskilled labour, respectively.

The table 5.7 shows construction cost at economic prices.

Table 5.7 Summary of Investment for IWT Container Terminal at Dhaka (Economic Price)

(Unit: 1000TK)

Year	Reclam.	Wharf	M.yard	A.road	Building	Utility	Eng.fee	Contl.	H.equip.	Land	Total
1991	0	0	0	0	0	0	30,729	0	0	0	30,729
1992	72,400	44,891	0	0	0	0	15,389	21,948	0	33,675	188,303
1993	40,083	15,417	0	30,560	8,984	0	10,965	19,583	0	0	155,593
1994	0	74,597	94,812	13,607	47,374	237,535	10,782	28,657	394,524	0	891,877
1995											
1996											
1997											
1998											
1999									154,237		154,237
2000											0
2001											0
2002											0
2003											0
2004			94,812	44,167			13,469	13,930	154,237		320,616
2005											0
2006											0
2007											0
2008											0
2009									394,524		394,524
2010											0
2011											0
2012											0
2013											0
2014			94,812	44,167			13,469	13,930	154,237		320,616
2015											0
2016											0
2017											0
2018											0
2019									154,237		154,237
2020											0
2021											0
2022											0
2023											0
2024		161,375	94,812	44,167			29,400	30,406	394,524		757,684
2025											0

Note
Reclam.: Reclamation
M.Yard:Marshalling Yard
A.Road:Access Road
Eng.fee:Engineering Fee
Contl.:Contingency
Handling Equipment
Land:Land Acquisition
Wharf:Wharf & Revetment

5.5.2 Maintenance and Operation Costs

The main items of the operation costs of the container terminal are personnel, fuel and administration expenses.

The details of these items mentioned in chapter 6.

The maintenance costs are assumed to consist of maintenance expenses for handling equipment and other depreciated assets.

These expenses are assumed to be a percentage of original procurement, the former is 4 percent and the latter is 1 percent.

Table 5.8 shows the maintenance and operation cost of the container terminal at economic prices.

Table 5.8 Maintenance and Operation Cost for IWT Container Terminal at Economic Price

(Unit:1000 TK)

Item		Economic operation cost
Maintenance expenses	Handling equipments	15,781
	Others	8,383
	Total	24,164
Fuel expense		3,945
Personnel expenses	Officer(skilled) 120persons	5,819
	Staff(unskilled) 190persons	4,877
	Total	10,696
Administration expense		3,209
Total		42,014

5.6 Evaluation

5.6.1 Calculation of the EIRR

The economic profitability of the project is evaluated in terms of the economic internal rate of return. The internal rate of return is a discount ratio satisfying the following equation:

$$\sum_{i=0}^{n} \frac{Bi - Ci}{(1+r)^i} = 0$$

Where, Bi: Benefit at i-th year
Ci: Cost at i-th year
r: Rate of discount
n: Period of Economic Calculation

From the result of the calculation, the EIRR of this project is found to be approximately 14.7 percent.

(Please refer to Appendix 2.5.8)

5.6.2 Sensitivity Tests

Sensitivity tests are made for 2 cases:

(a) Construction, Maintenance and Operation cost increase by 10%. (Case - 1)

(b) Cargo volume decreases by 10% (Case - 2)

The calculated EIRR is 13.0 percent for (a) and 12.6 percent for (b). (Please refer to Appendices 2.5.9 and 2.5.10.)

5.6.3 Results

The opportunity cost of capital in developing countries ranges up to 8% or more, as shown in Table 5.9 .

It is a generally accepted criterion that a project with an EIRR of more than 10% is economically feasible. For this project, the EIRR of all cases exceeds 10%, hence, the project is considered justifiable.

Table 5.9 Opportunity Cost of Capital

Nation	Sector	IRR (%)
India	Manufacturing	10 - 12
Pakistan	Agriculture	10
	Manufacturing	10
Nepal	Transport	8
Egypt	Manufacturing	8
Sudan	Agriculture	8
Gambia	Transport	10
Solomon Is.	Forestry	8
Indonesia	Power	6
Jordan	Water Supply	8

Source: O.D.M., U.K., 1975

CHAPTER 6 FINANCIAL ANALYSIS

6.1 Purpose of the Analysis

The purpose of the financial analysis is to appraise the financial feasibility of the short-term development plan for the new container terminal. This analysis focuses on the viability of the project and the financial soundness of the terminal management body during the project life.

6.2 General Prerequisites of the Financial Analysis

6.2.1 Scope of the Analysis

For the estimate of the financial soundness, the finances of not the entire BIWTA but the division of the BIWTA managing and operating the container terminal are analyzed in this study. Thus we cannot analyze the financial soundness appropriately, due to the large overall deficit of the BIWTA.

6.2.2 Project Life

Taking account of the conditions of the long-term loans and the service lives of the port facilities, the project life for the financial analysis is determined as 35 years including 4 years of detailed design and construction of the terminal.

6.2.3 Base Year

For the estimation, all costs, expenditures and revenues analyzed quantitatively here are indicated in prices as of 1 September 1990, when the price survey was conducted. Neither inflation of prices nor the increases of nominal wages are considered during the project life.

6.2.4 Cargo Handling Volume

Based on the cargo volume forecast, the modal split analysis and estimated cargo handling capacity, the annual cargo handling volume is determined as shown in Table 6.2.1.

6.2.5 Port Charges and Revenues

Revenues from port activities are calculated based on the new tariff shown in Fig. 6.2.1 and the cargo handling volume/number of calling vessels presented in Table 6.2.1.

The structure of the new tariff is based on the existing tariff on container transport at Chittagong and Mongla Ports presented in Fig. 6.4.3 of Part I. This existing system is familiar with almost all users, and thus, aid the transport through this terminal. The tariff systems at Singapore and Colombo Ports shown in Appendix 6.2.1 and 6.2.2 were also considered for determination of the new tariff. And the structure should include incentives for efficient cargo operations and transport.

We determined the level of rates for the new tariff by taking account of the feasibility of the project as well as rates at Chittagong and Mongla Ports. Revenues from port activities should cover all costs of construction as well as management and operations of the port facilities. The competitive power for trucks and railways should also be considered when setting rates. Total freight and charges for waterway container transport through this terminal which is calculated based on the proposed level of rates are lower than those for trucks and railways as shown in Appendix 6.2.3.

Table 6-2-1 Annual Container Handling Volume

ITEMS		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	----	2025
(TEU)														
IMPORT		34,400	40,300	44,500	48,800	53,100	57,000	57,000	57,000	57,000	57,000	57,000	57,000	57,000
EXPORT		34,400	40,300	44,500	48,800	53,100	57,000	57,000	57,000	57,000	57,000	57,000	57,000	57,000
TOTAL		68,800	80,600	89,000	97,600	106,200	114,000	114,000	114,000	114,000	114,000	114,000	114,000	114,000
SHARE OF LOADED CONTAINERS	IMPORT	0.8621	0.8621	0.8621	0.8621	0.8621	0.8621	0.8621	0.8621	0.8621	0.8621	0.8621	0.8621	0.8621
	EXPORT	0.4902	0.4626	0.4374	0.4149	0.3947	0.3769	0.361	0.3469	0.3344	0.3233	0.3134	0.3134	0.3134
SHARE OF 20' CONTAINERS		0.6939	0.6812	0.6717	0.6584	0.6445	0.6328	0.6211	0.6097	0.5985	0.5876	0.5768	0.5768	0.5768
(BOX)														
IMPORT	LOADED(20')	15,756	17,948	18,400	20,553	21,786	22,733	22,134	21,550	20,985	20,444	19,916	19,916	19,916
	LOADED(40')	6,950	8,399	9,482	10,759	12,006	13,203	13,503	13,795	14,077	14,348	14,612	14,612	14,612
	EMPTY(20')	2,520	2,871	3,103	3,288	3,482	3,636	3,541	3,447	3,357	3,270	3,186	3,186	3,186
	EMPTY(40')	1,112	1,343	1,517	1,721	1,920	2,112	2,160	2,207	2,252	2,295	2,337	2,337	2,337
EXPORT	LOADED(20')	8,959	9,630	9,843	9,891	9,965	9,939	9,269	8,671	8,140	7,667	7,240	7,240	7,240
	LOADED(40')	3,952	4,507	4,811	5,178	5,497	5,772	5,654	5,551	5,461	5,381	5,312	5,312	5,312
	EMPTY(20')	9,317	11,187	12,660	13,949	15,282	16,431	16,406	16,325	16,202	16,047	15,861	15,861	15,861
	EMPTY(40')	4,110	5,235	6,188	7,302	8,430	9,543	10,008	10,451	10,869	11,262	11,637	11,637	11,637
TOTAL	LOADED(20')	24,715	27,575	29,243	30,445	31,751	32,672	31,403	30,221	29,125	28,110	27,155	27,155	27,155
	LOADED(40')	10,902	12,905	14,293	15,937	17,503	18,975	19,157	19,346	19,538	19,729	19,924	19,924	19,924
	EMPTY(20')	11,837	14,057	15,763	17,237	18,784	20,067	19,947	19,772	19,558	19,317	19,047	19,047	19,047
	EMPTY(40')	5,222	6,579	7,704	9,023	10,350	11,655	12,168	12,657	13,121	13,558	13,975	13,975	13,975
NUMBER OF CALLING VESSELS		391	458	506	555	603	648	648	648	648	648	648	648	648

Table 6.2.2 Annual Revenues from Port Activities

ANNUAL REVENUES FROM PORT ACTIVITIES (UNIT:1000Tk.) (UNIT:1000Tk.)

KIND OF REVENUES	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	----	2025
PORT CHARGES ON VESSELS(*)	7,190	8,361	9,242	10,130	11,020	11,810	11,810	11,810	11,810	11,810	11,810	11,810	11,810
LOADING/UNLOADING CHARGES	115,940	133,152	145,604	157,731	169,883	180,392	178,868	177,466	176,179	174,999	173,903	173,903	173,903
STORAGE CHARGES	18,834	22,175	24,786	27,439	30,112	32,519	32,741	32,938	33,113	33,268	33,406	33,406	33,406
DELIVERY/RECEIVING CHARGES	39,050	44,522	48,321	52,079	55,795	58,981	58,253	57,606	57,031	56,519	56,061	56,061	56,061
STUFFING/UNSTUFFING CHARGES	33,688	38,460	41,790	45,100	48,372	51,187	50,605	50,088	49,631	49,224	48,861	48,861	48,861
OTHERS	20,032	23,194	25,536	27,892	30,245	32,322	32,240	32,168	32,103	32,046	31,995	31,995	31,995
TOTAL	234,733	269,865	295,279	320,372	345,427	367,211	364,517	362,077	359,867	357,866	356,037	356,037	356,037

(*)BERTH OCCUPANCY CHARGES, PORT DUES, PILOTAGE, ETC.

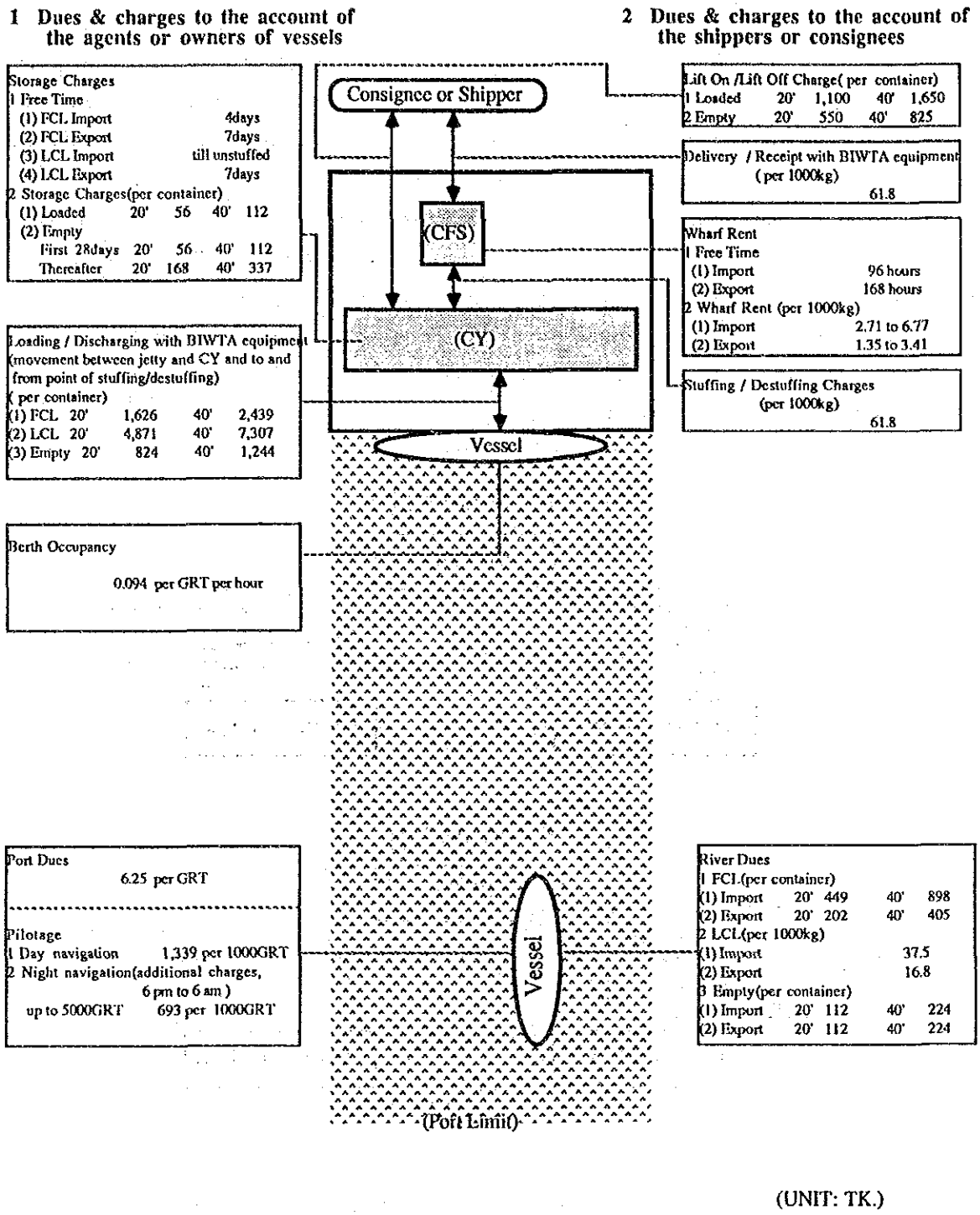


Fig. 6.2.1 Main Dues & Charges of Container Transportation in Dhaka Inland Container Terminal

Usually, the companies responsible for cargo transport must pay port charges and dues. In container transport, shipping companies are usually responsible for cargo transport after it has been received from the shippers or before it has been delivered to the consignees at CY or CFS in ports. On the other hand, under conventional transport system, shipping companies are responsible only for cargo transport after it has been loaded to or before it has been discharged from vessels. The border of responsibility between shipping companies and shippers/consignees is located at the wharves. Payment systems for both forms of cargo transport are shown in Fig. 6.2.2. Saving costs and time for collecting port charges and dues should also be considered.

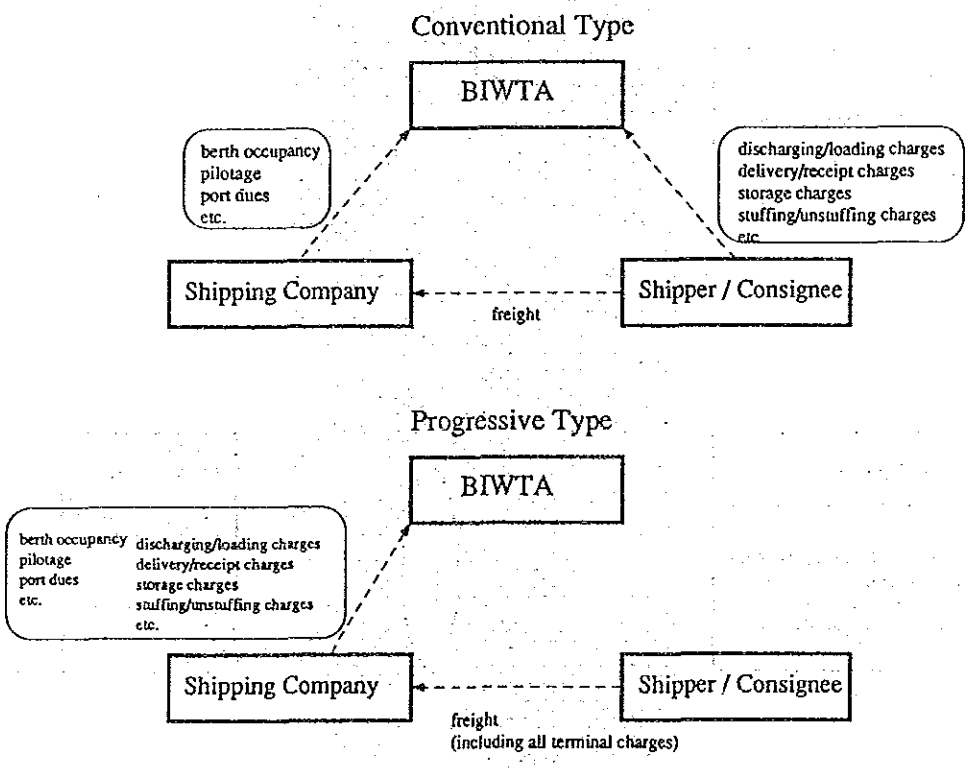


Fig. 6.2.2 Payment System for Port Charges and Dues

6.2.6 Fund Raising

The funds necessary for the implementation of the project are assumed to be raised as follows:

(1) Foreign currency

source:	loans from abroad (re-lending loans from the government)
interest rate:	11.5% per annum. (re-lending rate from the government)
repayment:	30 years, including a grace period of 5 years

(2) Local currency

source:	loans from the government
interest rate:	11.5% per annum.
repayment:	30, years including a grace period of 5 years

Any cash shortage should be covered by short-term loans with an interest rate of 12% per annum., in local currency.

6.2.7 Costs of Investments

The initial investment of the short-term project are estimated in Chapter 3. The facilities and the equipment will be renewed based on their service lives. The service lives of each facility and equipment are shown *in Chapter 9 of Part I.*

The funds for re-investment are assumed to be raised from the reserves of the division of the BIWTA managing and operating the container terminal.

6.2.8 Maintenance, Repair and Fuel Costs

The annual maintenance and repair costs for the port facilities are calculated as follows;

(1) depreciable assets excluding cargo handling equipment
1% of the original construction cost

(2) cargo handling equipment

4% of the original procurement cost

The annual fuel costs are calculated as 1% of the original procurement cost of cargo handling equipment.

6.2.9 Personnel and Administration Costs

The annual personnel costs are estimated based on the required number of workers proposed in Chapter 4.2.1 and the existing scales of pay.

The annual administration costs are calculated as 30% of the total annual personnel costs.

6.2.10 Depreciation Costs

The annual depreciation costs of the port facilities and equipment are calculated by the straight line method based on their service lives. Residual values after deprecation are estimated as 10% of the original construction or procurement cost. The port facilities and equipment after depreciation are assumed to be sold at the residual values.

6.2.11 Repayment of Loans and Interest on Loans

The repayment of long- and short-term loans and the interest on these loans are calculated based on the fund-raising plan presented in 6.2.6.

6.2.12 Taxes

All private and public enterprises in the black after payment of all expenditures must pay corporate tax. However, in this study, it is assumed that the BIWTA will not pay the tax because all of its finances, including not only the management and operations of the container terminal but also the other functions, are assumed to be in the red.

Taxes and duties on imported or manufactured goods, such as customs duty, sales tax, development surcharge tax, excise duty, etc., have already been included in the project costs.

6.3 Methodology of the Financial Analysis

6.3.1 Viability of the Project

The viability of the project is analyzed using the Discount Cash Flow Method and appraised by the FIRR. The FIRR is a discount rate that makes the costs and the revenues during the project life equal, and it is calculated using the following formula:

$$\sum_{i=1}^{n} \frac{Bi - Ci}{(1+r)^{i-1}} = 0$$

n : project life
Bi: revenues in the i-th year
Ci: Costs in the i-th year
r : discount rate

Here, the revenues and the costs are the difference between those under the "with" case and the "without" case. In this study, the "without" case is set as explained in Chapter 5. The revenues and the costs in this analysis cover the following items:

Revenues: operating revenues
Costs: investments(initial investments and re-investments)
maintenance, repair and fuel costs
personnel and administration costs

When the calculated FIRR exceeds the weighted average interest rate of the total funds for the investments of the project, the project is regarded as financially feasible.

6.3.2 Financial Soundness of the Organization Managing and Operating the Container Terminal

The financial soundness of the organization managing and operating the terminal is appraised based on its projected financial statements (Profit and Loss Statement, Cash Flow Statement and Balance Sheet). The appraisal

is made from the viewpoints of profitability, loan repayment capacity and operational efficiency, using the following ratios:

(1) Profitability

Rate of Return on Net Fixed Assets;

$$\frac{\text{Net Operating Income}}{\text{Total Fixed Assets}} \times 100(\%)$$

This indicator shows the profitability of the investments, which are presented as net total fixed assets. It is necessary to keep the rate above the average interest rate of the funds for the investments.

(2) Loan Repayment Capacity

Debt Service Coverage Ratio:

$$\frac{\text{Net Operating Income before Depreciation}}{\text{Repayment of and Interest on Long-term Loans}}$$

This indicator shows whether the operating income can cover the repayment of and the interest on long-term loans, and must be more than 1.

(3) Operational Efficiency

Operating Ratio:

$$\frac{\text{Operating Expenses}}{\text{Operating Revenues}} \times 100(\%)$$

Working Ratio:

$$\frac{\text{Operating Expenses} - \text{Depreciation Cost}}{\text{Operating Revenues}} \times 100(\%)$$

The operating ratio shows the operational efficiency of the organization as an enterprise, and the working ratio shows the efficiency of the routine operations of the port.

When the calculated operating ratios are less than 70-75%, and the working ratios are less than 50-60%, the operations of the terminal are efficient.

6.4 Evaluation

6.4.1 Viability of the Project

The FIRR of this project is 12.7% exceeding the weighted average interest rate of funds during the project life (11.5%), as shown in Table 6.4.1.

Table 6.4.1 FIRR Calculation

FIRR= 0.127

(UNIT:1,000Tk.)

YEAR	REVENUES	COSTS			REVENUES-COSTS	PRESENT VALUE IN 1991		
		INVESTMENT	EXPENSES	TOTAL		REVENUES	COSTS	DIFFERENCES
1991		30,730		30,730	-30,730	0	30,730	-30,730
1992		231,123		231,123	-231,123	0	205,025	-205,025
1993		185,679		185,679	-185,679	0	146,114	-146,114
1994		1,132,193		1,132,193	-1,132,193	0	790,337	-790,337
1995	246,620		55,770	55,770	190,850	152,716	34,535	118,181
1996	278,679		55,770	55,770	222,909	153,082	30,635	122,447
1997	304,613	0	55,770	55,770	248,843	148,433	27,176	121,257
1998	330,647		55,770	55,770	274,877	142,926	24,107	118,819
1999	356,595	299,433	55,770	355,203	1,392	136,737	136,203	534
2000	379,704		55,770	55,770	323,934	129,158	18,970	110,187
2001	376,918		55,770	55,770	321,148	113,733	16,828	96,904
2002	374,394	0	55,770	55,770	318,624	100,215	14,928	85,287
2003	372,109		55,770	55,770	316,339	88,356	13,242	75,114
2004	370,041	499,404	55,770	555,174	-185,133	77,944	116,939	-38,995
2005	368,149		55,770	55,770	312,379	68,789	10,421	58,368
2006	368,149		55,770	55,770	312,379	61,021	9,244	51,777
2007	368,149	0	55,770	55,770	312,379	54,131	8,200	45,931
2008	368,149		55,770	55,770	312,379	48,019	7,274	40,744
2009	368,149	628,624	55,770	684,394	-316,245	42,596	79,187	-36,591
2010	368,149		55,770	55,770	312,379	37,787	5,724	32,062
2011	368,149		55,770	55,770	312,379	33,520	5,078	28,442
2012	368,149	0	55,770	55,770	312,379	29,735	4,504	25,230
2013	368,149		55,770	55,770	312,379	26,377	3,996	22,381
2014	368,149	499,404	55,770	555,174	-187,025	23,399	35,286	-11,887
2015	368,149		55,770	55,770	312,379	20,757	3,144	17,612
2016	368,149		55,770	55,770	312,379	18,413	2,789	15,623
2017	368,149	0	55,770	55,770	312,379	16,334	2,474	13,859
2018	368,149		55,770	55,770	312,379	14,489	2,195	12,294
2019	368,149	299,433	55,770	355,203	12,946	12,853	12,401	452
2020	368,149		55,770	55,770	312,379	11,402	1,727	9,675
2021	368,149		55,770	55,770	312,379	10,114	1,532	8,582
2022	368,149		55,770	55,770	312,379	8,972	1,359	7,613
2023	368,149		55,770	55,770	312,379	7,959	1,206	6,753
2024	368,149	1,065,449	55,770	1,121,219	-753,070	7,060	21,503	-14,443
2025	368,149	-1,332,861	55,770	-1,277,091	1,645,240	6,263	-21,727	27,990
TOTAL	11,121,449	3,538,611	1,728,870	5,267,481	5,853,968	1,803,289	1,303,289	0

6.4.2 Financial Soundness of the Organization (Table 6.4.2)

(1) Profitability

The rate of return on net fixed assets is less than the average interest rate of the funds in 1995 and 1997, but after 1998 the rate of return exceeds the average interest rate.

(2) Loan Repayment Capacity

The debt service coverage ratios exceed 1 throughout the project life. There will be no problem with the repayment of the long-term loans using the annual operating revenues. But it is necessary to take out short-term loans to cover the cash outflow from 1993 to 2014.

(3) Operational Efficiency

Both the operating ratios and the working ratios constantly keep favorable levels.

Table 6.4.2

(Unit : 1000Tk.)

PROFIT AND LOSS STATEMENT

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
OPERATING REVENUES	0	0	0	0	240,920	278,879	304,833	330,647	356,595	379,704	398,818	374,394	372,109	370,041	368,149	368,148	368,149	368,149	368,149	368,149	368,149	368,149	368,149	368,149	368,149	368,149	368,149	368,149	368,149	368,149	368,149	368,149	368,149	368,149	368,149
OPERATING EXPENSES																																			
PERSONNEL EXPENSES	0	0	0	0	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320	13,320
ADMINISTRATION	0	0	0	0	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996	3,996
MAINTENANCE, REPAIR & FUEL	0	0	0	0	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454	38,454
DEPRECIATION	0	0	0	0	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,536
TOTAL OPERATING EXPENSES	0	0	0	0	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300	159,300
NET OPERATING INCOME	0	0	0	0	81,620	119,579	145,533	171,347	197,295	220,404	239,518	215,094	212,809	210,741	208,849	208,848	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849
NON-OPERATING REVENUES																																			
INTEREST ON DEPOSIT	0	1,848	762	-3,168	-10,683	-16,552	-15,532	-11,120	-3,842	-24,513	-19,408	-12,586	-3,878	3,812	-32,269	-24,881	-18,252	-4,700	10,312	-39,459	-29,225	-17,206	-1,593	16,398	-12,208	8,193	32,833	-56,524	91,098	94,898	133,027	175,781	224,575	283,044	230,855
OTHERS	0	0	0	0	6,812	5,574	6,082	6,713	7,132	7,554	7,530	7,448	7,442	7,401	7,383	7,383	7,383	7,383	7,383	7,383	7,383	7,383	7,383	7,383	7,383	7,383	7,383	7,363	7,363	7,363	7,363	7,363	7,363	7,363	7,363
TOTAL NON-OPERATING REVENUES	0	1,848	762	-3,168	-3,871	-10,978	-9,450	-4,407	3,290	-16,959	-11,866	-5,098	3,563	11,213	-24,834	-17,498	-10,869	2,683	17,675	-32,096	-21,842	-9,843	5,790	23,758	-4,845	15,556	39,196	69,887	98,461	102,258	140,390	183,144	231,938	290,407	238,218
NON-OPERATING EXPENSES																																			
INTEREST ON LONG-TERM LOANS	0	3,534	30,113	51,468	101,869	101,869	101,869	101,521	100,323	126,284	170,897	169,731	156,484	140,187	141,830	134,664	127,397	120,130	112,863	105,597	98,330	91,063	83,796	76,530	69,263	61,996	54,730	47,463	40,196	32,929	25,663	18,395	11,270	5,207	0
INTEREST ON SHORT-TERM LOANS	0	0	0	2,904	9,793	15,173	14,239	10,193	3,375	22,470	17,780	11,537	3,333	0	29,805	22,881	14,998	4,308	0	38,171	26,790	15,772	1,460	0	11,191	0	0	0	0	0	0	0	0	0	0
TOTAL NON-OPERATING EXPENSES	0	3,534	30,113	54,370	101,661	156,041	185,966	191,720	103,697	200,734	188,788	315,281	159,816	140,187	171,556	157,545	142,394	124,438	112,863	143,768	125,120	106,838	85,257	76,530	80,454	61,996	54,730	47,463	40,196	32,929	25,663	18,395	11,270	5,207	0
NET INCOME BEFORE TAX	0	-1,888	-29,351	-57,538	-118,011	-68,441	-50,034	-24,680	93,887	2,751	16,861	94,728	56,736	70,757	12,378	33,805	57,885	87,073	113,681	34,985	61,886	92,170	129,382	108,078	123,548	102,408	193,515	226,273	267,113	272,188	323,576	373,583	429,517	492,048	446,867
CORPORATE TAX	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NET INCOME AFTER TAX	0	-1,888	-29,351	-57,538	-118,011	-68,441	-50,034	-24,680	93,887	2,751	16,861	94,728	56,736	70,757	12,378	33,805	57,885	87,073	113,681	34,985	61,886	92,170	129,382	108,078	123,548	102,408	193,515	226,273	267,113	272,188	323,576	373,583	429,517	492,048	446,867
DIVIDENT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INTERNAL RESERVES	0	-1,888	-29,351	-57,538	-118,011	-68,441	-50,034	-24,680	93,887	2,751	16,861	94,728	56,736	70,757	12,378	33,805	57,885	87,073	113,681	34,985	61,886	92,170	129,382	108,078	123,548	102,408	193,515	226,273	267,113	272,188	323,576	373,583	429,517	492,048	446,867

CASH FLOW STATEMENT

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
CASH BEGINNING		19,718	8,515	-20,389	-69,024	-137,935	-128,436	-92,663	-30,699	-284,275	-161,733	-104,881	-30,861	65,101	-288,140	-281,012	-135,433	-39,168	65,938	-328,926	-243,545	-143,385	-13,277	152,303	-101,738	68,273	266,842	496,031	759,146	790,196	1,108,556	1,484,842	1,871,460	2,342,030	1,922,128
CASH INFLOW																																			
NET OPERATING INCOME	0	0	0	0	81,320	119,379	145,333	171,347	197,295	220,404	239,518	215,094	212,809	210,741	208,849	208,848	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849	208,849
DEPRECIATION	0	0	0	0	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530	103,530
CAPITAL																																			
SPANT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LONG-TERM LOANS	48,448	228,133	181,623	1,126,317	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER CURRENT LIABILITIES	0	0	0	0	11,154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER FIXED LIABILITIES	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INTEREST ON DEPOSIT, ETC.	0	1,848	762	-3,168	-5,871	-10,978	-9,448	-4,407	3,290	-16,959	-11,866	-5,098	3,563	11,213	-24,834	-17,498	-10,869	2,683	17,675	-32,096	-21,842	-9,843	5,790	23,758	-4,845	15,556	39,196	69,887	98,461	102,258	140,390	183,144	231,938	290,407	238,218
CASH	0	0	0	0	0	0	0	0	28,949	0	0	0	0	49,845	0	0	0	0	62,852	0	0	0	0	49,940	0	0	0	29,843	0	0	0	0	0	106,545	0
TOTAL CASH INFLOW	48,448	229,981	182,385	1,123,149	190,134	211,930	239,415	270,471	334,214	307,015	330,270	313,527	320,103	375,424	287,545	294,781	303,490	315,062	392,837	280,283	290,537	302,536	318,149	388,079	307,533	327,935	351,575	376,266	440,193	414,638	452,769	495,523	544,317	787,331	550,397
CASH OUTFLOW																																			
INVESTMENT	30,730	231,123	185,878	1,122,194	0	0	0	0	299,433	0	0	0	0	489,404	0	0	0	0	828,824	0	0	0	0	499,404	0	0	0	299,433	0	0	0	0	1,865,449	0
PAYMENT FOR LONG-TERM LOANS	0	0	0	0	0	0	1,229	10,474	17,901	63,189	63,189	63,189	63,189	63,189	63,189	63,189	63,189	63,189	63,189	63,189	63,189	63,189	63,189	63,189	63,189	63,189	63,189	63,189	63,189	63,189	63,194	61,958	52,719	45,282	0
INTEREST ON LONG-TERM LOANS	0	3,534	30,113	51,468	101,869	101,869	101,869	101,521	100,323	126,284	170,897	169,731	156,484	140,187	141,830	134,664	127,397	120,130	112,863	105,597	98,330	91,063	83,796	76,530	69,263	61,996	54,730	47,463	40,196	32,929	25,663	18,395	11,270	5,207	0
OTHER CURRENT ASSETS	0	328	-233	-290	47,582	6,580	5,495	6,194	6,781	548	453	850	1,315	1,878	-8,688	1,462	1,742	2,319	9,002	-8,854	2,047	2,404	2,323	3,898	-8,123	4,040	4,769	5,496	8,315	760	1,826	8,551	9,759	11,264	-10,078
OTHER FIXED ASSETS																																			
TAX	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DIVIDENT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
INTEREST ON SHORT-TERM LOANS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL CASH OUTFLOW	30,730	234,988	215,818	1,185,374	235,045	203,431	202,530	208,389	507,813	264,471	252,428	239,308	224,341	713,668	226,333	222,201	207,225	189,638	907,879	165,882	190,356	172,428	151,569	643,120	137,522	129,266	122,697	416,150	408,133	96,879	96,483	88,904	73,748	1,127,233	-10,078
CASH INFLOW-OUTFLOW	17,718	-7,203	-32,974	-62,625	-43,981	8,499	36,773	61,883	-173,594	42,544	58,958	74,221	95,762	-338,242	61,128	72,579	96,265	125,424	-436,782	85,281	100,181	130,107	166,580	-255,041	170,011	198,642	228,866	-39,650	-32,060	317,760	356,285	406,619	470,569	-419,902	560,475
CASH ENDING	19,718	6,515	-26,389	-89,024	-133,005	-129,436	-92,663	-30,699	-204,275	-161,731	-104,881	-30,861	65,101	-288,140	-281,012	-135,433	-39,168	65,938	-328,926	-243,545	-143,385	-13,277	153,303	-101,738	68,273	266,842	496,031	759,146	790,196	1,108,556	1,484,842	1,871,460	2,342,030	1,922,128	2,482,603
CASH EXCESS	19,718	6,515	0	0	0	0	0	0	0	0	0	0	65,101	0	0	0	0	65,938	0	0	0	0	153,303	0	68,273	266,842	496,031	759,146	790,196	1,108,556	1,484,842	1,871,460	2,342,030	1,922,128	2,482,603
SHORT-TERM LOANS	0	0	26,389	89,024	133,005	129,436	92,663	30,699	204,275	161,731	104,881	30,861	0	288,140	281,012	135,433	39,168	0	328,926	243,545	143,385	13,277	0	101,738	0	0	0	0	0	0	0	0	0	0	0

BALANCE SHEET

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
CURRENT ASSETS																																			
CASH & DEPOSIT	19,718	6,515	0	0	0	0	0	0	0	0	0	0	65,101	0	0	0	0	65,938	0	0	0	0	153,303	0	68,273	266,842	496,031	759,146	790,196	1,108,556	1,484,842	1,871,460	2,342,030	1,922,128	2,482,603
OTHER CURRENT ASSETS	0	328	158	-634	46,950	53,548	59,035	65,228	72,009	72,557	73,010	73,859	75,174	77,051	68,843	70,118	71,852	74,182	77,185	68,211	69,257	71,661	228,067	76,782	148,934	243,843	577,540	846,153	884,138	1,202,537	1,568,549	1,981,719	2,462,047	2,058,439	2,603,836
TOTAL CURRENT ASSETS	19,718	6,844	158	-634	46,950	53,548	59,035	65,228	72,009	72,557	73,010	73,859	140,276	77,051	68,843	70,118	71,852	140,098	77,185	68,211	69,257	71,661	228,067	76,782	148,934	243,843	577,540	846,153	884,138	1,202,537	1,568,549	1,981,719	2,462,047	2,058,439	2,603,836
FIXED ASSETS																																			
DEPRECIABLE ASSETS	23,623	108,158	218,513	1,330,884	1,330,884	1,330,884	1,330,884	1,330,884	1,600,374	1,600,374	1,600,374	1,600,374	1,600,374	2,049,837	2,049,837	2,049,837	2,049,837	2,049,837	2,815,598	2,815,598	2,815,598	2,815,598	2,815,598	3,065,081	3,065,081	3,065,061	3,065,061	3,065,051	3,334,551	3,334,551	3,334,551	3,334,551	3,334,551	4,283,456	4,283,456
ACCUMULATION OF DEPRECIATION	0	0	0	0	103,530	207,060	310,591	414,121	517,651	621,181	724,712	828,242	931,772	1,035,302	1,138,832	1,242,363	1,345,893	1,449,423	1,552,952	1,656,484	1,760,014	1,863,544	1,967,074	2,070,604	2,174,135	2,277,665	2,381,195	2,484,725	2,588,256	2,691,786	2,795,316	2,898,846	3,002,376	3,105,907	3,209,437
NET DEPRECIABLE ASSETS	23,623	108,158	218,513	1,330,884	1,227,353	1,123,823	1,020,293	916,763	1,082,722	979,192	875,662	772,132	668,602	1,014,535	911,004	807,474	703,944	600,414	1,262,645	959,115	855,584	752,054	848,524	994,457	890,927	787,396	683,866	580,336	746,295	642,764	539,235	435,705	332,175	1,177,549	1,073,519
NON-DEPRECIABLE ASSETS	7,189	153,695	229,018	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842	248,842
TOTAL FIXED ASSETS	30,730	261,853	447,532	1,579,726	1,476,195	1,372,665	1,269,135	1,165,605	1,331,565	1,228,034	1,124,504	1,020,974	917,444	1,263,377	1,159,846	1,056,316	952,786	849,255	1,511,487	1,208,957	1,104,427	1,000,896	1,097,366	1,243,299	1,139,769	1,036,238	932,708	829,178	995,138	891,608	788,078	684,547	581,017	1,426,391	1,322,361
CURRENT LIABILITIES																																			
SHORT-TERM LOANS	0	0	26,389	89,024	137,935	129,436	92,663	30,699	204,275	161,731	104,881	30,861	0	288,140	281,012	135,433	39,168	0	328,926	243,545	143,385	13,277	0	101,738	0	0	0	0	0	0	0	0	0	0	0
OTHER CURRENT LIABILITIES	0	0	0	0	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154
TOTAL CURRENT LIABILITIES	0	0	26,389	89,024	149,089	140,590	103,817	41,854	215,429	172,885	116,035	41,014	11,154	299,294	292,166	146,587	50,322	11,154	339,980	254,699	154,539	24,431	11,154	112,892	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154	11,154
FIXED LIABILITIES																																			
LONG-TERM LOANS	48,448	276,585	452,508	1,578,825	1,578,825	1,578,825	1,578,825	1,577,598	1,567,122	1,548,221	1,486,032	1,422,843	1,359,654	1,298,465	1,233,276	1,170,087	1,106,898	1,043,709	980,520	917,331	854,142	790,953	727,764	664,575	601,386	538,197	475,008	411,819	348,630	285,441	222,252	158,058	97,100	44,381	-901	-901
OTHER FIXED LIABILITIES																																			
TOTAL FIXED LIABILITIES	48,448	276,585	452,508	1,578,825	1,578,825	1,578,825	1,578,825	1,577,598	1,567,122	1,548,221	1,486,032	1,422,843	1,359,654	1,298,465	1,233,276	1,170,087	1,106,898	1,043,709	980,520	917,331	854,142	790,953	727,764	664,575	601,386	538,197	475,008	411,819	348,630	285,441	222,252	158,058	97,100	44,381	-901	-901
CAPITAL																																			
CAPITAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
RESERVES	0	-1,888	-31,219	-88,757	-204,769	-293,210	-353,244	-378,123	-361,076	-358,325	-341,384	-306,635	-249,899	-179,143	-166,764	-127,856	-69,393	17,680	131,341	166,328	278,192	370,363	449,724	887,803	331,352	883,760	1,087,275	1,313,548	1,582,661	1,860,839	2,194,435	2,558,012	2,937,529	3,429,577	3,926,444
TOTAL	0	-1,888	-31,219	-88,757	-204,769	-293,210	-353,244	-378,123	-361,076	-358,325	-341,384	-306,635	-249,899	-179,143	-166,764	-127,856	-69,393	17,680	131,341	166,328	278,192	370,363	449,724	887,803	331,352	883,760	1,087,275	1,313,548	1,582,661	1,860,839	2,194,435	2,558,012	2,937,529	3,429,577	3,926,444

FINANCIAL INDICATORS

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
WORKING PARTICLE(%)					238	207	188	171	161	152	152	152	155	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151	151
OPERATING PARTICLE(%)					661	574	524	484	454	422	422	432	439	431	431	431	432	432	432	432	432	432	432	455	433	431	431	431	431	431	431	431	431	431	431
RATE OF RETURN ON NET FIXED ASSETS(%)					51	91	113	151	151	181	192	211	233	193	181	201	220	256	164	171	181	211	231	171	181	201	221	251	211	231	271	311	351	151	341
DEBT SERVICE COVERAGE RATIO(TIMES)					1.0	1.2	1.4	1.4	1.5	1.3	1.4	1.4	1.4	1.5	1.5	1.8	1.8	1.7	1.9	1.9	1.8	2.0	2.1	2.2	2.4	2.5	2.6	2.9	3.0	3.2	3.5	3.7	4.9	6.2	

6.5 Sensitivity Analysis

Sensitivity analysis is made for the following three cases.

Case I: The revenues decrease by 10%.

Case II: The project costs increase by 10%.

Case III: The revenues decrease by 10% and the project costs increase by 10%.

The FIRR of each case is as shown in Table 6.5.1. The ratio of each case is less than the weighted average interest rate of funds during the project life.

Table 6.5.1 FIRR Sensitivity Analysis

	Base Case	Case I	Case II	Case III
FIRR	12.7	10.7	10.9	9.0
Average Interest Rate	11.5			

6.6 Conclusion

Judging from the above analysis, this project is financially feasible in the base case. However, it is recommended that the interest rate on the long-term loans from the government be kept less than 11.5% in order to ensure the competitive position of inland waterway container transport.

APPENDIX

PART I MASTER PLAN

Table A-2-1-(1) Meteorological Condition at Dhaka Station

Wind Speed(Knots)

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1961	2.9	3.1	5.6	5.1	7.6	6.4	8.0	7.5	6.0	3.4	2.9	3.6
1962	4.6	4.1	5.0	8.4	5.3	5.8	6.4	5.2	7.6	2.3	2.6	3.7
1963	2.6	3.7	4.1	4.8	5.2	5.6	5.9	4.4	4.7	6.1	2.8	3.4
1964	3.2	3.4	5.3	8.3	4.8	5.3	4.5	5.6	6.0	5.0	4.1	3.6
1965	3.6	4.0	5.4	6.7	6.3	5.2	5.8	5.7	4.6	3.3	3.7	3.8
1966	-	-	-	8.5	5.8	9.1	5.3	4.5	3.8	6.3	3.0	2.8
1967	3.3	3.2	3.9	6.5	6.6	5.2	4.9	5.0	4.5	2.0	3.4	2.6
1968	3.1	3.0	4.4	5.4	4.8	4.1	4.6	4.5	3.7	2.9	3.2	3.0
1969	3.4	2.9	4.8	5.1	4.1	4.5	5.0	4.4	5.6	3.0	2.4	2.9
1970	3.3	3.1	5.0	5.8	6.4	4.7	4.4	4.5	3.6	3.6	3.5	3.0
1971	3.3	3.4	-	-	3.0	4.8	4.9	4.3	3.8	3.8	2.5	-
1972	3.0	3.3	5.5	6.0	6.0	4.4	7.2	4.8	3.4	4.5	3.1	3.1
1973	2.8	3.1	3.6	4.8	4.5	3.3	-	4.0	3.8	2.2	6.5	3.0
1974	-	-	-	-	-	-	-	-	-	-	-	-
1975	2.8	3.5	4.2	6.5	5.1	3.8	3.8	4.7	3.7	3.4	2.8	2.6
1976	2.8	3.8	5.5	5.8	5.0	5.1	5.4	5.0	4.5	2.9	2.9	2.0
1977	2.9	3.8	4.6	7.5	5.6	5.6	4.4	5.6	5.4	4.2	3.8	2.2
1978	3.4	4.3	5.5	4.7	5.0	5.2	4.1	5.5	3.0	4.0	3.1	3.7
1979	3.2	3.0	5.0	4.3	4.8	4.5	3.9	5.5	3.2	3.7	5.2	3.4
1980	2.7	2.9	5.2	7.4	4.5	4.0	4.5	3.6	4.2	5.9	2.0	2.6
Ave.	3.2	3.4	4.9	6.2	5.3	5.1	5.2	5.0	4.5	3.8	3.3	3.0

Table A-2-1-(2) Meteorological Condition at Dhaka Station

Maximum Temperature(°C)

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1961	26.1	25.4	33.2	34.5	31.8	30.6	31.0	30.8	30.7	30.4	27.9	24.6
1962	25.1	29.0	34.8	35.3	32.5	31.2	31.7	30.8	31.7	30.4	28.5	25.7
1963	25.5	30.6	33.5	33.7	31.8	31.2	31.1	31.2	31.9	30.3	28.3	26.1
1964	24.3	28.7	33.9	32.9	32.6	31.6	30.3	31.2	31.3	30.3	28.1	26.2
1965	25.3	27.5	32.5	34.2	33.3	30.9	30.6	30.3	31.0	31.1	29.3	25.5
1966	-	-	-	36.5	35.4	31.1	30.8	30.9	30.6	29.9	29.0	25.2
1967	25.3	29.2	29.2	33.3	33.2	32.4	31.5	31.1	30.4	30.8	28.4	26.5
1968	25.0	27.5	33.0	33.7	33.8	30.3	30.7	31.2	32.3	30.6	28.8	25.7
1969	25.2	29.2	32.4	34.1	34.0	31.5	31.1	30.3	31.7	31.0	29.2	26.2
1970	24.8	28.8	32.4	34.1	34.4	31.9	31.1	31.0	31.3	29.8	27.9	25.6
1971	24.8	27.4	-	-	31.3	30.3	30.3	29.5	30.7	30.5	27.5	-
1972	25.9	26.0	32.7	33.2	33.9	32.0	31.7	30.4	32.3	31.7	29.7	26.5
1973	26.6	29.8	30.7	34.8	31.2	31.4	-	31.3	31.0	30.6	27.4	24.5
1974	-	-	-	-	-	-	-	-	-	-	-	-
1975	25.2	28.3	33.2	34.8	32.7	32.1	29.8	31.1	30.5	30.7	27.4	25.3
1976	25.9	28.0	31.5	34.8	32.4	30.9	30.8	30.4	31.6	31.3	25.0	26.0
1977	25.0	27.7	33.3	31.4	31.0	30.3	31.2	31.5	32.2	30.1	28.7	25.7
1978	24.4	27.3	31.9	33.0	31.4	31.2	31.2	31.7	31.3	31.9	30.1	27.1
1979	26.8	27.3	33.0	34.9	35.8	32.4	31.5	31.6	31.5	31.4	30.3	25.3
1980	24.7	28.0	32.0	35.7	31.9	31.6	31.0	31.4	31.5	30.5	29.5	26.6
Ave.	25.3	28.1	32.5	34.2	32.9	31.3	31.0	30.9	31.3	30.7	27.9	25.8

Table A-2-1-(3) Meteorological Condition at Dhaka Station

Minimum Temperature (°C)

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1961	13.2	13.5	22.1	23.8	25.3	26.0	26.4	26.2	25.7	23.8	16.3	11.3
1962	9.6	14.3	18.2	23.7	24.0	25.9	26.7	26.1	25.8	23.1	16.7	12.4
1963	10.6	15.2	18.8	22.0	24.1	25.9	26.5	26.6	26.2	23.5	17.7	13.6
1964	11.0	15.2	21.2	23.7	24.6	25.7	25.9	26.4	26.1	24.8	19.6	13.9
1965	11.8	14.3	18.0	23.4	25.7	25.7	26.0	25.4	25.8	23.2	18.0	14.3
1966	-	-	-	24.4	25.7	25.9	26.2	26.8	25.6	22.6	19.4	13.8
1967	12.9	15.8	19.4	22.0	25.0	26.0	26.4	26.2	25.5	22.8	15.9	13.4
1968	12.1	13.6	19.7	23.3	24.0	25.1	26.4	26.2	26.5	23.8	18.8	13.8
1969	11.8	14.4	20.6	23.6	25.5	26.0	26.5	25.5	26.3	23.3	18.3	13.9
1970	12.0	15.4	20.6	24.4	25.6	26.2	26.3	26.2	26.2	23.9	18.7	12.9
1971	12.9	14.5	-	-	23.7	25.7	25.6	24.6	25.3	24.2	17.3	-
1972	12.0	12.9	20.1	22.8	25.9	25.8	26.3	25.5	25.9	23.5	18.3	13.4
1973	12.4	16.5	19.3	24.7	23.6	25.7	-	25.9	25.5	24.1	19.1	14.1
1974	-	-	-	-	-	-	-	-	-	-	-	-
1975	12.3	15.6	19.9	23.9	24.7	26.0	25.7	25.9	25.3	24.4	18.0	12.4
1976	12.4	16.5	21.3	24.1	23.9	25.1	25.9	25.4	25.8	23.3	20.1	12.2
1977	11.7	15.0	22.2	22.2	23.1	25.2	26.3	26.7	26.1	22.8	20.2	19.3
1978	10.6	14.2	18.3	22.2	23.9	25.7	25.9	26.6	25.8	24.5	19.3	12.6
1979	12.4	14.1	19.8	24.0	26.3	26.5	26.6	26.5	26.1	23.9	20.9	14.3
1980	12.0	15.3	20.8	25.1	22.9	26.4	26.1	26.5	26.3	23.4	17.8	16.1
Ave.	11.9	14.8	20.0	23.5	24.6	25.8	26.2	26.1	25.9	23.6	18.4	13.4

Table A-2-1-(4) Meteorological Condition at Dhaka Station

Relative Humidity (%)

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1961	70	66	70	70	80	88	86	87	86	84	76	76
1962	70	66	49	68	79	87	85	86	85	78	74	74
1963	67	56	55	67	80	86	86	85	85	83	77	74
1964	69	66	63	76	79	86	88	85	85	86	77	72
1965	69	63	56	69	78	88	86	87	86	80	77	79
1966	-	-	-	66	72	86	85	87	86	82	75	76
1967	71	65	70	63	79	84	85	85	87	77	69	71
1968	68	60	56	69	76	88	86	85	82	80	74	73
1969	66	60	65	72	74	86	86	88	82	78	73	72
1970	70	62	62	72	75	86	87	86	85	85	74	71
1971	71	59	-	-	76	84	85	87	81	78	71	-
1972	69	63	60	73	77	83	86	87	81	77	71	68
1973	64	62	62	74	85	87	-	85	87	83	82	78
1974	-	-	-	-	-	-	-	-	-	-	-	-
1975	69	63	57	71	79	84	89	85	87	85	77	70
1976	66	67	64	66	80	87	87	87	83	79	74	71
1977	66	66	68	81	83	88	87	84	85	79	78	73
1978	67	61	53	73	84	88	86	83	86	80	72	68
1979	80	75	70	75	80	89	90	90	91	88	85	87
1980	69	66	64	69	81	85	86	85	85	81	70	69
Ave.	69	64	61	71	79	86	86	86	85	81	75	73

Table A-2-1-(5) Monthly Total Rainfall at Dhaka Station

Unit:mm

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1961	1	12	20	205	219	856	296	288	221	52	0	0
1962	0	15	6	116	205	191	355	273	395	180	0	0
1963	0	0	51	98	219	621	404	186	201	182	7	3
1964	9	42	18	275	236	354	629	155	269	283	41	0
1965	0	28	22	55	305	442	304	480	300	50	131	0
1966	-	-	-	34	127	270	291	306	496	261	14	15
1967	23	13	168	185	216	241	363	504	266	74	1	0
1968	0	5	121	27	194	590	480	207	128	69	74	0
1969	0	1	65	86	95	249	186	540	201	103	2	0
1970	16	8	23	45	192	276	496	280	200	427	32	0
1971	3	28	-	-	344	339	550	540	259	118	95	-
1972	0	11	12	248	340	353	249	380	110	105	0	0
1973	0	21	32	131	621	414	-	238	348	128	64	86
1974	-	-	-	-	-	-	-	-	-	-	-	-
1975	1	29	13	98	317	235	559	307	329	232	25	0
1976	0	7	117	34	459	627	346	361	165	114	8	0
1977	0	66	71	255	381	252	306	92	131	273	10	24
1978	0	20	18	194	454	529	320	426	192	98	0	0
1979	3	13	6	17	114	258	267	525	382	146	55	51
1980	3	32	54	147	414	323	380	269	296	300	0	0
Ave.	3	20	48	125	287	391	377	335	257	168	29	10

Table A-2-2-(1) Water level of Buriganga River at Dhaka (Mill Bark) Station, (m/P.W.D)

(No.1)

	Apr						May						Jun					
	H.W.L			L.W.L			H.W.L			L.W.L			H.W.L			L.W.L		
	AV1	AV2	AV3	AV1	AV2	AV3	AV1	AV2	AV3	AV1	AV2	AV3	AV1	AV2	AV3	AV1	AV2	AV3
1977	2.403	2.321	2.257	1.747	1.870	1.905	2.832	3.037	3.086	2.448	2.736	2.841	3.702	4.019	4.381	3.516	3.943	4.307
1978	1.751	1.722	2.109	0.954	1.125	1.465	2.146	2.333	3.242	1.507	1.836	2.886	3.322	3.563	4.237	3.076	3.418	4.106
1979	1.599	1.893	1.955	0.972	1.207	1.259	1.894	2.492	2.531	1.349	1.932	2.077	2.199	2.667	3.022	1.800	2.227	2.649
1981	1.950	2.149	2.119	1.246	1.581	1.653	2.322	2.191	2.628	1.714	1.735	2.258	3.106	3.012	3.272	2.800	2.710	3.015
1983	1.842	2.078	2.260	1.264	1.414	1.626	2.434	2.821	2.915	2.038	2.459	2.580	3.017	3.300	3.704	2.771	3.043	3.529
1984	2.012	2.211	1.999	1.315	1.529	1.476	2.416	2.917	3.271	1.885	2.484	3.034	3.878	4.062	4.519	3.690	3.901	4.458
1985	1.985	2.213	2.340	1.214	1.339	1.531	2.699	2.345	2.527	2.090	1.820	2.040	3.517	3.664	3.985	3.152	3.510	3.820
1986	1.634	1.946	2.249	0.949	1.357	1.625	2.240	2.307	2.524	1.736	1.888	1.988	2.239	2.644	3.364	1.718	2.174	2.973
1987	1.737	2.196	2.174	1.177	1.563	1.628	2.019	2.293	2.285	1.640	1.793	1.846	2.595	3.115	3.574	2.241	2.802	3.385
1988	2.017	2.261	1.917	1.375	1.595	1.512	2.297	2.795	3.333	1.781	2.329	3.115	3.997	3.899	4.091	3.810	3.747	3.997
Ave	1.893	2.099	2.138	1.221	1.458	1.568	2.330	2.553	2.834	1.819	2.101	2.467	3.157	3.395	3.815	2.857	3.148	3.624

	Jul						Aug						Sep					
	H.W.L			L.W.L			H.W.L			L.W.L			H.W.L			L.W.L		
	AV1	AV2	AV3	AV1	AV2	AV3	AV1	AV2	AV3	AV1	AV2	AV3	AV1	AV2	AV3	AV1	AV2	AV3
1977	4.452	4.480	5.061	4.377	4.436	5.022	5.197	5.168	5.448	5.168	5.142	5.419	5.496	5.041	4.568	5.474	5.007	4.523
1978	4.534	4.476	4.741	4.481	4.412	4.680	4.880	5.037	5.050	4.837	5.034	5.003	4.555	4.564	4.482	4.485	4.504	4.438
1979	3.574	4.058	4.479	3.391	3.926	4.411	5.090	4.746	4.619	5.040	4.673	4.555	4.653	4.811	4.465	4.589	4.773	4.400
1981	4.217	4.577	4.890	4.071	4.531	4.847	5.349	5.255	5.085	5.306	5.212	5.048	5.140	5.020	4.722	5.105	4.975	4.667
1983	4.137	4.540	4.610	4.027	4.467	4.545	5.145	4.993	4.878	5.084	4.937	4.815	5.136	5.393	5.718	5.092	5.358	5.693
1984	4.498	5.063	5.467	4.424	4.998	5.435	5.871	5.380	4.710	5.846	5.331	4.680	4.927	5.305	5.892	4.908	5.274	5.847
1985	4.340	4.604	4.914	4.231	4.557	4.865	5.323	4.812	4.712	5.274	4.764	4.651	4.892	4.859	4.573	4.852	4.810	4.523
1986	3.884	4.089	4.595	3.766	3.945	4.491	4.818	4.620	4.431	4.770	4.523	4.337	4.579	4.544	4.848	4.509	4.479	4.782
1987	4.327	4.795	4.885	4.210	4.720	4.825	5.715	6.116	6.433	5.648	6.076	6.380	5.717	5.793	5.745	5.680	5.771	5.717
1988	4.505	5.546	5.392	4.387	5.508	5.354	5.333	5.316	5.976	5.294	5.279	5.898	7.383	6.560	5.210	7.327	6.504	5.135
Ave	4.247	4.623	4.904	4.137	4.550	4.848	5.272	5.144	5.134	5.230	5.097	5.079	5.248	5.189	5.022	5.202	5.146	4.973

Source:BWDB

(No.2)

	Oct						Nov						Dec					
	H.W.L			L.W.L			H.W.L			L.W.L			H.W.L			L.W.L		
	AV1	AV2	AV3	AV1	AV2	AV3	AV1	AV2	AV3	AV1	AV2	AV3	AV1	AV2	AV3	AV1	AV2	AV3
1977	4.187	4.100	3.310	4.142	4.011	3.152	2.693	2.702	2.338	2.480	2.304	1.937	2.062	2.187	1.859	1.597	1.652	1.352
1978	4.285	3.670	2.883	4.188	3.467	2.656	2.577	2.469	2.151	2.166	1.967	1.722	2.042	1.876	1.586	1.630	1.274	1.083
1979	4.182	4.246	3.440	4.048	4.176	3.289	2.816	2.146	2.327	2.048	1.724	1.737	2.233	1.893	1.762	1.622	1.353	1.155
1981	4.036	3.592	2.801	3.979	3.042	2.491	2.366	2.530	2.213	2.005	2.020	1.700	1.940	2.087	1.706	1.469	1.540	1.170
1983	5.351	4.671	4.135	5.307	4.618	4.046	3.575	2.856	2.670	3.276	2.574	2.191	2.336	1.902	1.997	1.759	1.385	1.360
1984	5.032	4.155	3.573	4.954	4.053	3.350	2.779	2.365	2.232	2.564	1.896	1.677	1.942	1.868	1.879	1.348	1.327	1.232
1985	4.420	4.286	3.855	4.365	4.131	3.732	2.992	2.871	2.281	2.742	2.356	1.799	2.088	2.170	1.815	1.569	1.495	1.157
1986	4.682	4.558	3.885	4.585	4.499	3.789	3.417	2.938	2.331	3.081	2.586	1.992	2.203	1.870	1.627	1.679	1.297	1.094
1987	5.330	4.358	3.628	5.285	4.290	3.469	3.148	2.583	2.451	2.807	2.277	1.988	2.206	1.829	2.036	1.662	1.360	1.428
1988	4.308	4.105	3.625	4.247	3.940	3.428	2.747	2.503	2.579	2.469	2.004	1.975	2.308	2.112	1.845	1.843	1.534	1.204
Ave	4.581	4.174	3.514	4.510	4.059	3.340	2.911	2.596	2.357	2.600	2.171	1.872	2.136	1.979	1.811	1.608	1.422	1.224

	Jan						Fev						May					
	H.W.L			L.W.L			H.W.L			L.W.L			H.W.L			L.W.L		
	AV1	AV2	AV3	AV1	AV2	AV3	AV1	AV2	AV3	AV1	AV2	AV3	AV1	AV2	AV3	AV1	AV2	AV3
1977	1.649	1.667	1.513	1.152	1.046	0.887	1.582	1.503	1.554	0.930	0.780	0.861	1.622	1.472	1.671	0.911	0.713	0.909
1978	1.640	1.599	1.492	1.055	1.001	0.863	1.299	1.410	1.400	0.727	0.721	0.672	1.344	1.561	1.697	0.680	0.825	0.767
1979	1.608	1.519	1.489	1.015	0.899	0.874	1.532	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1981	1.534	1.564	1.561	0.955	0.971	0.858	1.508	1.475	1.518	0.729	0.693	0.824	1.434	1.550	1.747	0.724	0.798	0.986
1983	1.882	1.809	1.787	1.218	1.133	1.175	1.784	1.668	1.399	1.065	0.910	0.734	1.709	1.793	1.690	0.961	1.034	1.016
1984	1.660	1.575	1.546	0.990	0.913	0.854	1.640	1.510	1.525	0.892	0.780	0.750	1.795	1.830	2.025	0.856	1.048	1.304
1985	1.592	1.612	1.520	0.993	0.955	0.784	1.519	1.339	1.469	0.806	0.692	0.673	1.423	1.505	1.630	0.760	0.876	0.886
1986	1.646	1.499	1.425	1.099	0.911	0.853	1.461	1.489	1.436	0.896	0.862	0.708	1.427	1.591	1.594	0.750	0.879	0.926
1987	1.873	1.620	1.570	1.228	1.068	0.975	1.583	1.647	1.628	0.932	1.000	1.061	1.734	1.753	1.675	1.090	1.141	1.157
1988	1.654	1.489	1.495	1.090	0.909	0.783	1.767	1.519	1.628	0.952	0.881	0.913	1.655	1.576	1.737	0.926	0.956	1.039
Ave	1.674	1.595	1.540	1.080	0.981	0.891	1.568	1.507	1.506	0.881	0.813	0.802	1.571	1.626	1.718	0.850	0.919	1.021

Appendix 3.1 Questionaires of O/D Survey (Export)

FORM B(FOR EXPORT CARGO)

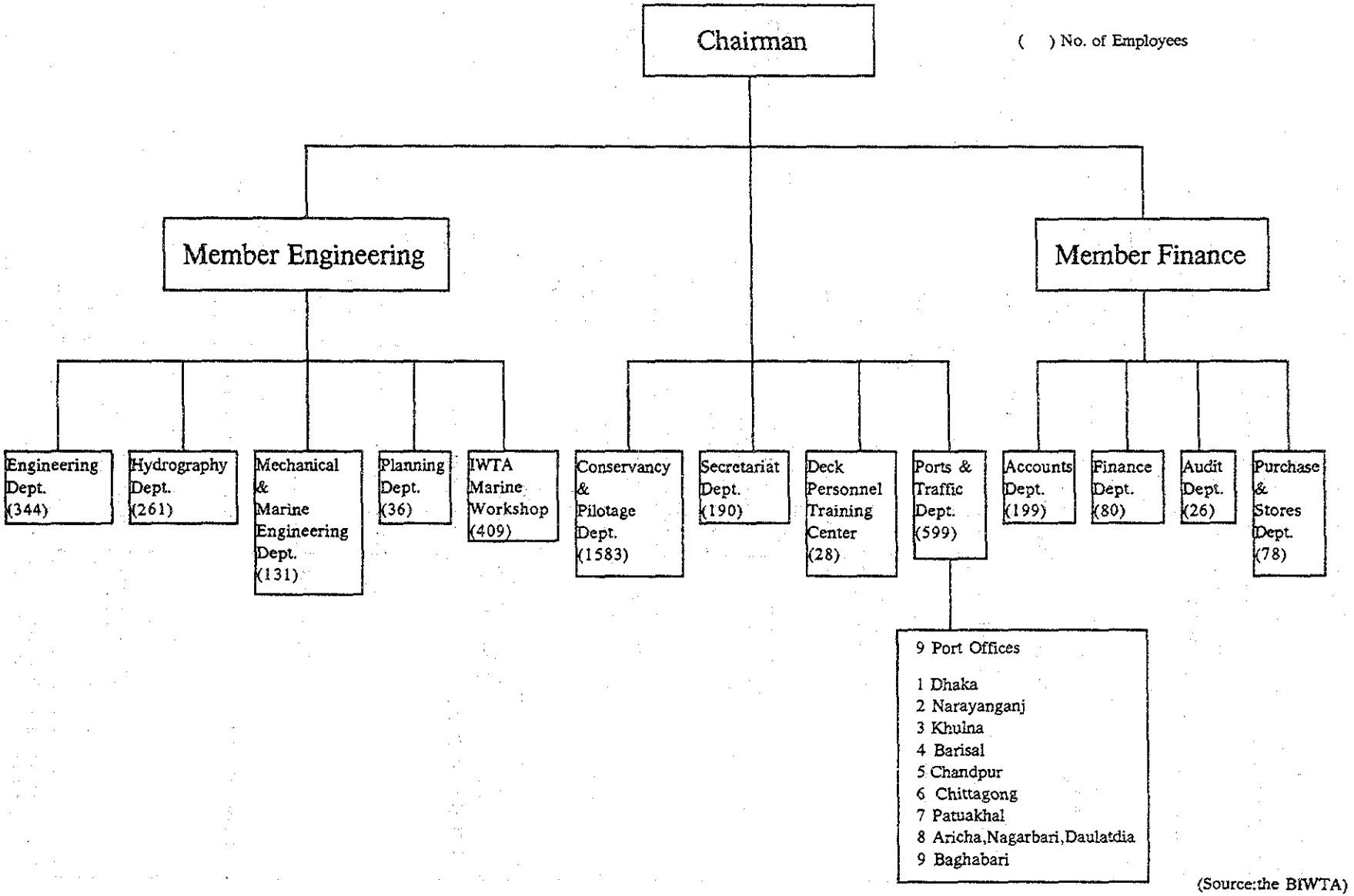
DATE OF INVESTIGATION		NAME OF INVESTIGATOR		
OBJECT OF INVESTIGATION	NAME OF FIRM			
	CAPITAL		CATEGORY OF BUSINESS	
	1 LESS THAN		1 MAKER(SHIPPER) 4 OTHERS	
	2 TO		2 FORWARDER/CONSOLIDATOR	
	3 OVER		3 SHIPPING COMPANY/AGENT	
KIND OF CARGO			CUSTOMS CODE NO. OF CARGO	
VOLUME OF CARGO	WEIGHT: mt/l	MEASURE: ft/m	PACKAGE	
TYPE OF PACKING		KIND OF CONTAINER	SIZE OF CONTAINER	TYPE OF CONTAINER LOAD
	1 CONTAINER	1 DRY	1 20 FEET	1 FCL
		2 REEFER	2 40 FEET	2 LCL
		3 OTHERS	3 OTHERS	
	2 NON-CONTAINER	1 PALLET	5 DRUM	
		2 BAG	6 BULK	
		3 CARTON/CASE	7 OTHERS	
		4 BALE		
VANNING (ONLY CONTAINER)	AREA(ANNEX-1)	FACILITY		TIME REQUIRED (COMMENCEMENT TO COMPLETION OF VANNING)
		1 MAKER'S FACTORY	4 PORT AUTHORITY'S WAREHOUSE	HOURS
		2 SHIPPER'S WAREHOUSE	5 OTHERS	
		3 FORWARDER/ CONSOLIDATOR'S WAREHOUSE		
CUSTOMS CLEARANCE	AREA(ANNEX-1)	FACILITY		TIME REQUIRED (DECLARATION TO PERMISSION)
		1 MAKER'S FACTORY	4 PORT AUTHORITY'S WAREHOUSE	DAYS
		2 SHIPPER'S WAREHOUSE	5 OTHERS	
		3 FORWARDER/ CONSOLIDATOR'S WAREHOUSE		
DELIVERY	TIME REQUIRED(RECEIVING TO DELIVERY AT VANNING OR CLEARANCE DEPOT)			DAYS
ORIGIN(ANNEX-1)		COUNTRY OF DESTINATION(ANNEX-2)		
INLAND TRANSPORT	1 THROUGH DHAKA	ORIGIN TO DHAKA	MODE	TIME REQUIRED
			1 TRUCK 4 OTHERS	
			2 RAILWAY	DAYS
			3 VESSEL	
		DHAKA TO CHITTAGONG/KONGLA	MODE	TIME REQUIRED
			1 TRUCK 4 OTHERS	
			2 RAILWAY	DAYS
			3 VESSEL	
	2 NOT THROUGH DHAKA	ORIGIN TO CHITTAGONG /KONGLA	MODE	TIME REQUIRED
			1 TRUCK	
			2 RAILWAY	DAYS
			3 VESSEL	
HANDLING AT CHITTAGONG /KONGLA	DWELLING TIME AT CONTAINER YARDS (CARRYING IN CONTAINER YARDS TO LOADING)		DAYS	

Appendix 3.2 Questionaires of O/D Survey (Import)

FORM A(FOR IMPORT CARGO)

DATE OF INVESTIGATION		NAME OF INVESTIGATOR			
OBJECT OF INVESTIGATION	NAME OF FIRM				
	CAPITAL		CATEGORY OF BUSINESS		
	1 LESS THAN		1 CONSIGNEE	4 OTHERS	
	2 TO		2 FORWARDER/CONSOLIDATOR		
	3 OVER		3 SHIPPING COMPANY/AGENT		
KIND OF CARGO			CUSTOMS CODE NO. OF CARGO		
VOLUME OF CARGO	WEIGHT: mt/l	MEASURE: ft/m	PACKAGE		
TYPE OF PACKING	1 CONTAINER	KIND OF CONTAINER	SIZE OF CONTAINER	TYPE OF CONTAINER LOAD	
		1 DRY	1 20 FEET	1 FCL	
		2 REEFER	2 40 FEET	2 LCL	
		3 OTHERS	3 OTHERS		
	2 NON-CONTAINER	1 PALLET	5 DRUM		
		2 BAG	6 BULK		
		3 CARTON/CASE	7 OTHERS		
		4 BALE			
DEVANNING (ONLY CONTAINER)	AREA(ANNEX-1)	FACILITY		TIME REQUIRED (COMMENCEMENT TO COMPLETION OF DEVANNING)	
		1 MAKER'S FACTORY	4 PORT AUTHORITY'S WAREHOUSE		
		2 SHIPPER'S WAREHOUSE	5 OTHERS	HOURS	
		3 FORWARDER/ CONSOLIDATOR'S WAREHOUSE			
CUSTOMS CLEARANCE	AREA(ANNEX-1)	FACILITY		TIME REQUIRED (DECLARATION TO PERMISSION)	
		1 MAKER'S FACTORY	4 PORT AUTHORITY'S WAREHOUSE		
		2 SHIPPER'S WAREHOUSE	5 OTHERS	DAYS	
		3 FORWARDER/ CONSOLIDATOR'S WAREHOUSE			
DELIVERY	TIME REQUIRED(RECEIVING TO DELIVERY AT DEVANNING OR CLEARANCE DEPOT)				DAYS
DESTINATION(ANNEX-1)		COUNTRY OF ORIGIN(ANNEX-2)			
INLAND TRANSPORT	1 THROUGH DHAKA	CHITTAGONG/MONGLA TO DHAKA	MODE	TIME REQUIRED	
			1 TRUCK 4 OTHERS		
			2 RAILWAY	DAYS	
			3 VESSEL		
		DHAKA TO DESTINATION	MODE	TIME REQUIRED	
			1 TRUCK 4 OTHERS		
			2 RAILWAY	DAYS	
			3 VESSEL		
	2 NOT THROUGH DHAKA	CHITTAGONG/MONGLA TO DESTINATION	MODE	TIME REQUIRED	
			1 TRUCK		
			2 RAILWAY	DAYS	
			3 VESSEL		
HANDLING AT CHITTAGONG /MONGLA	DWELLING TIME AT CONTAINER YARDS (CARRYING IN CONTAINER YARDS TO LOADING)		DAYS		

Appendix 6.3.1 Organizational Chart of the BIWTA



(Source:the BIWTA)

Appendix 6.3.2 Revenues and Expenditure of the BIWTA (unit:Lac Taka)

(Revenues)

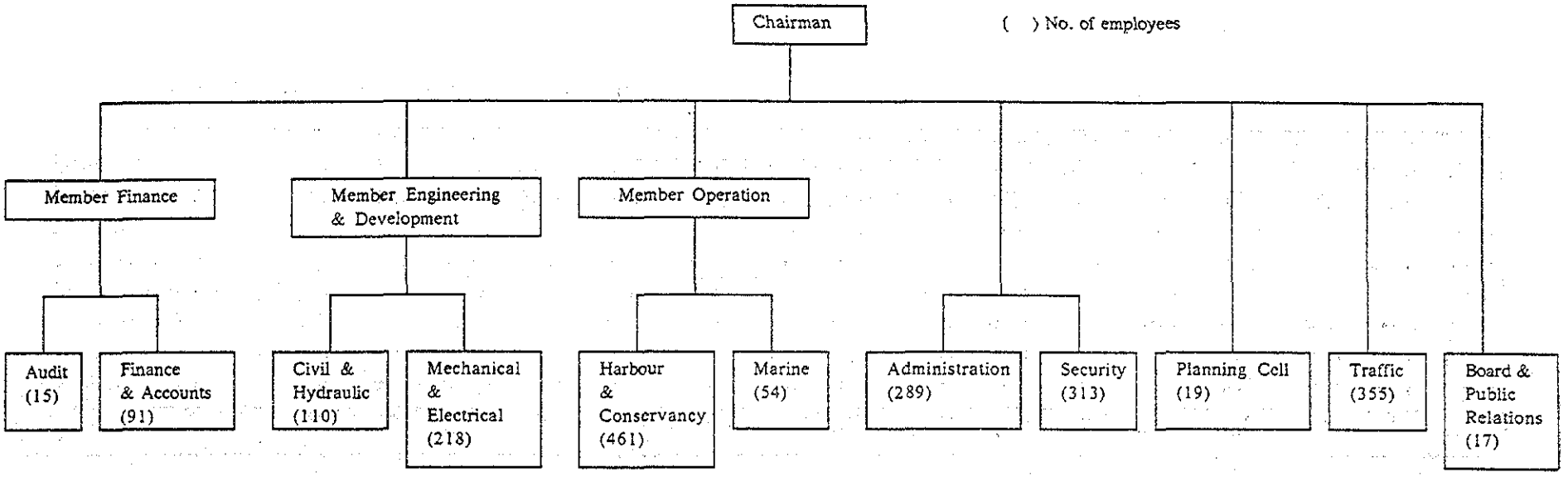
	1972 1973	1973 1974	1974 1975	1975 1976	1976 1977	1977 1978	1978 1979	1979 1980	1980 1981	1981 1982	1982 1983	1983 1984	1984 1985	1985 1986	1986 1987	1987 1988
Grant from the government	75.18 48%	31.34 12%	64.15 19%	100.15 22%	142.00 15%	133.15 22%	133.15 19%	158.15 17%	133.15 13%	213.15 15%	263.15 18%	280.15 16%	450.00 18%	556.00 28%	690.00 31%	1.065.00 35%
Own source	81.81 52%	225.93 88%	266.38 81%	363.42 78%	783.42 85%	472.33 78%	558.40 81%	777.38 83%	885.96 87%	1.209.32 85%	1.236.19 82%	1.474.04 84%	1.993.71 82%	1.448.27 72%	1.533.87 69%	1.965.50 65%
Port earnings	46.02	53.64	74.00	123.43	211.56	141.43	164.11	230.31	267.98	255.15	409.57	397.73	648.73	530.26	654.05	841.69
canal revenue	4.33	4.09	8.44	10.41	44.37	17.31	28.35	44.94	26.52	46.23	49.41	53.38	32.78	41.72	40.98	227.48
Conservancy & pilotage revenue	22.46	24.82	22.85	43.00	141.84	17.25	37.33	42.21	56.62	70.39	104.69	152.08	306.12	200.57	190.78	49.24
Dredger revenue		50.84	97.71	117.15	301.53	263.39	249.72	405.47	430.54	731.98	598.53	702.80	712.79	380.62	521.49	752.43
Other income	9.00	92.54	63.37	69.43	84.10	32.95	78.89	54.45	102.30	105.57	73.99	168.05	293.29	296.10	126.57	94.66
Total	156.99	257.27	330.53	463.57	925.42	605.48	691.55	935.53	1.019.11	1.422.47	1.499.34	1.754.19	2.443.71	2.005.27	2.223.87	3.030.50

(Expenditure)

	1972 1973	1973 1974	1974 1975	1975 1976	1976 1977	1977 1978	1978 1979	1979 1980	1980 1981	1981 1982	1982 1983	1983 1984	1984 1985	1985 1986	1986 1987	1987 1988
Salaries & Benefits	67.17	106.32	141.62	158.15	174.67	205.41	243.44	319.51	335.42	314.61	398.34	442.27	708.98	976.65	1.003.56	1.137.40
Contingencies	1.57	2.43	4.76	7.49	10.12	12.35	13.68	12.81	21.74	19.89	23.22	29.43	35.31	2.28	4.42	2.65
Fuel & Lubricants	6.10	10.97	27.09	55.99	95.91	120.90	110.14	148.23	276.52	308.98	341.23	434.51	402.49	326.28	305.63	367.30
Repairs & Maintenance	24.74	44.48	81.75	95.03	113.33	120.93	169.43	194.04	146.42	259.22	259.32	320.44	431.55	248.92	313.73	363.21
Maintenance Dredging	35.00	46.27	34.43	98.18	80.96	72.33	70.41	95.74	70.01	150.00	150.00	150.28	150.00	150.00	264.00	344.00
Depreciation					210.56		33.34	233.62	204.06	243.53	254.13	339.83	359.86	448.77	442.67	491.98
Others	26.01	43.23	45.75	49.49	231.58	89.27	84.83	49.63	92.99	227.95	182.20	167.17	163.51	372.78	354.32	376.59
Total	160.59	253.70	335.40	464.33	917.13	601.19	705.27	1.053.58	1.147.16	1.524.18	1.608.44	1.883.93	2.251.70	2.525.68	2.708.33	3.083.13
Surplus(Deficit)	-3.60	3.57	-4.87	-0.76	8.29	4.29	-13.72	-118.05	-128.05	-101.71	-107.10	-129.74	192.01	-520.39	-484.46	-52.63

(Source : the BIWTA Income and Expenditure Statement)

Appendix 6.4.1 Organizational Chart of the Mongla Port Authority



(Source:the MPA)

Appendix 6.5.1 Gang Formations of Cargo Handling at ICD

unstuff LCL import containers and store CFS with the cargo	10
remove export cargo for stuffing	10
unload export cargo from shippers' trucks and directly stuff to containers	10
unload export cargo from shippers' trucks and store CFS with the cargo	8
deliver import cargo from CFS to consignees	8
remove import cargo to auction shed	8

(Source:the CPA)

Appendix 6.5.2 Main Charges of ICD (Unit:Taka)

Description	Rates	Notes
Lift off/Lift on Charges	600 / loaded 20' 900 / loaded 40' 300 / empty 20' 450 / empty 40'	from wagons to cy. and vice versa from trucks to cy. and vice versa no additional charges for night, Fridays and Public Holidays cargo operations
Stuffing & Unstuffing Charges	56.2 / metric ton	
LCL Cargo Handling Charges	56.2 / 1000 kg.	receive or deliver cargo at CFS
Hoisting Charges on cargo	56.2 / 1000 kg.	receive or deliver cargo by the ICD's equipment
Storage Rent for Containers	US$ 1.5 / 20' US$ 3.0 / 40' US$ 4.5 / 20' US$ 9.0 / 40'	up to 28 days up to 28 days over 28 days over 28 days
Rent on Cargo	1.23 / 1000 kg. of export 3.10 / 1000 kg. of export 4.92 / 1000 kg. of export 3.10 / 1000 kg. of export 2.46-24.60/ 1000 kg. of import 6.15-61.50/ 1000 kg. of import 9.85-98.50/ 1000 kg. of import 6.15-61.50/ 1000 kg. of import	up to 7 days after the free period from 8 days to 14 days from 15 days to 21 days for each subsequently up to 7 days after the free period from 8 days to 14 days from 15 days to 21 days for each subsequently

(Source:the CPA)

Appendix 10.1.3

(1) Maximum Dimensions of Self-Propelling Vessel Navigable to the Dhaka-Narayanganj Area

It is important item in this study to confirm maximum size of vessels that can navigate the waterways in between Chittagong and Dhaka, and also Mongla and Dhaka.

Because, vessel having larger principal dimensions navigable in the subject water ways may carry more number of container, that is a transportation cost per TEU can be reduced.

In this study, the container vessels are designed so as to apply these data for design of container terminal, especially for design of layout and section figure of the wharf including strength, water depth at the wharf and cargo handling equipment on the wharf. Moreover the container terminal should be designed at the initial stage so that the terminal equipment can conform to vessel which may be operated in the future.

Information on maximum size of vessel that can navigate to the Dhaka are has been obtained from the persons concerned in BIWTA, BIWTC and private shipping companies as per attached Table 10.1.3(1).

The maximum dimension of vessel are thought to be as per 3) in Table 10.1.3(1) based on the information of above data and existing vessels dimensions.

Consequently, open type domestic service vessel is designed in following dimension with some margin considering the practice of the navigators.

Length	overall	68.00 m (223' - 0")
Length	p.p.	63.00 m (206' - 8")
Breadth	mld.	13.00 m (42' - 8")
Depth	mld.	8.00 m (26' - 0")
Draft	mld. (designed)	3.40 m (11' - 2")
Draft	mld. (scantling at sea)	3.80 m (12' - 6")

(2) Building Schedule of Container Vessel

If first container vessel for domestic service is designed and built in Japan, it takes about 16 months to delivery of the vessel at shipyard after commencement of planning design as per attached Table 10.1.3(2), this table is prepared as one example.

Table Appendix 10.1.3 (1) Max. Dimensions of Self Propelling Vessels to the Dhaka/Narayangang Area

1) Information of the subject obtained by interview with following persons in 1990 in Fest

Date	Name of Person	Position	Length O.A.	Length 10	Breath	Draft	
2. Feb.	Mr.T.Hossain	Dty. D. Cartagraphy Dept BIWTA	230-240			12	
3. Feb.	Dr.Zaful Islam	Naval Avchitect BIWTA	200		40		by Master Plan of DHV Consultant
5. Feb.	Mr.Sarwar N.A.Khan	Secretary, Coaster Owner Association of Bangladesh				10	
7. Feb.	Mr.M.Alam Chawdhury	Ex, D BSC	230		45	12	
7. Feb.	Mr.A.B.Siddig	Chairman Coast Marine	200		45		M.S. Qulan of Heart
	Mr.M.A.Hassan	Naval Arditact "	214		50	16	in the wet season
8. Feb.	Mr.A.I.Siddig	Sr.Dty.D. (PdT) BIWTA	236		43	11'-2"	
10. Feb.	Mr.Faqbque Ahmed	Sr Dty.D. (CdP) Chittagong BIWTA	250		40-45	11'-6"	
	Mr.Nur Mahammed	Master Pilot Superiror Chittagong BIWTA					
15. Feb.	Mr.Akm Nural Alan	Dty.D. Hydrography Dept. BIWTA				12	
17. Feb.	Mr.Abul Mokarrom	Sr.Dty.D Survey BIWTA				12	
18. Feb.	Mr.A.M.Talkdar	G.Manager High Speed Group	230-250		40-45	10-12	
	Mr.K.Z.Siddig	Naval Architect Do					
25. Feb.	Mr.Tawfig A.Rhaman	Naval Architact Chief Maine Construction BIWTA	230-250		42	12	We said more time to study in necessary
27. Feb.	Mr.Amiruz Zaiman	Dyt.D. (CdP) N'ganj BIWTA	200			12	
1. Mar.	Mr.M.A.Chowdhury	Chief Engineer MME, BIWTA	230-250		40-45	12	
1. Mar.	Mr.Tawfig i. Rhamen	Chief Marine Construction BIWTA					
	Mr.Azain Hassam Khan						

2) Principal dimensions of M/V RAHU d M/V SANGU owned by BIWTC	208'-6"	195'-10"	40'	12'

3) Max. dimensions of the vessels considered by the consultant	230-250' 70-76m		40-45' 12.1 -13.6	12' 3.66m

Table 10.1.3(2) Building Schedule for Container Vessel

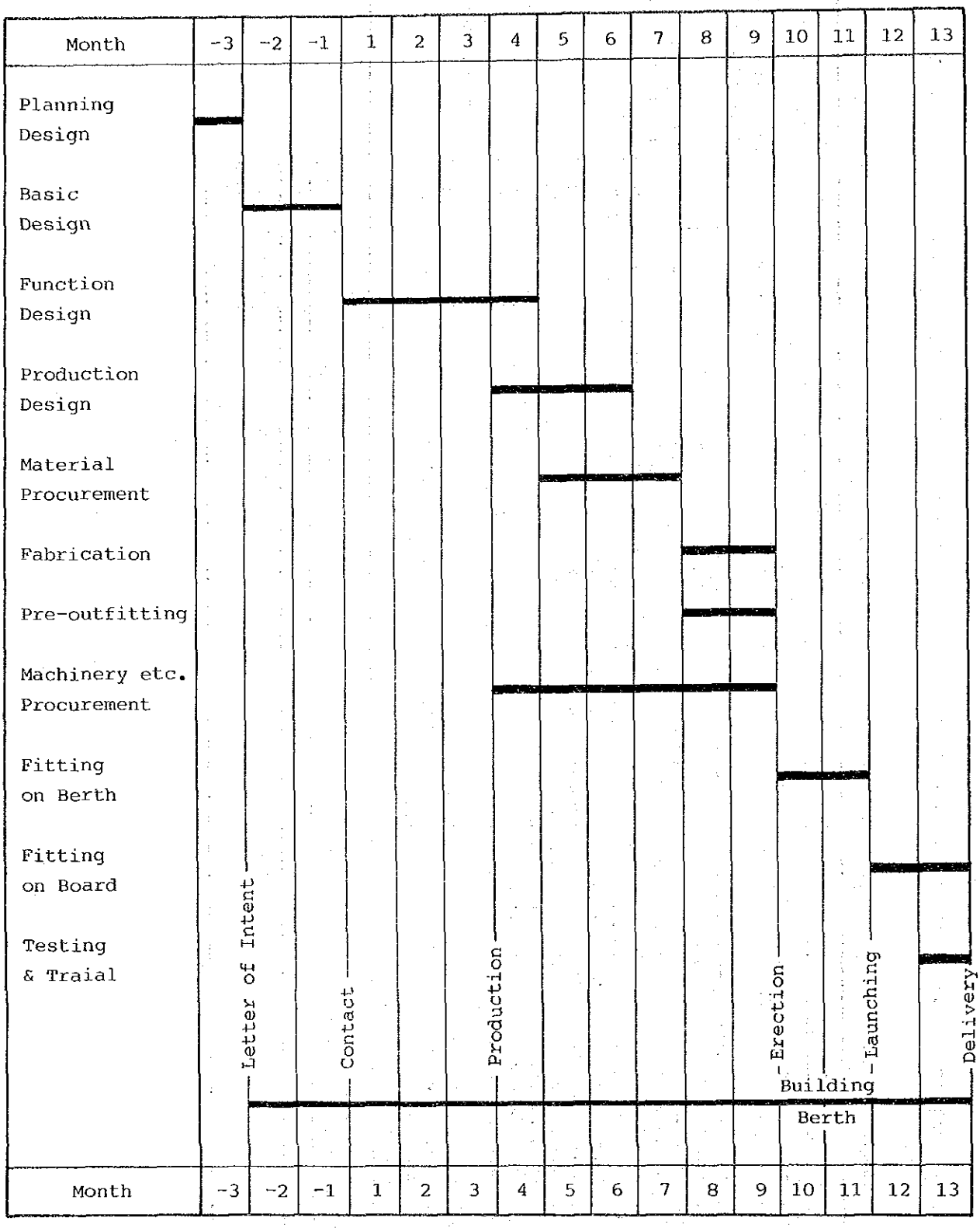


Table A-12-1(1) H.W.L OF STATION 179 DEMRA

DATE	W.L(m/P.W.D)	DATE	W.L(m/P.W.D)
10/9/1966	6.114	3/9/1980	5.940
1/8/1968	6.081	5/8/1981	5.605
4/9/1969	5.782	18/8/1982	5.000
10/8/1972	5.410	26/9/1983	5.773
17/8/1973	5.809	8/8/1984	5.950
10/8/1974	6.578	7/8/1985	5.540
11/8/1975	5.563	6/8/1986	5.020
24/8/1977	5.680	26/8/1987	6.360
16/8/1978	5.320	14/9/1988	6.675
8/8/1979	5.481	26/7/1989	5.120

Table A-12-1-(2) H.W.L and L.W.L STATION 42 MILL BARAK

H.W.L		L.W.L	
DATE	W.L(P.W.B)	DATE	W.L(P.W.B)
2/9/1977	5.639	19/3/1977	0.518
22/8/1978	5.258	8/2/1979	0.503
8/8/1979	5.283	3/3/1980	0.363
9/8/1981	5.455	5/2/1982	0.480
24/9/1983	5.765	26/2/1984	0.425
26/9/1984	6.040	16/5/1985	0.650
7/8/1985	5.410	2/2/1986	0.390
9/8/1986	5.000	11/3/1987	0.590
22/8/1987	6.640	3/1/1988	0.710
4/9/1988	7.580	1/2/1989	0.570

Table A-12-1-(3) Daily tide level a statistics/pwd (No.1)

Station: 42 Dhaka (Mill Brak) River: 20 Buriganga Year: 1988-89

Date	Apr HWL	Apr LWL	Apr RNGE	May HWL	May LWL	May RNGE	Jun HWL	Jun LWL	Jun RNGE	Jul HWL	Jul LWL	Jul RNGE
1	1.900	1.260	.640	2.150	1.580	.570	3.960	3.750	.210	4.230	4.110	.120
2	2.010	1.260	.750	2.220	1.660	.560	4.040	3.580	.190	4.230	4.140	.090
3	2.070	1.310	.760	2.340	1.750	.590	4.080	3.930	.150	4.250	4.140	.110
4	2.080	1.340	.740	2.400	1.810	.590	4.100	3.960	.140	4.270	4.170	.100
5	2.130	1.430	.700	2.360	1.830	.530	4.040	3.910	.130	4.340	4.200	.140
6	2.210	1.500	.710	2.300	1.810	.490	3.960	3.820	.140	4.450	4.300	.150
7	2.150	1.520	.630	2.250	1.780	.470	3.930	3.760	.170	4.570	4.430	.140
8	2.020	1.470	.550	2.210	1.790	.420	3.940	3.620	.320	4.740	4.600	.140
9	1.870	1.380	.490	2.270	1.840	.430	4.010	3.780	.230	4.910	4.810	.100
10	1.730	1.280	.450	2.470	1.960	.510	3.910	3.720	.190	5.060	4.970	.090
11	1.780	1.250	.530	2.590	2.050	.550	3.880	3.660	.220	5.180	5.120	.060
12	1.860	1.220	.640	2.620	2.130	.490	3.880	3.700	.180	5.320	5.260	.060
13	1.930	1.290	.640	2.680	2.130	.550	3.930	3.750	.180	5.410	5.380	.030
14	2.180	1.460	.720	2.570	2.070	.500	3.960	3.760	.200	5.530	5.470	.060
15	2.500	1.830	.670	2.680	2.160	.520	3.910	3.760	.150	5.590	5.580	.010
16	2.660	1.870	.790	2.720	2.240	.480	3.900	3.760	.140	5.640	5.620	.020
17	2.590	1.810	.780	2.840	2.360	.480	3.970	3.810	.160	5.680	5.650	.030
18	2.420	1.690	.730	3.000	2.590	.410	3.880	3.790	.090	5.730	5.710	.020
19	2.360	1.750	.610	3.110	2.760	.350	3.840	3.750	.090	5.730	5.680	.050
20	2.330	1.780	.550	3.140	2.810	.330	3.840	3.730	.110	5.650	5.610	.040
21	2.210	1.780	.440	3.200	2.950	.250	3.870	3.760	.110	5.560	5.530	.030
22	2.080	1.750	.330	3.210	3.050	.160	3.960	3.840	.120	5.490	5.440	.050
23	1.900	1.660	.240	3.120	2.920	.100	3.990	3.880	.110	5.440	5.410	.030
24	1.790	1.520	.270	3.080	2.890	.190	4.050	3.930	.120	5.380	5.330	.050
25	1.730	1.400	.330	3.080	2.880	.200	4.060	3.990	.070	5.320	5.290	.030
26	1.750	1.340	.410	3.170	2.910	.260	4.140	4.050	.090	5.330	5.300	.030
27	1.750	1.340	.410	3.230	3.000	.230	4.160	4.110	.050	5.330	5.290	.040
28	1.950	1.430	.520	3.350	3.110	.240	4.220	4.160	.060	5.320	5.290	.030
29	1.950	1.460	.520	3.500	3.320	.180	4.230	4.140	.090	5.350	5.300	.050
30	2.050	1.470	.580	3.780	3.550	.230	4.230	4.110	.120	5.380	5.350	.030
31	--	--	--	3.940	3.690	.250	--	--	--	5.410	5.360	.050
The Daily averages												
AV1	2.017	1.375	.642	2.297	1.781	.516	3.997	3.810	.187	4.505	4.387	.118
AV2	2.261	1.595	.666	2.795	2.329	.466	3.899	3.747	.152	5.546	5.508	.038
AV3	1.918	1.512	.405	3.333	3.115	.217	4.091	3.997	.094	5.392	5.354	.038
Monthly Means & Extremes												
Max	2.660	1.870	.790	3.940	3.690	.590	4.230	4.160	.320	5.730	5.710	.150
Mean	2.065	1.494	.571	2.825	2.431	.394	3.996	3.851	.144	5.155	5.092	.064
Min	1.730	1.220	.240	2.150	1.580	.160	3.840	3.620	.050	4.230	4.110	.010

Annual means & Extremes

	Date	Max.	Mean	Min.	Date
High Tide	4/ 9/1988	7.580	3.301	1.200	31/ 3/1989
Low Tide	4/ 8/1988	7.550	2.930	.570	1/ 2/1989
Range	8/ 3/1989	.950	.371	.010	15/ 7/1988

Daily tide level & statistics meter/pwd (No.2)

Station: 42 Dhaka (Mill Brak) River: 20 Buriganga Year: 1988-89

Date	Aug HWL	Aug LWL	Aug RNGE	Sep HWL	Sep LWL	Sep RNGE	Oct HWL	Oct LWL	Oct RNGE	Nov HWL	Nov LWL	Nov RNGE
1	5.420	5.380	.040	7.340	7.450	.190	4.630	4.550	080	3.010	2.920	.090
2	5.490	5.420	.070	7.510	7.430	.080	4.540	4.480	.060	2.830	2.760	.070
3	5.530	5.490	.040	7.570	7.540	.030	4.460	4.370	.060	2.710	2.630	.060
4	5.450	5.420	.030	7.580	7.550	.030	4.310	4.280	.030	2.660	2.540	.120
5	5.410	5.360	.050	7.510	7.490	.020	4.250	4.220	.030	2.650	2.440	.210
6	5.320	5.270	.050	7.460	7.410	.050	4.230	4.200	.030	2.360	2.330	.300
7	5.240	5.190	.050	7.360	7.300	.060	4.220	4.140	.080	2.690	2.300	.390
8	5.160	5.150	.010	7.240	7.200	.040	4.170	4.110	.060	2.710	2.280	.430
9	5.160	5.130	.030	7.160	7.130	.030	4.160	4.070	.090	2.790	2.250	.540
10	5.150	5.130	.020	7.100	7.070	.030	4.140	4.050	.090	2.790	2.240	.550
11	5.160	5.130	.030	7.030	6.980	.050	4.140	4.030	.110	2.710	2.180	.530
12	5.160	5.130	.030	6.940	6.900	.040	4.170	4.070	.100	2.660	2.110	.550
13	5.180	5.150	.030	6.850	6.800	.050	4.200	4.100	.100	2.620	2.070	.550
14	5.210	5.180	.030	6.760	6.740	.020	4.190	4.080	.110	2.560	2.020	.540
15	5.270	5.230	.040	6.670	6.610	.060	4.130	4.020	.110	2.400	1.960	.440
16	5.330	5.290	.040	6.560	6.510	.050	4.000	3.930	.070	2.340	1.890	.450
17	5.380	5.330	.050	6.450	6.390	.060	3.900	3.810	.090	2.280	1.890	.390
18	5.450	5.410	.040	6.290	6.220	.070	3.820	3.720	.100	2.300	1.890	.410
19	5.490	5.450	.040	6.110	6.020	.090	4.450	3.730	.720	2.540	1.950	.590
20	5.530	5.490	.040	5.940	5.870	.070	4.050	3.910	.140	2.630	2.080	.540
21	5.550	5.520	.030	5.760	5.700	.060	3.850	3.750	.100	2.480	2.050	.430
22	5.560	5.550	.010	5.630	5.580	.050	3.780	3.660	.120	2.620	1.990	.630
23	5.590	5.580	.010	5.500	5.440	.060	3.620	3.550	.070	2.590	1.950	.640
24	5.620	5.590	.030	5.380	5.290	.090	3.620	3.530	.090	2.560	1.920	.640
25	5.670	5.640	.030	5.250	5.150	.100	3.750	3.490	.260	2.530	1.920	.610
26	5.760	5.710	.050	5.140	5.040	.100	3.760	3.460	.300	2.400	1.810	.590
27	5.840	5.820	.020	5.030	4.940	.090	3.750	3.440	.310	2.330	1.730	.600
28	6.020	5.850	.170	4.920	4.840	.080	3.660	3.400	.260	2.370	1.750	.620
29	6.380	6.190	.190	4.800	4.740	.060	3.520	3.250	.270	2.560	1.830	.730
30	6.720	6.540	.180	4.690	4.630	.060	3.370	3.150	.220	3.350	2.800	.550
31	7.030	6.890	.140	--	--	--	3.200	3.030	.170	--	--	--
The Daily averages												
AV1	5.333	5.294	.039	7.383	7.327	.056	4.308	4.247	.061	2.747	2.469	.278
AV2	5.316	5.279	.037	6.560	6.504	.056	4.105	3.940	.165	2.503	2.004	.499
AV3	5.976	5.898	.089	5.210	5.135	.075	3.625	3.428	.197	2.579	1.975	.604
Monthly Means & Extremes												
Max	7.030	6.890	.190	7.580	7.550	.190	4.630	4.550	.720	3.350	2.920	.730
Mean	5.556	5.504	.052	6.384	6.322	.062	4.000	3.857	.143	2.610	2.149	.460
Min	5.150	5.130	.010	4.690	4.630	.020	3.200	3.030	.030	2.280	1.730	.070

Annual means & Extremes

	Date	Max.	Mean	Min.	Date
High Tide	4/ 9/1988	7.580	3.301	1.200	31/ 3/1989
Low Tide	4/ 8/1988	7.550	2.930	.570	1/ 2/1989
Range	8/ 3/1989	.950	.371	.010	15/ 7/1988

Daily tide level a statistics meter/pwd (No.3)

Station: 42 Dhaka (Mill Brak) River: 20 Buriganga Year: 1988-89

Date	Dec HWL	Dec LWL	Dec RNGE	Jan HWL	Jan LWL	Jan RNGE	Feb HWL	Feb LWL	Feb RNGE	Mar HWL	Mar LWL	Mar RNGE
1	2.590	2.250	.340	1.490	1.110	.380	1.320	.570	.750	1.290	.940	.350
2	2.280	2.010	.270	1.430	1.080	.350	1.460	.730	.730	1.280	.910	.370
3	2.160	1.830	.330	1.570	1.050	.520	1.570	.770	.800	1.460	.800	.660
4	2.160	1.750	.410	1.570	1.000	.570	1.700	.910	.790	1.460	.760	.700
5	2.220	1.750	.470	1.580	1.000	.580	1.730	1.000	.730	1.540	.820	.720
6	2.280	1.780	.500	1.640	1.110	.530	1.870	1.000	.870	1.670	.830	.840
7	2.340	1.790	.550	1.700	1.110	.590	1.990	1.150	.840	1.790	.940	.850
8	2.370	1.810	.560	1.790	1.120	.670	2.040	1.120	.920	1.950	1.000	.950
9	2.340	1.760	.580	1.870	1.170	.700	2.040	1.150	.890	2.040	1.120	.920
10	2.340	1.700	.640	1.900	1.150	.750	1.950	1.120	.830	2.070	1.140	.930
11	2.370	1.700	.670	1.890	1.120	.770	1.790	1.120	.670	2.040	1.250	.790
12	2.370	1.700	.670	1.780	1.090	.690	1.630	1.040	.590	1.840	1.180	.660
13	2.340	1.690	.650	1.580	1.030	.550	1.410	.920	.190	1.720	1.060	.660
14	2.280	1.660	.620	1.410	1.000	.410	1.280	.750	.530	1.490	.890	.600
15	2.180	1.610	.570	1.320	.970	.350	1.410	.760	.650	1.290	.830	.460
16	2.040	1.540	.500	1.220	.820	.400	1.370	.730	.640	1.430	.730	.700
17	1.890	1.430	.460	1.310	.820	.490	1.460	.820	.640	1.400	.930	.470
18	1.890	1.380	.510	1.460	.720	.740	1.520	.880	.640	1.320	.760	.560
19	1.890	1.340	.550	1.430	.800	.630	1.660	.910	.750	1.570	1.050	.520
20	1.870	1.290	.580	1.490	.720	.770	1.660	.880	.780	1.660	.880	.780
21	1.900	1.310	.590	1.520	.850	.670	1.670	.850	.820	1.790	.990	.800
22	1.950	1.290	.660	1.490	.770	.720	1.720	.910	.810	1.900	1.090	.810
23	1.950	1.250	.700	1.570	.790	.780	1.750	.960	.790	2.020	1.200	.800
24	1.930	1.220	.710	1.630	.860	.770	1.610	.930	.680	2.080	1.250	.830
25	1.930	1.220	.710	1.630	.860	.770	1.600	.860	.740	2.050	1.250	.800
26	1.930	1.190	.740	1.580	.800	.780	1.610	.940	.670	1.950	1.220	.730
27	1.930	1.220	.710	1.550	.750	.800	1.540	.910	.630	1.830	1.140	.690
28	1.790	1.150	.640	1.310	.740	.570	1.520	.940	.580	1.600	1.020	.580
29	1.690	1.150	.540	1.460	.760	.700	--	--	--	1.370	.820	.550
30	1.670	1.120	.550	1.370	.730	.640	--	--	--	1.290	.670	.620
31	1.630	1.120	.510	1.340	.700	.640	--	--	--	1.200	.760	.440
The Daily averages												
AV1	2.308	1.843	.465	1.654	1.090	.564	1.767	.952	.815	1.655	.926	.729
AV2	2.112	1.534	.578	1.489	.909	.580	1.519	.881	.638	1.576	.956	.620
AV3	1.845	1.204	.642	1.495	.783	.713	1.628	.913	.715	1.735	1.039	.695
Monthly Means & Extremes												
Max	2.590	2.250	.740	1.900	1.170	.800	2.040	1.150	.920	2.080	1.250	.950
Mean	2.081	1.516	.564	1.545	.923	.622	1.639	.915	.723	1.658	.976	.682
Min	1.630	1.120	.270	1.220	.700	.350	1.280	.570	.490	1.200	.670	.350

Annual means & Extremes

	Date	Max.	Mean	Min.	Date
High Tide	4/ 9/1988	7.580	3.301	1.200	31/ 3/1989
Low Tide	4/ 8/1988	7.550	2.930	.570	1/ 2/1989
Range	8/ 3/1989	.950	.371	.010	15/ 7/1988

Appendix 12.5.1 OUTLINE SPECIFICATION FOR CARGO HANDLING EQUIPMENT

1. General

All machinery to be designed and manufactured in accordance with Japanese Industrial Standard (JIS) and the maker's standard.

Dimensions and performance of all machinery mentioned below show their approximate values. Each value will be changed and or modified depending on the makers.

The types of containers handled by these machinery are 1A, 1AA (40 ft length), 1C, 1CC (20 ft length) of ISO design.

2. Gantry Crane (G.C.)

The gantry crane is used for loading or unloading the containers in between the container feeder vessel and the apron in the terminal.

The gantry crane has a handling capacity of about 20 containers per hour working on a domestic service container feeder vessel, as stated in Chapter 1.10.1.3.

The outreach and lifting distance of the gantry crane are designed so that the container can be handled on the vessel mentioned in Chapter 1.10.1.3 (6) which is conceived as a vessel that can navigate to the Dhaka terminal in the future.

The outline plan is shown in Fig. A-12.5.1.

(1) Design condition and criteria

Wind velocity	In operation	16m/sec
	Stowed condition	50m/sec
Ambient temperature	max.	40°C

(2) Particulars

Type of crane	Semi-rope trolly, hinged boom type gantry crane	
Rated load	(under the spreader)	30.5t
Type of spreader	20ft/40ft telescopic speeder	
Dimensions etc.		
Span of rail		10m
Outreach from riverside rail		16m
Backreach from landside rail	minus	3m (Approach 3m)
Traversing distance		23m

Lift		21m
Above rail		13m
Below rail		8m
Wheel base (center of bogic fulcrums)		16m
Buffer to buffer		21.5m
Overall length of gantry travel		250m
Wheel		
Number of gantry wheels		4 wheels/corner (16 wheels in total)
Max. wheel load, approx.		
Operating condition	Sea side	38t/wheel
	Land side	26t/wheel
Stowed condition	Sea side	42t/wheel
	Land side	45t/wheel
Rated speeds		
Main hoist With rated load		20m/min
Spreader only		20m/min
Trolly traverse		47m/min
Gantry travel		26m/min
Boom hoist (excluding latching time)		7m/min

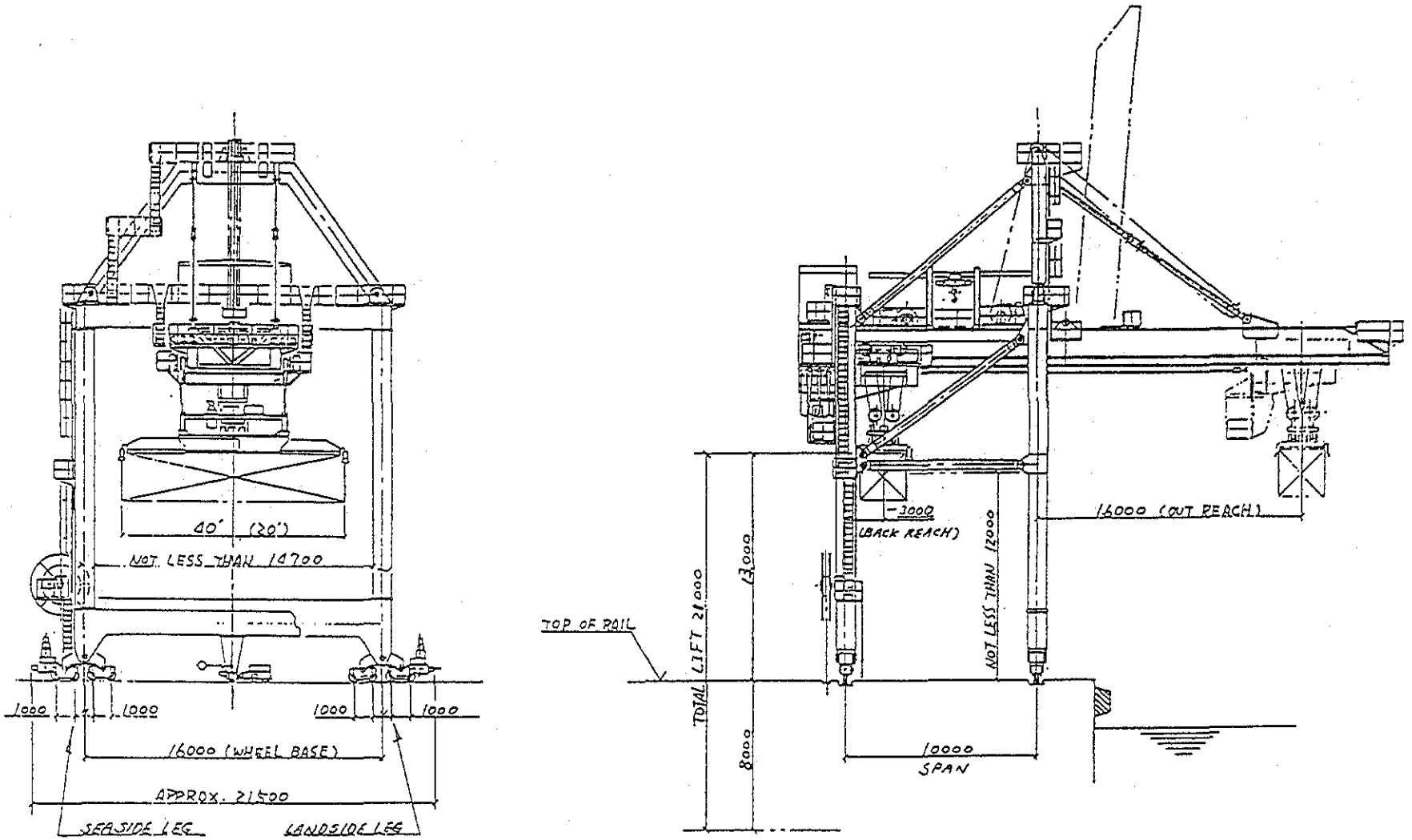
Electrical control : A.C. Thyrister primary voltage system

Power source : A.C. 400V, 50Hz, 3ϕ

Power supply system

Trolley : Festoon system

Gantry : Cable reel system



Unit : mm

Fig. A-12.5.1 Gantry Crane

3. Straddle Carrier (S.C.)

The straddle carrier is used for transporting containers in the terminal and also for stacking them up to 3 tiers, as well as passing them onto 2-tier container stocks. For the purpose the following two types, A and B, are available;

Type :		A	B
Stacking height	in tier :	3	3
Passing height with load	in tier :	2	2
Passing height without load	in tier :	3	2
Overall length :	approx.	12.2m	16.2m
Number of wheels :		8	6
Wheel load :		A is lower compared with B	

For the project, a type A straddle carrier is proposed, because of its maneuverability on berths with short length and the savings on civil work such as pavement due to the reduced wheel load.

The particulars of the type A straddle carrier are shown below and the outline plan in Fig. A-12.5.2.

Particulars

Rated load (under the spreader)	30.5t
Type of spreader	20ft/40t telescopic spreader

Dimensions, approx.

Overall length at 40ft	12.2m
Overall width	5.2m
Overall height	11.3m
Max. lifting height (upper face of container)	9.0m
Turning radius, outside 40ft spreader	10.5m

Wheels 8 wheels of rubber tire

Travelling speed (same speed for forward d reverse)

Loaded	0 - 24km/h
Empty	0 - 24km/h

Spreader lifting a lowering speed

	Lifting	Lowering
Loaded	0.20m/sec	0.35m/sec
Empty	0.22m/sec	0.30m/sec

Engine One set of Diesel, rated output about 230PS

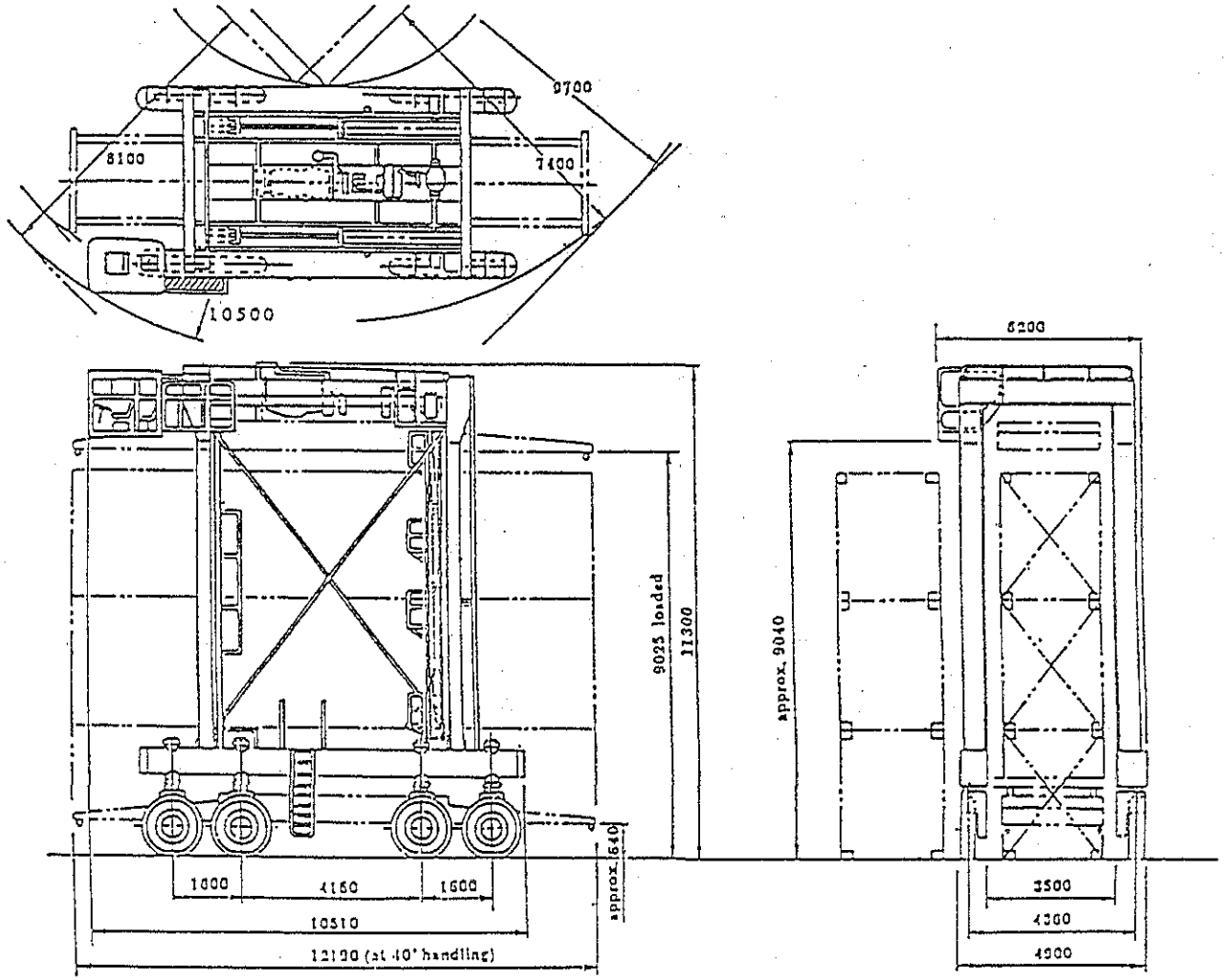


Fig. A-12.5.2 Straddle Carrier

Unit : mm

4. Top lifters of 4.5t

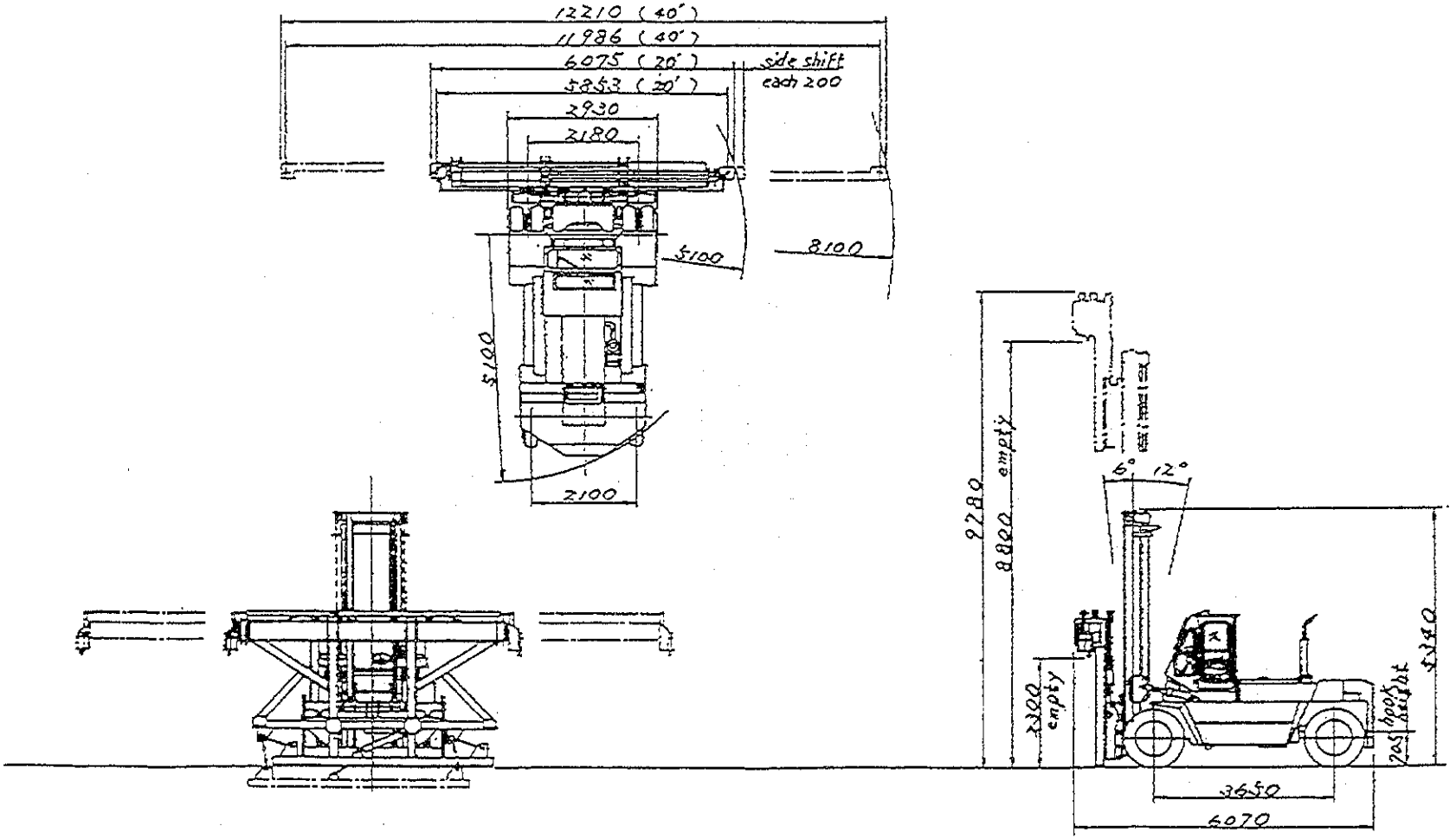
The top lifters are used for transporting empty containers and also stacking them up to 3 tiers. The outline plan is shown in Fig. A-12.5.3.

Particulars

Type of top-lifter		Counter - balance type
Type of lifter		20ft/40ft telescopic side lift frame
Rated load	by 2 stacks container	6t
	by 3 stacks container	4.5t

Dimensions approx.

Overall length	6.07m
Overall width at 40ft	12.21m
Overall height at normal	5.34m
at max. lift up	9.78m
Wheels	6 wheels of rubber tire (4 at front, 2 at rear)
Wheel base	3.65m
Turning radius, outside spreader, Min. 20'/40'	5.10/8.10m
Lifting height under the lifter	2.30-8.80m
Side shift (for rightward & leftward, each)	0.20m
Traveling speed (same for forward & reverse)	0 - 30km/n
Lifting speed with load	0.20m/sec
Gradeability	1/5
Engine	One set of Diesel, rated output about 140ps

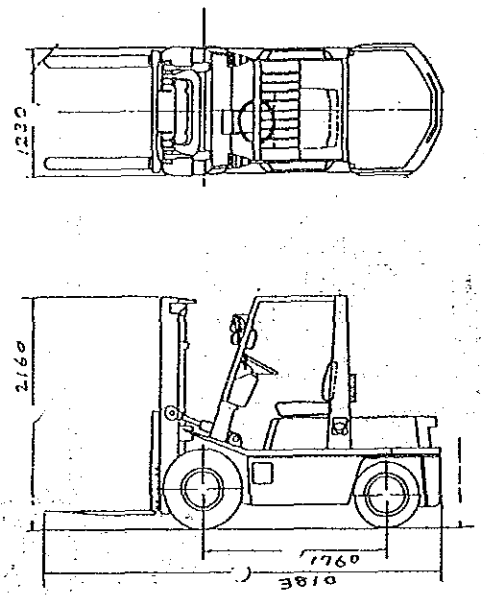


Unit : mm

Fig. A-12.5.3 Top lifter of 4.5t

5. Fork Lift of 3 t (FL-3)

Rated load			3t
Overall length			3.81m
Overall width			1.23m
Overall height	at normal		2.16m
	at max. lift up		4.43m
Wheel base			1.76m
Turning radius, outside,		min.	2.42m
Lifting height		max.	3.00m
Traveling speed (same speed forward d reverse)		max.	18km/n
Lifting speed	with load		0.48m/sec
Lowering speed	with load		0.50m/sec
Gradeability			1/5
Engine	One set of Gasoline, rated out put about		50ps



Unit : mm

Fig. A-12.5.4 Forklift of 3t

6. Tractors d Trailers (T d T)

The tractors and trailers are used for carrying container in the terminal. The tractor and the trailer are detachable. When the trailer is not coupled with the tractor, it is parked by lowering the landing gear located at the front. Each tractor and trailer is capable of carrying one 40ft container of 30.5t or two 20ft containers provided the total weight of two 20ft containers is less than 30t. The tractor's steering wheel is on the right hand side. An outline of the tractor and trailer is shown in Fig. A-12.5.5, 12.5.6.

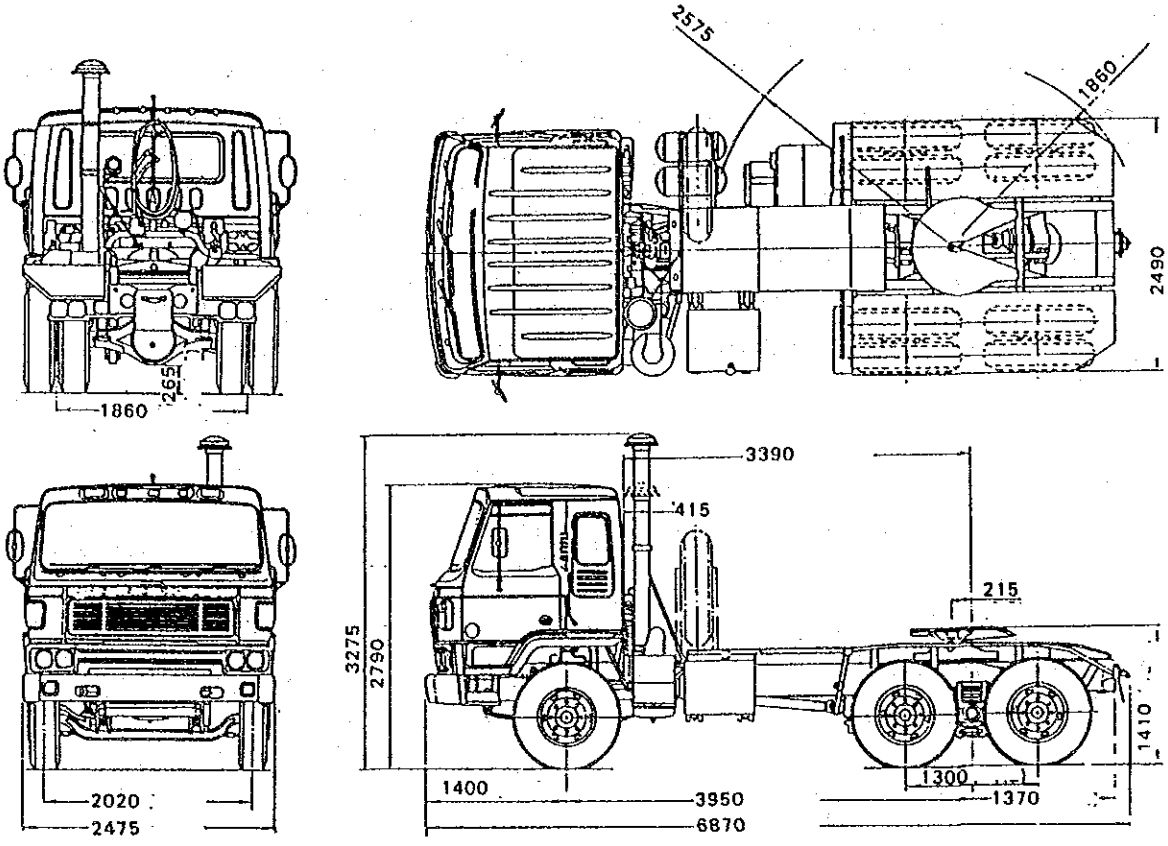
Particulars

(1) Tractor approx. dimensions

Wheel base		3,950mm
Overall length		6,870mm
Overall width		2,475mm
Overall height		3,275mm
Cab to rear axle center		3,390mm
Front fitting radius		2,575mm
Lower fitting radius		1,860mm
Coupler height		1,410mm
Turning radius	min.	7,300mm
Traveling speed (tractor only)	max.	80km/n
Engine	One set of Diesel, rated out put: about	270ps

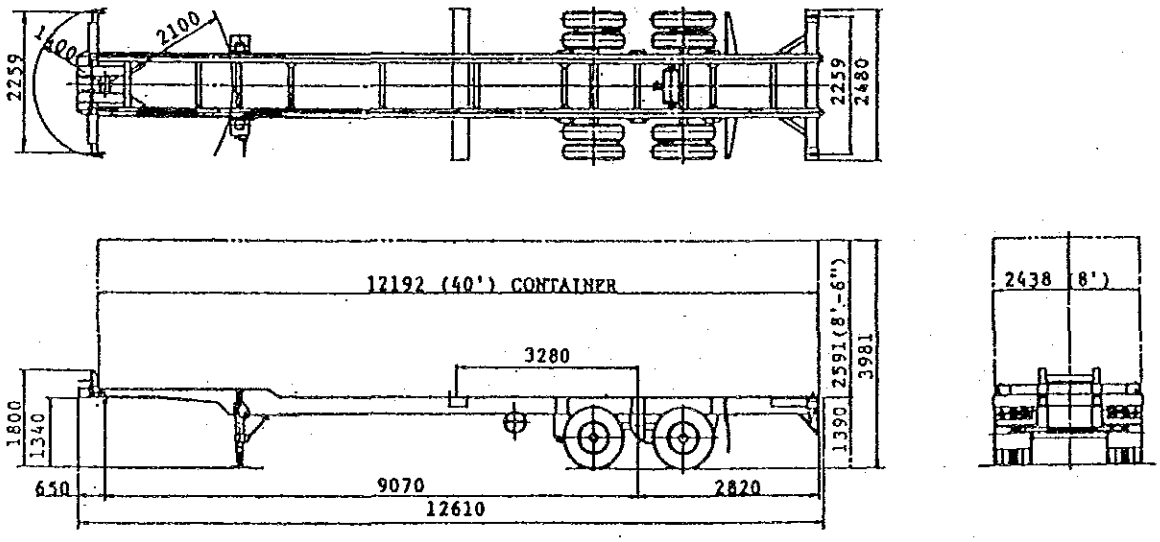
(2) Trailer approx. dimensions

Max. pay load	30.5t
Overall length	12,610mm
Overall width	2,480mm
Overall height with container of 8'-6" height	3,981mm
Floor height	1,390mm
Wheel base (King pin to center of rear wheels)	9,070mm
Front fitting radius	1,400mm
Rear fitting radius	2,100mm



Unit : mm

Fig. A-12.5.5 Tractor



Unit : mm

Fig. A-12.5.6 Trailer

Appendix 12.6

MARKET Table. MARKET PRICE OF EQUIPMENT

Item	Name	Quantity on Board Taka	FOB Price Taka	Insurance and Transp'n cost Taka	CIF price Taka	Customs Duties (%)	Tariff Taka
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

Miscellaneous Bank Stamp Duties (6)*0.00135	Miscellaneous Port Charge	Loading Unloading Charge (8)+(8)+(9)+(10)	Tax for Loading Unloading --%*(11)	Miscellaneous Charge Taka/case	Miscellaneous Lift Charge Taka/T	Sub Total (11)+(12)+(13)+(14)
(9)	(10)	(11)	(12)	(13)	(14)	(15)

Overhead Charge 10% * (15)	Market Price of Equipment			
	Local Currency		Foreign Currency	Market Price
	Tax (8) + (12)	Other (9)+(10)+(13)+(14)+(18)		(17)+(18)+(19)
(16)	(17)	(18)	(19)	(20)

PARTICULARS OF B. I. W. T. A DREDGERS

SL. NO	NAME OF VESSELS	TYPE	YEAR OF CONSTRUCTION	SHIPYARD	DIMENSIONS (m) Length (m)	Breath (m)	Depth (m)	Draft (m)	FLOATIN DEPTH (m)
1	KHANAK	BLLICOTT	1982	U. S. A	26. 00	8. 00	2. 50	1. 80	1. 10
2	DELTA-I	BEAVERKING	1970	I. H. C	24. 00	7. 00	2. 50	1. 80	1. 10
3	DELTA-II	BEAVERKING	1971	I. H. C	24. 00	7. 00	2. 50	1. 80	1. 10
4	D -135	HOLL: YSSEL	1975	OUDEWATER	25. 80	8. 00	2. 50	2. 10	1. 25
5	D -136	HOLL: YSSEL	1975	OUDEWATER	25. 80	8. 00	2. 50	2. 10	1. 25
6	D -137	HOLL: YSSEL	1975	OUDEWATER	25. 80	8. 00	2. 50	2. 10	1. 25
7	D -138	HOLL: YSSEL	1975	OUDEWATER	25. 80	8. 00	2. 50	2. 10	1. 25
8	D -139	HOLL: YSSEL	1975	OUDEWATER	25. 80	8. 00	2. 50	2. 10	1. 25

MINIMUM DREDGING DEPTH (m)	MAXIMUM DREDGING DEPTH (m)	MINIMUM DREDGING WIDE (m) In Channe	Open Water	MAXIMUM DREDGING WIDE (m)	DIAMETER SUCTION PIPE (mm)	DIAMETER DISCHARGE PIPE (mm)	SPUD POLE LENGTH (m)	CATTERPILLAR MAIN ENGIN H. P	AUX-ENGIN H. P
2. 20	11. 00	-	10. 00	32. 00	450	400	15. 50	850	365
3. 00	14. 00	-	10. 00	35. 00	500	450	18. 00	1165	290
2. 20	14. 00	-	10. 00	30. 00	500	450	18. 00	1165	290
2. 20	9. 00	20. 00	10. 00	30. 00	500	450	14. 50	1100	365
2. 20	9. 00	20. 00	10. 00	30. 00	500	450	14. 50	1200	365
3. 00	13. 00	20. 00	10. 00	35. 00	500	450	18. 00	1200	365
3. 00	13. 00	20. 00	10. 00	35. 00	500	450	18. 00	1200	365
3. 00	13. 00	20. 00	10. 00	35. 00	500	450	18. 00	1200	365

PARTICULARS OF ANCILLARY CRAFT OF B.I.W.T.A.

SL NO	NAME	TYPE	YEAR OF BUILT	YARD	DIMENSIONS LENGTH	BREATH	DEPTH	DRAFT	MAIN ENGINE MAKE	H.P
1	DREDGER TENDER	WORK BOAT	1974	COLDIWAS SHIPYARD VIRGINIA. U. S. A	17.00	4.60	3.00	2.30	G.M	22542
2	DOLPHIN	WORK BOAT	1971	I. H. C	11.00	5.00	2.50	1.90	CAT333	235
3	FLIPPER	WORK BOAT	1971	I. H. C	"	"	"	"	"	"
4	DORDURI	SOUNDING VESSEL	1976	NETHERLANDS	10.00	5.00		1.50	G.M	150
5	KHANIKA-I	WORK BOAT	1975	BK. SCHEEPSWERF DAMEN. HOLLAND	11.00	5.00	2.50	1.90	G.M	240
6	KHANIKA-II	"	1975	"	"	"	"	"	"	"
7	KHANIKA-III	"	"	"	"	"	"	"	"	"
8	KHANUKA-IV	"	"	"	"	"	"	"	"	"
9	KHANUKA-V	"	"	"	"	"	"	"	"	"
10	AMENA	INSPECTION LAUNCH	1961	KHULNA SHIPYARD	75'-5.5"	18'-4.5"	7'-7.5"	4'-7.5"	GLENTFHER ENGINE LTD	320
11	ASHA-I	TUG	1975	BK. SCHEEPSWEF DAMEN. HOLLAND	47.58'	14.55'	6.97'	5.47'	DETROIT DESEL USA	460
12	ASHA-II	TUG	1975	"	"	"	"	"	"	"
13	AGRAJAN	TUG	1975	HIGH SPEED NAVIGATION CO., LTD	60'-0"	17'-0"	6'-6"	4'-6"	VOLVOPENTA	540
14	NIR JHARONI	S.P.OIL BARGE	1975	NARAYANGANJI DOCKYARD	30.50M	7.60M		2.00M	"	270
15	SAQI	S.P.WATER BARGE	1976	KHULNA SHIPYARD	95'0"	21'-0"		4'-6"	DEUTZ	240
16	OBD-I	FUEL BARGE	1976	K.S.Y	"					
17	OBD-II	FUEL BARGE	"	"	"					
18	OBD-III	"	"	"						
19	OBD-VI	"	"	"						
20	OBD-VII	"	"	"						
21	OBD-VIII	"	"	"						
22	FLOATING WORK SHOP	PONTOON	1974	NARAYANGANJ	30.00M	7.80M		2.00M		
23	HOUSE BOAT NO-1	HOUSE BOAT	1975	KHULNA SHIPYARD	16.80M	5.50M	2.00M	1.20M		
24	HOUSE BOAT NO-2	"	"	K.S.Y.	"	"	"	"		
25	HOUSE BOAT NO-3	"	"	"	"	"	"	"		
26	HOUSE BOAT NO-4	"	"	"	"	"	"	"		
27	HOUSE BOAT NO-5	"	"	"	"	"	"	"		
28	HOUSE BOAT NO-6	"	"	"	"	"	"	"		
29	HOUSE BOAT NO-7	"	"	"	"	"	"	"		
30	HOUSE BOAT NO-8	"	"	"	"	"	"	"		
31	HOUSE BOAT NO-9	"	"	"	"	"	"	"		
32	HOUSE BOAT NO-10	"	"	"	"	"	"	"		

Unit Rate in Dhaka (1986-1990) prepared by BIWTA 31 May, 1990

Item NO	Item	Unit	Unit Price	Remarks
1	Earthwork in Excavation Channel	Cu.m	19.50	II-5
2	Construction of Embankment	Cu.m	80.00	II-10
3	Earthwork for Excavation of Foundation of Structures	Cu.m	16.00	II-11
4	Dressing and Turfing	Sq.m	5.00	II-18-b
5	1st class brick work in Cement Mortar 1:4	Cu.m	1251	III-2
6	Mass cement concrete(1:3:6) with cement of best-quality coarse sand 20mm down-graded picked jhama chips	Cu.m	1560	IV-1-a-i
7	-ditto- 1:2:4	Cu.m	1816	IV-1-a-ii
8	-ditto- 1:2:4 Bholagonj crushed stone chips-do-	Cu.m	2132	IV-1-a-iii
9	RCC Work in foundation, raft, road, column footing floor and open yard	Cu.m	1830	IV-2-a
10	-ditto- Bholgonj crushed stone chips	Cu.m	2147	IV-2-b
11	RCC Work(1:2:4) with cement of best quality coarse sand FM-1.80 20mm down-graded picked jhama chips in column raft beam, lintel and ribes Ground floor	Cu.m	2947	IV-3-a-i
12	Jetty RCC work having ultimate cube strength of 200Kg/cm^2 at 28 days concrete mixed(1:2:4) with fresh cement, best-quality coarse screened Sylhet sand of minimum (FM-2.00) & 20mm down graded Bholaganj crushed stone chips	Cu.m	4177	IV-5-B
13	Casting of RRC pre-cast piles on concrete bed having minimum ultimate cube strength of 350Kg/cm^2 at 28 days with concrete mix not leaner than			

Item NO	Item	Unit	Unit Price	Remarks
	1:1:2 by volume with 20mm down graded crushed Bholaganj stone chips Sylhet sand of minimum (FM 2.00) and cement	Cu.m	3300	IV-6
14	Driving pre-cast RCC piles vertically with drop hammer either land or water including supply of all labour, materials & equipment etc.			
	a)254mm*254mm(10"*10")	m	217	
	b)305mm*305mm(12"*12")	m	260	
	c)381mm*381mm(15"*15")	m	282	
	d)457mm*457mm(18"*18")	m	304	IV-7
15	Boring holes by bentonite slurry circulation process either in land or water and casting 60m, 508mm and 25", 20" dia, RCC, cast-in-situ piles having minimum ultimate cube strength of 300 Kg/cm2 at 28 days with concrete mix not leaner than 1:1.5:3 by volume of best-quality 20mm down-graded Bholagonj shingles, Sylhet sand of minimum (FM-2.0) and cement			
	a)610mm(24")dia	m	1364	IV-8
	b)508mm(20")dia	m	1197	IV-8
16	Precast cement concrete slab(1:2:4) with cement coarse sand and 20mm down graded picked Jhama ships, mixing laying compacting and curing, etc., complete including supplying all the materials			
	a)610mm*610mm*102mm	Each	76	
	b)305mm*306mm*51mm	Each	1150	IV-15
17	76mm (3")thick cement concrete (6:3:1) in flooring with cement, best-quality coarse sand and picked Jhama chips including breaking chips, screening, mixing, laying, compacting, curing etc.	Sqm	116.00	IV-4

Item NO	Item	Unit	Unit Price	Remarks
18	Roofing			
	26 BWG galvanixed C.I sheet(Foreign made)& fixed on M.S section or wooden urline with screws, limpet washer and putty, etc., all materials (Excluding			
	frame work	Sq.m	235	VII-4-a
19	Water supply and Sanitary Works			
	Supplying and fitting fixing porcelain combicloset"P" Type (superior quality white) code NO.112/412 (BISF) with abonite seat cover, rubber buffer,C.P. or plastic hinges, plastic connection pipe, etc., including making holes in wall & floors for fitting foxing nuts			
	& bolts.	Each	4055.00	IX-14-a
20	Electrification			
	Supplying and installation of PVC insulated PVC sheated NYY under ground cable (Eastern cable) including sand cushion and providing cable file/one brick flat soling all along including digging trench & re-filling the same as per direction of Engineer -in-Charge			
	(a) 2*1.5rm	m	74.00	X-10-a
	(b) 2*2.5rm	m	79.00	X-10-b
	(c) 2*4.02rm	m	94.00	X-10-c
	(d) 2*16 rm	m	141.00	X-10-d
21	L.T Overhead line			
	Supply & installation of G.I pipe pole 1st 6.10m length being 102mm dia and 2nd 3.05m length being 76mm dia with a base plate 406mm*406mm welded at bottom including supply of head cap, red oxide painting over 1.75m embedded underground level completed in all respects as per direction of			

Item NO	Item	Unit	Unit Price	Remarks
	Engineer-in-charge	Each	3250.00	X-1
22	Metal Works M.S. work in Tee, Angle, Cleat, Plates jist, etc., including fitting fixing completed in all respect with supply of all materials	m.ton	26113.00	XII-1
23	M.S. work in reinforcement for all kinds of RCC work including forging bending, binding of reinforcement with different section placing them in position including supply of M.S. rod and G.I. wire, etc., complete	m.ton	19638.00	XII-2
24	Spud and Sheet Piling Fabrication of 22-25 metre long M.S. spud of octagonal section & 558mm to 685mm dia with 9mm to 13mm thick M.S. sheet piles at site including handling, placing, cutting the sheet piles to required length, 3 round (440 volts) welding with best quality electro-rods & electric charges, etc., completed as per direction of Engineer-in charge (M.S. sheet piles will be supplied by the Authority)	RM	596.00	XII-41-a
25	-ditto- hexagonal section	RM	479.00	XII-41-b
26	Fabrication and supply at site 22-25 metre long M.S spud of hexagonal section & 610mm (24") dia with 9mm (3"/8) thick M.S sheet including cutting the sheets to required length placing properly 440 volts welding with best quality electro-rods to sheet's thickness sectional joint should not be in one or same line which must differa minimum 1 metre			

Item NO	Item	Unit	Unit Price	Remarks
	from each other 2 coats of anti-corrosive painting, supplying all materials and electric charge, etc.	RM	4040.00	XII-42-a
27	Driving 558mm to 686mm (22"to27") dia. spud to an approximate depth of 13 metres by water circulation method or any other means in water including cleaning loose soil from inside the spud after driving and filling with local sand, compacting with watering, casting 610mm mass concrete(1:3:6) at top & with hire charge of spud driving Machineries & Equipments with all necessary accessories including cost of fuel & operation of machine-ries, Mobilization & Demobilization of Machineries & Equipment, etc.	RM	3500.00	XII-45
28	Supplying fitting fixing of steel lining with 4.76mm thick M.S. plate for 610mm and 508mm dia RCC cast in situ piles including supply of all labour materials, welding, rolling, fabrication grinding, transportaion etc. completed as per drawing, specifi-cation and directions of Engineer-in -Charge			
	(a)610mm dia	RM	2637.00	XII-46
	(b)508mm dia	RM	2204.00	XII-46
29	RIVER/BANK PROTECTION WORK Supplying at site 1st class brick-bats of not less than half brick size	Cu.m	520.00	XIII-18
30	Supplying at site 2nd class brick-bats of not less than half brick size	Cu.m	380.00	XIII-19
31	Labour for dumping brickbats in position as per direction	Cu.m	25.00	XIII-20

Item NO	Item	Unit	Unit Price	Remarks
32	labour for dumping position brick blocks of any size carefully at site as per direction	Cu.m	23.00	XIII-21
38	Preparation & Transportaion of complete boring equipment including all accessories, G.I.pipes, pump, engineer strainers, M.S. housing pipes, etc. complete at boring work site & re-transportation of bouring equipments including excess materials of deep tube well if any after complete of work including setting up stores & accommodation of the field staff	L.S	16.00	XIV-B-a)-2
39	Execution of Deep tube well boring by reverse circulation a water jet method, the boring diameter should be between 253mm to 379mm dia			
	* Boring charge			
	a)0 meter to 51 meter	m	263.00	XIV-B-A)-3
	b)Above 51 meter to 102 meter boring	m	199.00	-ditto-
	c)Above 102 meter to 153 meter boring	m	158.00	-ditto-
40	Road and Fence Works			
	Single brick flat soling 76mm (3")thick with 1st class or picked Jhama bricks including filling the joints etc, complete with sand (F.M.O.50) including supplying all the materials	Sq.m	74.00	XVI-3
41	Brick on edge pavement with 1st class or picked Jhama brick (herring bone bond) including filling the joints with sand including supplying all the materials	Sq.m	116.00	XVI-6
42	Road surfacing consisting of laying and consolidation by roller (8 to 10 tons) Jhama Khoa 51.0mm down-graded to a thickness between (76mm to 152mm) 3" to			

Item NO	Item	Unit	Unit Price	Remarks
	6" including supply of materials, etc., completed as per directions	Cu.m.	983.00	XVI-13
43	Spreading and consolidation broken brickes or stone materials (Rubbish) etc., by roller(8 to 10 tons) excluding the cost of materials as per directions	Cu.m.	60.00	XVI-14
44	Supplying and soreading local sand as sand cushion up to thickness of 76mm	Cu.m.	215.00	XVI-15
45	51mm thick compacted premixed bituminous carpetting with specified graded stone chips @0.566 Cu.m. of stone chips mixed with 1.80 Kg of heated bitumin 0.02 Cu.m (per) of stone chips spreaded uniformly over the 9.29 M2 (100sft) of surface rolled with 8 to 10 tons roller compacted fully in proper grade and camber and spreading 0.113 M3 (4cft) sand (F.M.0.80) per 4.29 Sqm completed as per directions of the Engineer-in-charge	Sq.m	115.00	XVI-18
46	Providing tack coat @11.25 Kg(25lbs) per (100sft)9.29 M2 including heating bitumin to 176.67'c to 190.56' c(350'F to 375'F) and spreading the complete (cost of bituminous included)	Sq.m	23.00	XVI-20(C)
47	Pre-mixed bituminous seal coat with 0.142 M3(5 cft)of per gravel mixed with 2.23Kg.(5 lbs)of bitumin 0.028 M3 per (cft)of per-gravels and laid over 9.29 M2(100 sft) of road surface including spreading with proper camber and grade and bleading with dry sand @0.085 M2 (3 sft)(F.M.0.80)per 9.29 M2(100 sft) including cost of all materials rolling with 8 to 10 tons power driver roller			

Item NO	Item	Unit	Unit Price	Remarks
	etc., completed as per directions of the Engineer-in-charge	Sq.m	44.00	XVI-22
48	FENCING WORK 1.83(6') high barbed wire fencing of 9 lines with 12 BWG 2 ply 4 pointed barbed wire fixing with 152mm (6")dia, sundary or gazari bullah post @1.83M c/c embedded 0.914m into ground and 2 diagonnall lines of the same barbed wire in each bay of 1.83 M, fixing with minimum 64mm long G.I. nail etc, completed including supply of all materials	RM	295.60	XVI-B-2
49	Compacted water hound machadam base course with graded materials of crushed well-burnt picked Jhama 1st class bricks and bats, having compacted thick-ness 76mm to 152mm (3" to 6")including local handling, spreading uniformly to proper grade, camber and super elevator, hand packing, rolling properly with 8 to 10 tons power-driven road roller and watering profusely for proper con-solidation, blending with blending mater-ials etc. complete as per direction of the Engineer in charge with supply of all materials (pavement will be made on compacted thickness). Thickness of each layer should not be more than 127mm loose. Reduction of loose height by 30%-35% may be allowed on maximum possible compaction	per M3	975	Chapt 17-1
50	76mm(3")thick(compacted) semi-grouting with brick metal and hot bitumen, laying and spreading materials			

Item NO	Item	Unit	Unit Price	Remarks
	@114mm (loose)in two layers of 76mm & 38mm to proper camber, level, grade and super elevation and spreading hot bitumen @35 lbs.per 9.29m^2 on the 2nd layer and rolling hard to full compaction with 8 to 10 tons power driver roller including heating bitumen to 350'F to 375'F. temperature to completion as per directions the Engineer-in-charge	per M2	128.00	
51	CARRIAGE OF MATERIALS Carriage of materials as follows by truck within 10Km including carriage by head load up to a distance of 100 meters at each point of loading and unloading including stacking Keeping properly as per direction of Engineer in-charge			
	(a) Bricks	1000	170.00	XVII-1-a
	(b) Cement.M.S.Rod, Joint, Channel Angle, Cleat & Sheet, C.I.Sheet & others	M.ton	80.00	XVII-1-b
	(c) Shingles, Stone chips, Khoa, Brick-bats, Sand surki, Lime, Timber and Wooden bullah, etc.	Cu.m	60.00	XVII-1-c
	(d) Furniture, Equipment, office stationery and other goods by 5 ton truck	Truck	338.00	XVII-1-d
	(e) -ditto- by 3 ton truck	Truck	282.00	XVII-1-e
52	Extra rate for item NO.1 as followas by truck for every additional distance of 5Km or part thereof beyond the initial distance of 10Km.			
	(a) Bricks	1000Nos	28.00	XVII-2-a
	(b) Cement,M.S.rod,Joint,Channel, Angle,Cleat & Shet,CI.Sheet &			

Item NO	Item	Unit	Unit Price	Remarks
	Others	M.ton	11.50	XVII-2-b
	(c) Shingles, Stone chips, khoa, Brick bats, Sand, Surki, Lime, Timber & Wooden Bulah, etc.	Cu.m	9.00	XVII-2-c
	(d) Furniture, Equipment, Office Stationery and other goods by 5 ton truck	Truck	56.00	XVII-2-d
	(e) -ditto- by 3 ton truck	Truck	45.00	XVII-2-e
53	Carriage of material as follows by boat within 10Km including carriage by head up to a distance of 100 meters at each point of loading and unloading including stacking/Keeping propwely as per direction of Engineer -in-Charge			
	(a) Bricks	1000	113.00	XVII-3-a
	(b) Cement, M.S.rod,Joint,Channel Angle,Sheet.C.I.sheet & Others	M.ton	56.00	XVII-3-b
	(c) Shingle,Stone Chips,Khoa,Brick bats,Sand,Surki,Lime,Timber Wooden bullah, etc.	Cu.m	50.00	XVII-3-c

PART II SHORT-TERM PLAN

Appeadix 3.2 Analysis of Stresses in Structural members of Jetty

(1) Establishment of Design Loading Conditions

The design loading conditions that will generate the maximum stresses in the various structwal members of the open type jetty are established by a combination of crane and straddle carrier loads moving over the jetty parallel to it.

In normal situations, the maximum stresses will be produced in the structural members of the jetty when a gantry crane lifts a container load on shore with an empty straddle carrier positioned on the crane apron and a loaded straddle carrier on the apron area behind.

During earthquakes, the stresses will attain their maximum when the crane lifts a container load with its outreach becoming longest and with loaded straddle carriers positioned on the erane apron and the apron area behind.

The design loadings perpendicular to the jetty line based on the foregoing situations are illustrated in Fig.3.2.1.

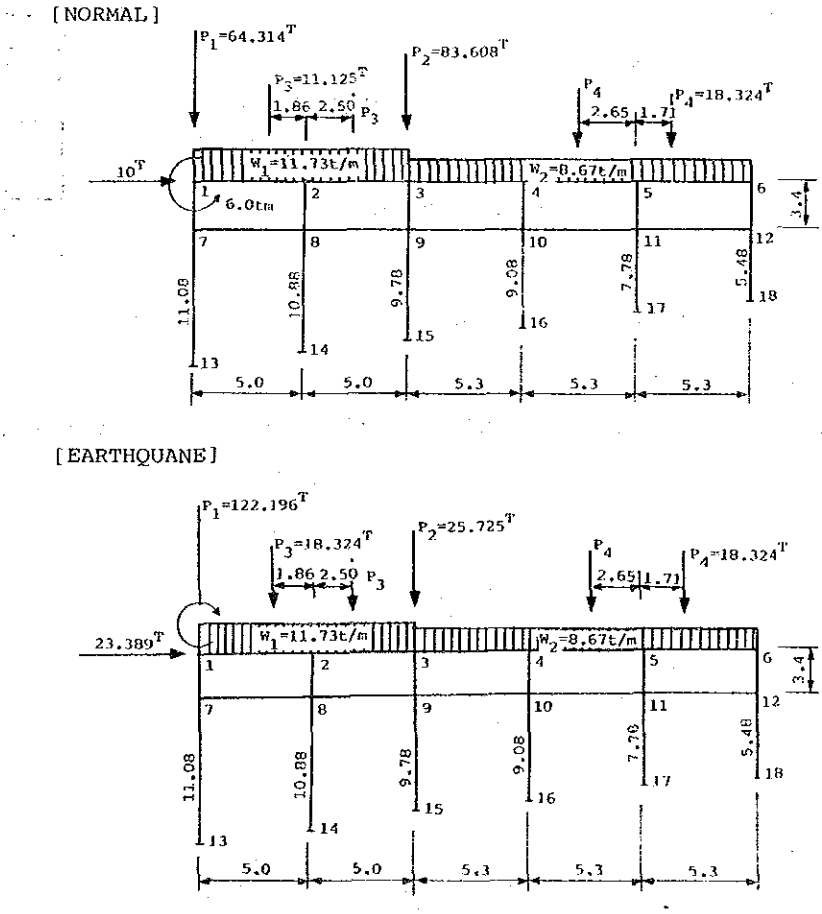


Fig.3.2.1 Design Loadings Perpendicular to Jetty Line

(2) Maximum Stresses in Structural members

Assuming the open-type jetty structure illustrated in Fig.3.2.1 is a rigid frame, calculations were made of the stresses generated in the foundation piles and beams of the jetty by the design loads in normal situations and during earthquakes. The section characteristics of the structural members and the calculation results are as follows:

1) Section characteristics of structural members

(a) In-situ concrete piles (ϕ800)

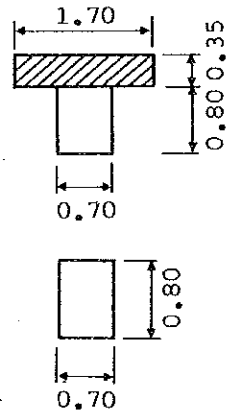
- Section area $A=0.5027m^2$
- Moment of inertia section $I=0.020106m^4$
- Section modulus $Z=0.050265m^3$
- Allowable bending conpressive strength $\sigma ca=50Kg/cm^2$
- Modulus of elasticity of concrete $Ec=2.4X10^5kg/cm^2$
- Characteristic value of pile $B=\sqrt{Kh.D/4.E.I} = 0.223$ (N=5, $Kh=750t/m^3$)

(b) Upper Beam

- Section area $A=1.155m^2$
- Moment of inertia of section $I=0.13132m^4$

(c) Lower Beam

- Section area A=0.56m2
- Moment of inertia of section $I=0.029867m^4$
- Allowable bending conpressive strength of upper and lower beams $\sigma ca=80kg/cm^2$
- Modulus of elasticity of upper and lower beam concrete $E=2.7X10^5kg/cm^2$



2) Calculation Results

Table 3.2.1 Presents the results of the stress in structural members

Table 3.2.1 Actual Stresses Penerated in Structural Members and Reinforcing bar Requirements

Stress	Structural member		Amount Reinforcing bars As		Actual stress (kg/cm^2)			Allowable stress(kg/cm^2)		
					σc	σs	τ	σca	σsa	τa
In normal situation	lipper beam	2-1	Uepper	D22-6 D22-4	58	1,485	7.1	80	1,800	4.5
		5-6	Lower	D22-6	28	1,093	-	"	"	"
	Lower beam	12-11	Upper	D19-6	29	1,095	0.8	"	"	"
		11-12	Lower	D16-6	24	1,078	0.8	"	"	"
	Pile	18-12	Under ground	D29-18	30	367	1.1	50	1,800	4.5
During earthquakes	Upper beam	2-1	Upper	D22-6 D22-4	67	1,596	8.0	120	2,700	6.75
		5-6	Lower	D22-6	32	896	-	"	"	"
	Lower beam	12-11	Upper	D19-6	58	2,008	1.7	"	"	"
		11-12	Lower	D16-6	46	1,874	1.7	"	"	"
	Pile	18-12	Under ground	D29-18	71	1,173	2.8	75	2,700	6.75

Notes:1. The amount of pile head displacement is 1.8mm in normal situations and 4.5mm during earthquakes.

2. Numbers in the "Structural member" column correspond to node mumbers indicated in Fig.3.2.1.

APPENDIX-3.4.1 Land Reclamation

1) Scope on investigation and choice of method

It must be emphasised that site investigation for dredging should not be confined to investigation of soils. The scope of investigation will depend to a certain extent on the type of site and contract to be arranged but there are two good reasons for not taking a conservative approach.

First, many potential problems can only be revealed through investigation and the more detailed it is the more accurate the budget estimate for the work will be.

Secondly, from a client's point of view it is advantageous to build up a comprehensive dossier of site investigation which will almost inevitably prove useful at some later stage in the development of the site.

Site investigation is essential in each of the following aspects of planning a dredging operation.

- Effect of dredging

One of the most important, investigation items is the environmental effect of dredging. Apart from the disturbance to the ecological regime, a point which is too often overlooked is the siltation which will occur during and after the dredging.

Siltation during capital dredging operations can cause contractual problems.

- Choice of dredger

Correct choice of dredger is of fundamental importance in the planning and execution of a dredging contract. Although the final choice may lie with a dredging contractor it is essential to provide the contractor with sufficient information such as wind, flood or current data on the site to help him take appropriate decision.

- Choice of investigation method

It is important that the method of investigation chosen should be the most suitable for obtaining the desired information and knowledge on distribution of materials in a dredging area is more important than an exact analysis of each of the types of materials in the area.

2) Water conditions

- Objective of investigation

The level of water in a river is usually referred to a fixed point conveniently located on land.

The measurement of water level has two very important purposes;it provides method of checking whether a particular dredger or associated craft can operate in the water depths available on the site and also a method of referring the water depth at a point at any moment to the datum level of the site. It, therfore, influences the dredging operations and choice of dredger and is essential for the planning and supervision of the dredging contract.

- Method of investigation

Although Dhaka port is mentioned in the tide manual published by the BIWTA, it is advisable to install a tide gauge, with a view to defining a local datum as well as to referring the water depths to that datum.

There are simple poles, available for measuring tide level. The gauge or measuring device should be related to a permanent local level.

It is also important that the tide gauge should be near enough to the site of the dredging operations to ensure that the levels at the site and at the gauge are roughly the same at any moment.

Appreciable differences in level can be detected in some locations is only 2 to 3 km distance from each other.

3) Soil conditions

- Direct sampling

The most effective methods of investigation is those giving the most comprehensive results of boreholes, are those involving direct sampling.

Direct sampling means continuous retrieval of soil from the hole in an undisturbed or semi-disturbed state.

This allows a full classification of the soil to be made at regular intervals, changes of soil type to be accurately positioned and both in situ and laboratory tests to be carried out.

- Jet probes

The jet probe is simply a hollow tube through which water is pumped. It can be constructed by lengths of gas pipes, with threated joints, and a simple submersible pump. The water jet emitting from the tip of the probe is usually sufficient to allow penetration through most granular and light cohesive soils. Since there is no recovery of samples the materials penetrated cannot be identified.

- Laboratory testing

It is necessary to carry out laboratory tests of samples obtained from the proposed dredging site, to confirm the validity of the visual classification carried out on site and also to dertermine the basic properties of the soils.

- Granular soils

The normal tests for granular soils are to determine the following properties:

bulk density
particle size distribution
angularity
moisture content
organic/lime content

- Cohesive soils

The normal tests for cohesive soils are to determine the following properties:

bulk density
particle size distribution
specific gravity (silt only)
moisture content
plastic and liquid limits
shear strength

Consolidation test may also be required if the soil is to be used as fill or is already in a fill area.

4) Construction Condition

As the project site is mostly located in the low land +1m high above

the Public Works Datum, it seems that there is no suitable borrow pit due to the low lying condition of the area around the project site.

Accordingly, filling materials will be obtained from the bed of Buriganga River located near the project site by cutter suction dredger.

It may be recommended to use the existing dredger belonging to BIWTA of the government of Bangladesh which is listed in APPENDIX-8.

5) Borrow pit for Dredging

Location of borrow pits are shown in Figure 3.4.1.

6) Cutter Suction Dredger (Short Term Development Plan)

6-1) Condition

Total filling volume : 1,116,000m^3

Planned area:Approx. 116,000m^2

Container yard : 79,700m^2

Access road : 36,000m^2

Soil condition:N-value 2-8 Silty Sand

Dredging Depth:-8m below PWD

Length of discharge pipeline on river:150m

ditto on ship : 30m

ditto on land : 800m

Diameter of discharge pipe : 45cm

6-2) Capacity of Dredging Pump

With respect to the capacity of the dredging pump, it is necessary to make sure that it is enough to pump the soil to the required distance. If the pump capacity is insufficient, it is necessary to choose a bigger dredger or add a booster pump to the pumping system.

The normal output of the dredging pump by diesel engine should be in erased by 20% considering transportation of discharge soils and soil characteristics, as shown in the following formula:

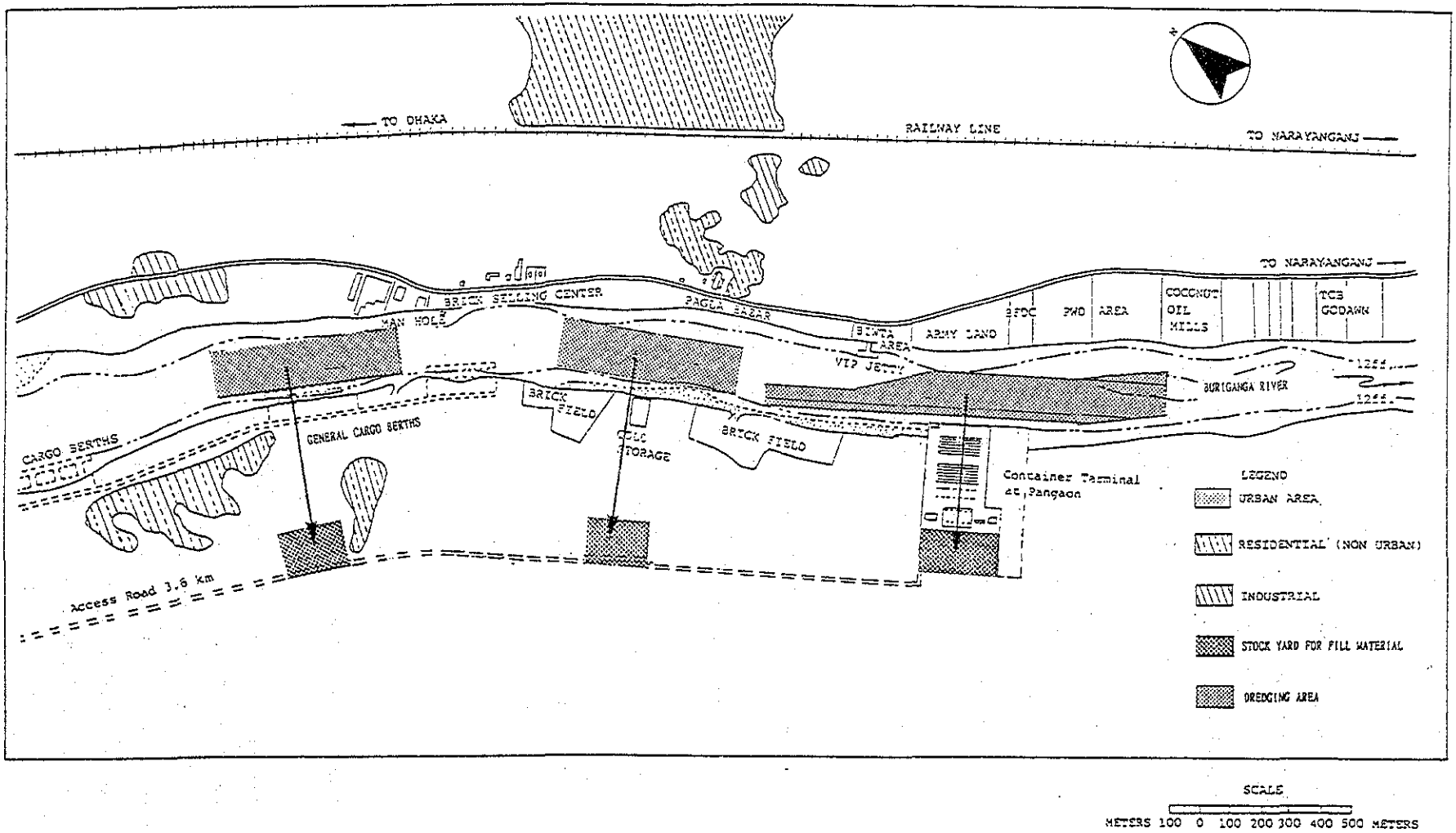


Fig. 3.4.1 LAND RECLAMATION PLAN AT PANGAON SITE

Nr = 0.8 Nd

where Nr : Motive power for discharge soils

Nd : Normal output of diesel engine

- Total Head

Ht = ht + hr

where Ht : Total head

ht : Actual head

hr : Head loss of discharge pipe

Resistance coefficient of discharge pipeline and length

p = 0.017*2.4	pipeline on ship	Lp = 30m
i = 0.017*1.3	pipeline on river	Li = 150m
t = 0.017	pipeline on land	Lt = 800m

Ht = ht+t*v/2g*1/D(2.4LP+1.3Li+Lt)

= 16+0.017*3.5/(2*9.8)*1/0.45*(2.4*30+1.3*150+800)

= 16+25.2 =41.2

Neccessary capacity of main pump

N = r*(Ht* /4*D*Vr*60)/(4.5*y)

= 1.2*(41.2* /4/0.45*3.5*60)/(4.5*0.55)

= 667.2 H.P < 1,200 H.P

where r = 1.2 assumed ---- Specific gravity of mixture

Vr = 3.5m/sec ------- Water velocity inside discharge pipeline

y = 0.55 ---------- Pump efficiency

D = 0.45m ---------- Diameter of discharge pipeline

6-3) Required Number of Cutter Suction Dredger

The volume of dredged materials per hour by Cutter Suction Dredger is estimated as follows;

$Q = q*d/1,000*E(m^3/h)$

where q : 250-240m^3/h dredged volume per 1,000 H.P electrical

d:Nr = 0.8 Nd = 0.8*1,200

= 960 H.P in terms of electrical motor of dredger

E : Working efficiency at site --- 1.0 assumed

: Time ratio of actual work ---- 0.9 assumed

$Q = 250*960/1,000*10*0.9$

$= 216m^3/h$

Concentration(X) is calculated as follow;

$X = 216(m^3/h)/q*100$

$= 216(m^3/h)/2,004(m^3/h)*100 = 10.8\%$

where $q = \pi/4*0.45^2*3.5m/s*3,600$

$= 2,004(m^3/h)$

The number of working days is estimated as follows;

$1,116,000c.m/(216m^3/h*17h/day) = 304$ days

304 day/25 day/month = 12 months

If the period of dredging work is estimated at 4 months excluding preparation works, the necessary number of Cutter Suction Dredger is as follows;

12 months/4 months = 3 units

6-4) Layout of discharge pipeline

The dredging area will be separated into 3 zones as shown in Figure 3.4.1

The discharge pipeline will be installed from the dredging site to the reclamation site and connecting points will be provided at every 100-meter interval along the river wall.

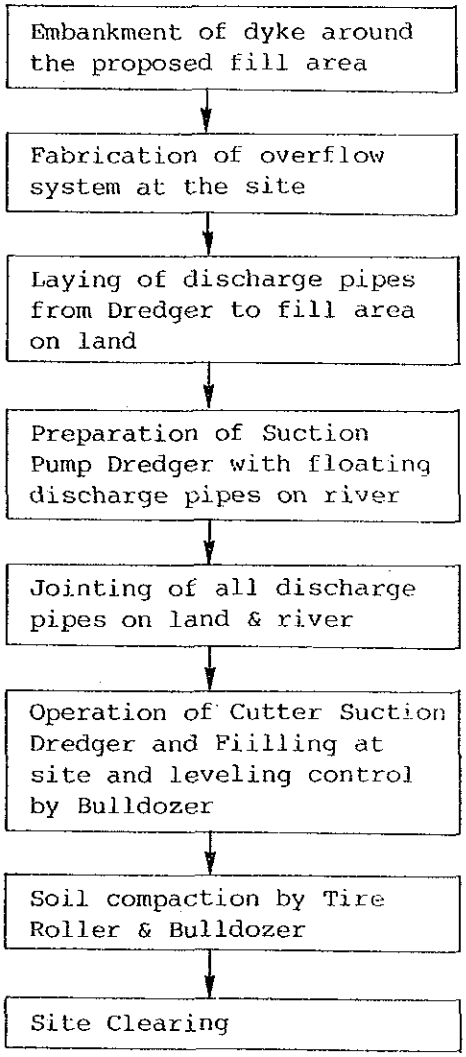
6-5) Construction Equipment

The capacity and number of the main equipment are as follows;

Equipment	Capacity	Necessary Numberr
- Cutter Suction Dredger	1200 hp	3 nos
- Anchor Boat	D5t-lift 180 hp	3 nos
- Discharge pipes	dia 0.45m	950m * 3 lines
- Floaters		30 units * 3 lines
- Rubber Joint		31 units * 3 lines

7) Construction Procedure

The Work Schedule is shown in Figure and The Work Procedure is as follows;



APPENDIX-3.4.2 Pier and Revetments

1) Construction Condition

As the pier and revetment an relatively else to each other, the construction procedure has to be given due care taking this condition into consideration.

The revetment is a L-shaped block of reinforced concrete cast in the Pangaon production yard.

Driving work of steel sheet pile, rubble discharging and trimming of rubble bed shall be finished before installation of L-shaped concrete blocks.

L-shaped concrete blocks will be transported from the block production yard to the planning site by platform trucks and installed in the proposed position by crane.

The connected space of every concrete block shall be protected by water stops to prevent from quicksand.

Cast-in-situ RC piles located at land side consisting a portion of the pier foundation shall be finished before rubble discharging work for the base of revetment in order to ensure smooth pile driving on the river.

2) Cast-in-situ Piles

A cast-in-situ pile is made by making a hole in the ground and filling it with concrete. The hole may be drilled, but more often is formed by driving a shell or casing into the ground. The casing may be driven open end, the soil entrapped in the casing being jetted out after the driving is completed.

3) Equipment for execution of Cast-in -Situ method

The foundation structure will be come trusted by a kind of Benoto's method in Japan and the main dimensions of the equipment to be used for this purpose are shown in Table 3.4.1 for reference.

4) Digging Bucket

Digging Bucket is a kind of grab type bucket designed to break and crush the soil by dropping impact and to discharge it from bottom of casing by grabbing.

Table 3.4.1 Dimensions of Benoto's Eyuispment for foundation pile

NAME		KATO 20TH EARTH DRILL	MITSUBISHI BT-2S TYPE	HITACHI U106A EARTH DRILL WITH CASING DRIVER
NAME OF MAMUJACTUCER		KATO INDUSTRIES,LTD	MITSUBISHI HEAVY INDUSTRIES	HITACHI INDUSTRIES,LTD
MAIN DIMENSION (WORKING)	TOTAL WEIGHT	27.0 T	20.0 T	45.8 T
	TOTAL LENGTH	7.9 M	10.0 M	8.0 M
	TOTAL HEIGHT	14.5 M	9.8 M	17.6 M
	TOTAL WIDTH	3.7 M	2.5 M	3.8 M
CAPACITY	MAX' DIGGING DIAMETER	1.2 M	1.2 M	2,0 M
	MAX' DIGGING DEPTH	40.0 M (Dia'1.0M)	40.0 M (Dia'1.0M)	29.0 M
	MAX' DIGGING SPEED		APPRO' 10 M/H	APPRO' 14 M/H
UNDER-CARRIAGE	LOADED SYSTEM	CRAWLER	TRUCKCHASSIS	CRAWLER
	SPEED	1.7 KM/H	56 KM/H	
TUBING SYSTEM	MAX' OSCILLATING TORQUE	40 TON-M	46 TON-M	38.7 TM
	OSCILLATING ANGLE	17	------	10
	EXTRACTION CAPACITY	42 TON	46 TON	43 TON
	INDENTATION CAPACITY	56 TON	60 TON	32 TON
WINCH	TYPE	2 DRAMS	SINGLE DRAM	2 DRAMS
	MAIN HOISTING CAPACITY	3.3 TON	2.5 TON	5.4 TON
	SUB HOISTING CAPACITY	3.3 TON	------	3 TON
ENGINE	NAME OF COMPANY	ISUZU DIESEL ENGINE	MITSUBISHI DIESEL ENGINE	HITACHI B-40 TYPE DIESEL ENGINE
	MACHINE RATING PER HOUR	65.5 PS/1500 R.P.M 76.5 PS/1800 R.P.M	105 PS/1500 R.P.M 160 PS/2100 R.P.M	100 PS/1500 R.P.M
	BUCKET	GRAB BUCKET	GRAB BUCKET	GRAB BUCKET

5) Casing and Tube

Casing can guarantee the accuracy of the hole's diameter and prevent collapse of the surrounding soil. It is also a useful guide equipment for digging vertical holes.

6) Construction Method

- As pile driving machine procured local by cannot oscillate the casing, it will be used only for soil digging.

On the other hand, the function of crane is to carry out only auxiliary works of inserting steel bars and casing.

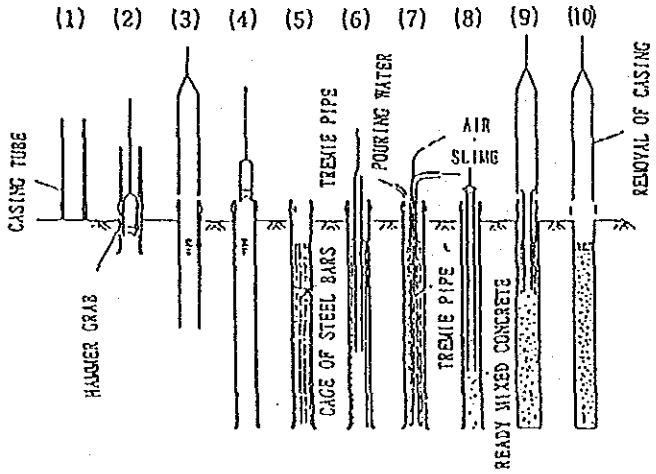
- Digging

In digging work, care should be taken to insert the first casing and to strictly avoid even slight inclination in the case of long pile.

Vertical check of piles will be carried out by transit instrument during digging work.

The bucket type of excavation shall be chosen in advance on the basis of the soil conditions in accordance with soil profile.

CONSTRUCTION PROCEDURE OF Cast-in-Situ METHOD



(1) Election of casing
(2) Digging of hole
(3) Jointing of additional casing
(4) Digging of hole
(5) Insert cage of steel bars to casing
(6) Insert tremie pipe
(7) Discharge slime
(8) Casting by tremie concrete
(9) Removal of casing
(10) Casing extraction

- Steel bars

Erection of steel bars will be carried out by an auxiliary crane during erection of steel bars, the machine shall be shifted to an adjacent area.

In the case of long pile, as the weight of steel bars will increase significantly, the main steel bars shall have thick diameter especially to avoid buckling by arrangement of reinforcement.

- Tremie pipe

After erection of the cage of steel bars, tremie pipe will be inserted to the bottom of the hole.

The diameter of tremie pipes is usually 30cm.

Plunger will be used to avoid mixing water and concrete in the casting tremie concrete.

- Discharging slime

The volume of slime may increase in the case of long pipe pile as well as due to collapsing soil layer. In this case, air lift method using tremie pipe has good merit.

The air lift method consists in decreasing the specific granity of water in the tremie pipe by sending compressed air into the pipe, as a result, water will come up the pipe from the bottom of the hole due to different water pressures between outside and inside of tremie pipe, and slime remained at the bottom of the hole will be sucked and discharged together with water.

The slime will be removed perfectly in approximately 15 minutes in ordinary cases.

- Concrete

The method of concrete casting by bucket should be avoided as far as practicable due to its an efficiency.

Casting of concrete will start when the tip tremie pipe comes to the bottom of the hole and the tremie pipe will be raised by 20cm or so when it becomes full of fresh concrete.

Concrete casting should be made continuously with fresh concrete the wing inside the pipe. When concrete level raises the tremic pipe will be raised and taken off gradually. In any case, the tip of tremic pipe should

be inserted more than 1m under concrete.

The slump of underwater concrete supplying the tremie pipe should be 18cm or so. The tremie pipe should be moved up and down regularly at about every 50cm so as to avoid choked condition.

Moreover, addition of concrete is allowable up to about 10% of the designed concrete volume.

- Treatment of pile head

As the pipe head made of a mixture of laitance, soil, bentonite and other materials, the pipe head concrete shall be removed up to a length of more than 50cm within 2 weeks after casting.

Demolition of pipe head may be difficult due to strong compressive strength of concrete in case of more than 2 weeks after concrete casting.

7) Construction planning

- Geotechnical investigation

When the condition of bearing strata varies remarkably, geotechnical investigation will be carried out in the site. It is recommended to carry out geotechnical investigation in more than 3 boreholes considering present condition judged from the existing data.

- Machine & Equipment plan

Table 3.4.2

Name of equipment	Quantity	Capacity	Remarks
Machine	1 no.		digging, casting concrete
Crawler crane	1 no.	20t boom 16m long	steel bars, hoisting casing
Hopper barge	1 unit		transportation of spoil materials
Tug boat	1 unit		
Compressor	1 no.	75 ps	for air lift
Underwater Pump	2 no.		for water supply, Dia 4" for cleaning, Dia 2"
Electric Welder	1 no.	11 KVA	for welding & fabrication of steel cage
Hammer Grab	2 nos.		with spare grab for many piles
Casing tube/ Guide pipe	1or2 sets		with spare casing/pipe
Tremie pipe	2 sets		with spare pipe
Bucket for spoil materials	2 nos.	2cm	discharging hopper barge
Scaffolding	1 set		preparations of temporary road for concrete supply

- Manning plan

Table 3.4.3

Instruction & Supervision of Works	Inspector	3 persons
Digging	Operation of Maachine,	2 (Chief, Sub)
	Operation of crane	2 (Chief, Sub)
Compressor	Mechanic	1
Concrete/Digging	Labour	6
Steel	Welder	1
	Steel fixer	3
Transportation of	Sailor	2 (Barge)
Spoil Materials	Sailor	1 (Tug boat)
	Captain	1 (Tug boat)

- Construction Procedure and Preparation

The machine will be lead on a steel pontoon of large size, and the latter will be fixed by spuds to present displacement during construction works.

- Construction Efficiency

The efficiency of digging work may vary with the characterisics of the soil and normal construction efficiency is indicated below;

Moving and installation of the machine	60 minutes
Hoisting of casing/guide tube	25 minutes
Hoisting of cage of steel bars	20 minutes
Digging	5 minutes/m - 20 minutes/m
Cohesive soil (silt, clay)	5 - 15 minutes/m
Sand	10(coase) - 20(fine)minutes/m
Sand gravel	20 - 25 minutes/m
Mudstone	30 - 50 minutes/m
Inserting tremie pipe	15 minutes/10m
Discharging slime	30 - 40 minutes
Cating concrete (including extraction time of casing, tremie)	5 minutes/m

Transportation and casting of concrete may be made from a batch system instalied on river and concrete will be received by bucket and poured into the inside casing through a pipe. This is called "pontoon and bucket system".

- Production for Beam and Slab Concrete

Selection of concrete mixture system and kind of machine

Concrete will be prepared by in-situ mixture method, in accordance with the present construction conditions

System	Method	Machine
Mixing method at site	Batching/weighing materials and mixing concrete at site	Batcher plant

- Selection of Batcher Plant

(a) Scale of mixing facilities

Casting volume of concrete

Number of days for casting

Constrution conditions

(b) Area for plant

Planned mixing facilities

Material supply and stock

Batcher plant

System	Mixer Capacity	Number	Necessary plant capacity	Remarks
Trolley or Semi-automatic system	$0.50m^3$	2	41 KW	Mixer, Water-pump Measuring instru't skip and bin

The area of aggregate stock yard will be sufficient to store the maximum casting concrete volume of approximater 7 days.

Area for plant facilities

Capacity of Mixer Unit	Area for plant facilities
$0.5m^3$ * 2 nos.	$1100m^2$ * 2

- Working hour and standard operation hour

The numbers of working hour, standard operation hour, and standard suspension days per year of mixing plant are as follows:

Machine Dimension	Average ope'g hour	Number per year ope'g hour	work'g day	susp'n day
Mixer	-	120	180	60

- Conveying, Casting of slab and beam concrete

(a) Selection of conveying method, casting concrete and detarmination of machine.

Conveying means to move concrete from batcher plant to placing site.

Batch method and agitator truck or dump truck method is selected for the purpose.

Agitator Truck, Dump Truck

Equipment	Capacity	Output	Remarks
Agitator truck	$3.0m^3$	125 ps	
Dump truck	$6t(2.5m^3)$	125 ps	4 wheels

Necessary number of vibrator

Desingation	Casting cocrete per day			
	$< 30m^3$	$30 - 50m^3$	$50 - 100m^3$	$> 100m^3$
Plain concrete	1 no	2 no	3 no	4 no
Reinforced concrete	2 no	3 no	4 no	5 no
Pavement concrete	1 no	1 no	1 no	2 no

- Rubble discharging

Armour stone will be conveyed from river and discharged directly by ship with crane. Armour stone will be conveyed by stone carrier with selfpropeller and pontoon with tug boat.

- Trimming of stones

Trimming of stones, in this case, will be done entirely underwater because the design crest height is +2.00 m P.W.D. Divers will carry out trimming work underwater by use of diver boat and handling of stones will be made by crane.

H.W.L +6.40

M.L.W.L +3.00 Working on land after neap tide on land

under water

L.W.L +0.40 Working underwater after high tide

- Diver boat

Diver boat and Worker

Diver boat	Diver	Foreman	Helper of A.S
D 30 PS with 3t winch, 1 ship	1 person	1 person	1 person

Working of Diver boat, Operation hour

Designation	Working hour	Operation hour	Depth
Diver boat	8	5	under 15m

- Transportation, Installation of L-shaped Concrete Blocks

Transportation, installation of concrete blocks and machine or equipment required there for are determined as follows:

Crawler crane will be used to shift concrete blocks from the adjacent block production yard to the temporary stock yard, considering such factors as working schedule, distances and present construction conditions. Platform truck will be used to convey concrete blocks from the stock yard to the installation places.

- Installation of Concrete Blocks

Concrete blocks will be installed by divers and crawler crane.

APPENDIX-3.4.3 Container Marshalling Yard Pavement

a) Improving land for pavement use

Compaction is usually the cheapest method of improving site soil. It may be accomplished by excavation to some depth, then by careful backfilling in controlled thickness and compaction by the appropriate equipment such as tire roller.

Fills which will later support pavements should be placed in accordance with compaction control criteria. With compaction control, the fill is often of better quality than the underlying soil. The underlying soil will undergo settlements of varying magnitude depending on its characteristics and the depth of fill. Settlements will be non uniform of the fill depth varies and may be of long duration unless special steps are taken to speed up the process such as over fill or installation of drainage to speed consolidation.

Compaction of cohesionless soils at the Pangaon site can be accomplished using smooth wheel rollers, commonly equipped with a vibratory device, so that the compaction is a combination of confinement, pressure and vibration. After the site has been leveled and graded, the stacking yard within the premises will be paved.

b) Subbase course

Subbase course work will be performed in dry season in the last stage of the construction period.

Subbase borrow pits are available in the area adjacent to the project site Prepared by the dredged materials from the Buriganga River. Material transportation is planned to pass on the completed road embankment in temporary stages.

- Lower Subbase

The lower subbase material will be excavated in the borrow pits and hauled to the work site by 15 ton bulldozer, backhoe and 11 ton dump truck. The material will be spread by 3.7m mother grader and compacted by 15 ton tired roller and 10 ton macadam roller.

- Upper Subbase

The upper subbase material will be obtained from the same borrow pits as for the lower one and mixed with brick chips on site. Sand and brick chips will be spread and leveled by 3.7m motor grader and brick chips will be spread uniformly on the road surface by manpower and spike harrow. Brick chips and sand will be mixed by 1.6m wide road stabilizer and compacted by 15 ton tired roller and 10 ton macadam roller.

After clearing the upper subbase surface, prime coating will be carried out. Cut-back bitumen will be melted in a 6,000 litre kettle and sprayed by 4,000 litre distributor and 600 litre engine sprayer, Sand will be spread by manpower and rolled by 15 ton tired roller.

c) Base course

Following the subbase course work, the base course work will be carried out in dry season. The base course materials will be procured from Bholagong Stone Boulder and Shingle. The base course structure is planned to be crushed stone.

Boulders procured from the quarry site will be crushed by a portable crushing plant of 60 ton/hr capacity. The raw material will be taken by local labour and the stones will be gathered at the site using local boat and other equipment, loaded and hauled to the crushing plant by 15 ton bulldozer, backhoe and 11 ton dump truck. Loading and hauling from both plants will be made by 1.6,^{3} wheel loader and 8 ton dump truck. Crushed stone will be spread by 3.5m wide aggrergate spreader in the yard. Rolling compaction will be made by 15 ton tired roller and 10 ton macadam roller.

After the base course layer, the prime coating will be carried out by the same method as applied for the subbase course work.

d) Bituminous surfacing

Bituminous surfacing work will also be carried out in dry season. It is planned that simple bituminous surfacing method will be applied. Bitumen heated by 6,000 litre asphalt kettle will be transported by 4,000 litre asphalt distributor and sprayed on the base course surface. The cover aggregate will be transported by 1.6m^3 wheel loader and 8 ton dump

truck from the crushing plant. Within 15 minutes after spraying asphaltic concrete, the sand will be spread by manpower and compacted by 15 tone tired roller and 15 tone tandem roller.

Container terminal pavements are normally exposed to much heavier loads than general cargo terminal pavements. The potential damage effects on pavements of heavy traffic of straddle carriers, fork-lift trucks and tractor-trailer units have recently been assessed. Fork-lift trucks which have very high front-wheel loads, were found to be much worse in this respect than the other yard systems, which carry about equal loads on all wheels.

Bituminous pavement of the container marshalling yard is normally prefered for the purpose and all ground slots should be clearly delineated by lines and numbered after completion of pavements.