10.2.2 Construction Plan

The Buriganga River Bridge is now under construction by a Chinese team in the upper reaches of the river. The planned date of completion for the bridge is April, 1990. Following completion of the bridge large vessels will not be able to travel beyond the bridge since their masts will be higher than the bridge clearance. As a result, it is important that this project be completed at about the same time as the bridge facilities in order to minimize the disruption of cargo vessels' navigation from the bridge project.

(1) Operations Flow For Construction

The main construction projects in the Short-term Development Plan be divided into the following: preparations, temporary work, land reclamation, constructing mooring facilities, road construction, shed building, construction for bank protection and bridge abutment, and additional construction.

Fig. 10.2.10 shows the operations flow for these construction items.

(2) Method of construction

The following is a discussion of the content and the flow of the construction presented in Fig. 10.2.10.

(a) Preparations and temporary work

Preparations and temporary work will include preparation and survey of the construction site, construction of a temporary pier, temporary roads and temporary buildings as well as bringing equipment and materials and setting up electricity and water supply.

Preliminary preparation must be done at the start of

construction. It must account for securing materials, equipment and manpower, supply routes for materials and equipment and transporting these items. In addition, the positions indicated on the blueprints must be located on the site through a survey.

A temporary pier is necessary to bringing heavy construction equipment and a huge amount of materials into the construction site. The materials will be are carried in river boats, because the site has no road connection able to transport them. The temporary pier will probably be a kind of an open-type jetty. It consists of H-shaped steel piles, cross-beams, and a floor covered with fill material. Driving of piles will be executed by a combination of pile drivers, mobile cranes and barges.

The temporary road will be used for transportation between the temporary pier and the storage yard for materials and machinery and the actual construction site.

The temporary buildings will include a storage building for housing materials and machinery, a construction site office and workers' quarters and any other facilities required for the smooth execution of the construction project.

Preparation works will include the construction of an asphalt plant and a concrete plant as well as facilities for bringing in electricity from a power substation in the vicinity of the construction site. Since there is no water supply in the vicinity, it is necessary to dig a well in order to supply water.

(b) Land reclamation

The crown elevation of land reclaimed for the general cargo terminal and the access road must be + 7.00m P.W.D. The ground level at the planned site is 2.0m to 5.0m P.W.D. for

an average of 4.0m P.W.D. As a result, the amount of fill needed when reclaiming land will be approximately 230,000 m^3. This fill material will be obtained from the relatively shallow area of the river at the mooring point in front of the berths.

A Pump dredger (1,200 ps) and dicharge pipes will be used for fill work. The reclaimed land will be allowed to sit for a month to settle after which it will be smoothened as the site. Land for purpose of constructing the temporary buildings and the yard for location of materials and equipment will be constructed during this same period in a neighboring area.

(c) Construction of mooring facilities

Mooring facilities consist of a pontoon and an approach bridge both of which will be fabricated at a local dock. The steel necessary for producing these items will be shipped in from abroad and used to fabricate the facilities locally. The pontoon and approach bridge will then be hauled by tug to the construction site for installation.

Before bringing the pontoon and the approach bridge to the construction site it will be necessary to drive guide piles for mooring the pontoon as well as to construct a bridge abutment on the land side of the approach bridge. Installing the pontoon will be done with chains attached to the guide piles. The approach bridge will be raised with cranes and installed on the pontoon and the landbased bridge abutment.

(d) Road construction

After the site reclaimed by pump dredger has settled and been levelled, the access road and the road within the terminal will be paved. The base course of the roads will

be made using crushed bricks produced in the area around the construction site. The access road will connect with the road for the bridge being constructed by the Chinese team. There is thus a need to finish this project at the same time the bridge is completed.

(e) Shed construction

Building of the sheds will follow the operational flow shown in Fig. 10.2.9.

The floor of the sheds will be 30 cm above ground level to prevent the entry of rain water.

The roofs of the sheds must be fabricated precisely according to the design in order to stably resist against the severe pressure of strong winds.

The steel materials needed for the steel roofing frames will be manufactured in the factory and assembled to create a roof truss at the site. This truss will be installed with truck cranes after completion of the concrete pillars. The concrete pillars and the truss will be secured with bolts.

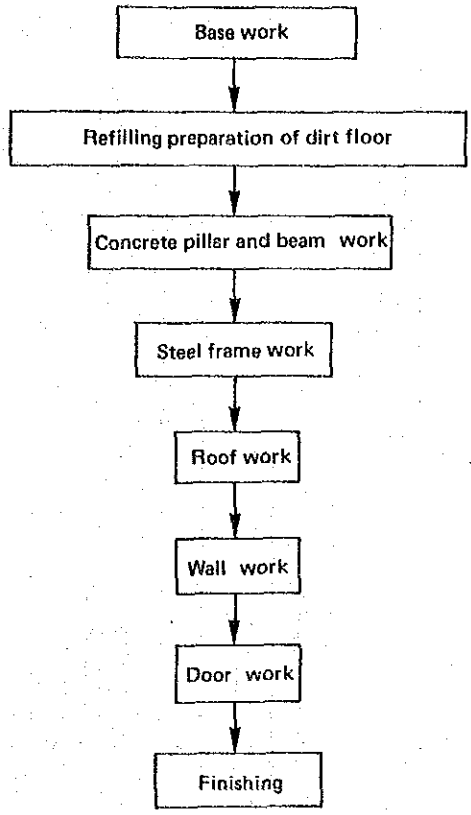


Fig. 10.2.9 Operational Flow of the Shed Construction

(f) Construction of bank protection and abutment for approach bridge

Construction of the bank protection will be executed by smoothing the face, digging a ditch in the face rear and inserting brick chips to make foot protection. Bricks will then be arrayed in a row from the upper part of this foot protection to the shoulders of the face.

In constructing the bridge abutment for the approach bridge, pile drivers on a truck crane will be used to drive steel pipe piles and the upper portion of these piles will be surrounded by reinforced concrete.

(g) Other construction

Other construction includes fences, gates, lighting, sewerage and water supply.

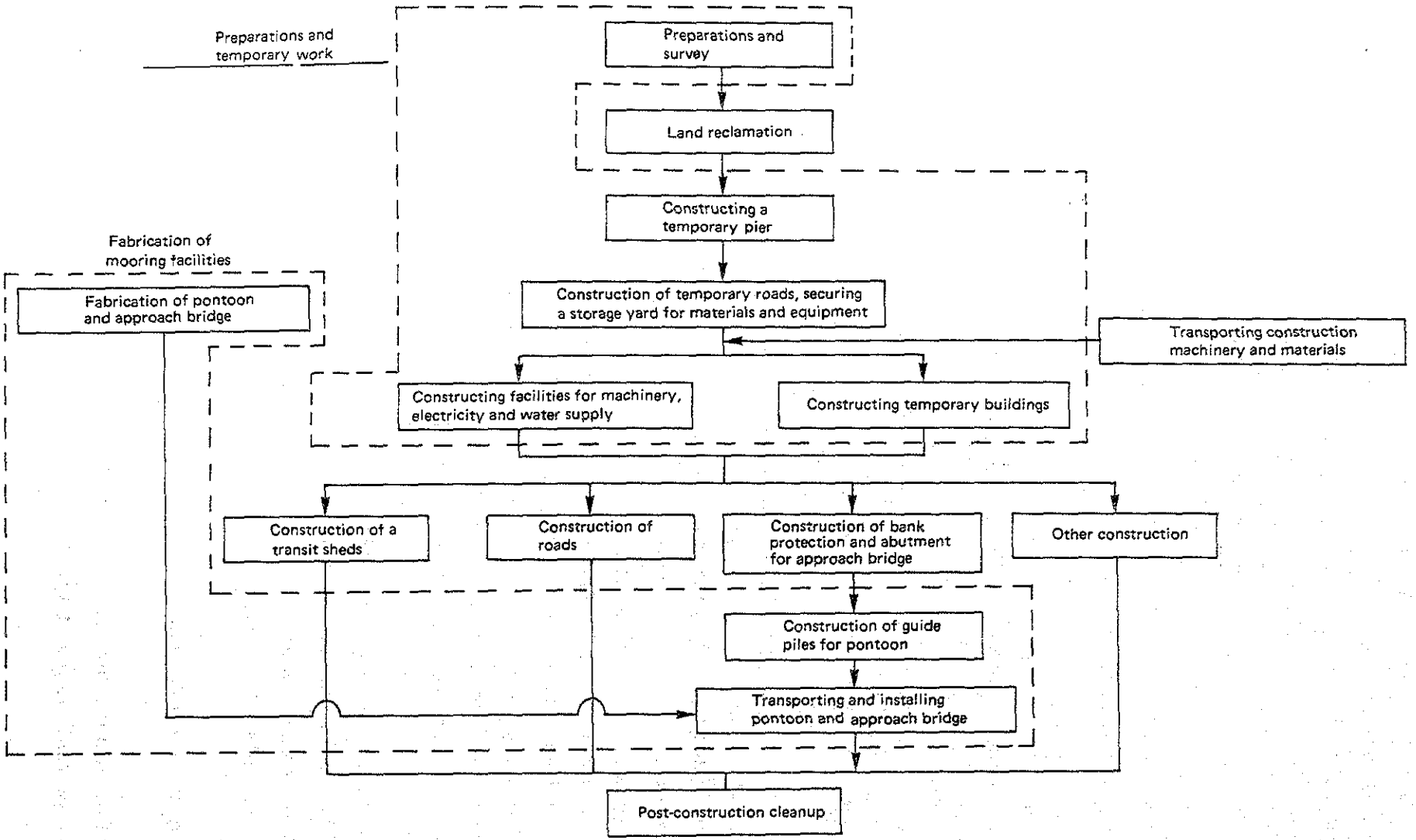


Fig. 10.2.10 Operations Flow for Construction Projects

(3) Construction Materials, Equipment and Labor Force

(a) Construction Materials

The volume of principal construction materials are shown in Table 10.2.1

Table 10.2.1 Major Construction Materials

Material	Item	Unit	Quantity
Sand, Stone & Cement	Stone	m^3	12,700
	Reclamation fill	m^3	230,000
	Cement	t	600
	Fine aggregate	t	1,400
	Coarse aggregate	t	2,000
Steel	Reinforcing bars	t	350
	Steel pile	t	300
	Others	t	1,250
Others	Asphalt	t	1,100
	Fuel	KL	500

(i) Materials for fill work and road beds

° Materials for fill work

Fill materials will comprise dredged soil from the river beds.

The soil consists of fine-grain sand and silt.

° Base course materials

Well burned brick chips will be employed as sub-base course materials. Crushed stones from the Sylhet region will be used as base course materials.

(ii) Concrete Materials

° Cement

Since imported cement is often kept for long periods of time in warehouses, the quality of imported cement cannot be guaranteed except for cement which has just been unloaded from the ship. Thus it is recommended to use cement coming directly from a cement factory such as the one located in Chittagong which makes cement using imported clinker.

° Coarse Aggregates

Crushed stones produced in the Sylhet region will be used as coarse aggregates.

° Fine Aggregates

Sand produced in the Sylhet region will be used as fine aggregates.

(iii) Steel Materials

° Steel pipes, H-shaped and I-shaped steel

These will be imported since they are not produced in Bangladesh.

° Other Steel Materials

As for steel bars used as reinforcing rods, L-shaped steel, flat bars, etc., imported materials will be used as well as locally rolled steel made from scrap. However, for major structural sections, the strength and mechanical properties should be tested and the steel should only be used when the quality has been certified. It is neccessary also to consider the limited local structual steel supply.

(b) Construction equipment, working craft

Table 10.2.2 shows the major types of working craft and equipment to be used for the construction.

(i) Construction Equipment

There has been a great increase in construction works in Bangladesh in recent years including construction of roads, bridges and buildings. The construction equipment used on these projects includes bulldozers, shovels, trucks, concrete plants and cranes.
Local construction machinery will be used as much as possible for this construction project. When certain items are not available, they will be obtained from abroad.

(ii) Working Craft

The number of tugboats, barges floating cranes and dredging ships available in Bangladesh is limited and the dredgers need to engage in a lot of maintenance dredging every year. Locally obtainable working craft will be utilized as much as possible. When necessary craft are not available locally, they will be brought in from abroad.

(c) Labor Force

The labor force for construction-related activities in Bangladesh is plentiful. It is easy to find unskilled laborers and it is also possible to obtain skilled laborers for masonry work, reinforcing, etc.

However, there will be cases where it will be necessary to rely on foreign workers for particular types of skilled work.

Table 10.2.2 Construction Equipment

Name of equipment	Specifications	Quantity	Remarks	Availability in Bangladesh
Bulldozer	21t class	2	Digging, plant	Yes
Grader	3.7m	1	Grading land	Yes
Tire-roller	20t	1	Rolling	No
Macadam Roller	10t	1	Rolling	No
Asphalt plant	42 T/H	1	Paving	No
Truck-crane	20t	1	Construction	Yes
Generator	200 KVA	1	Plant	No
Concrete mixer	0.75 m^3	2	Concrete	Yes
Wheel loader	1.4 m^3	1	Plant	Yes
Dump truck	10t	5	Transporting frame-works and joining materials	Yes
Single-body truck	7t	2	Transporting materials	Yes
Water spraying truck	5000 L	1	Construction of roadbed	No
Stationary dredging ship	1200 PS	1	Dredging	Yes
Pile driver		1	Pile driving	No
Floating crane	100t	1	Setting the Bridge	Yes
Tugboat	800 PS	1	Handling pontoons	Yes
Tugboat	1000 PS	1	Dredging	Yes
Self-propelled windlass ship	5t 90 PS	1	Dredging	Yes

(d) Quality and working schedule control

A group of specialists in the fields of quality control and construction work schedule control are neccessary for the construction of good, structually stable, durable facilities within a planned construction schedule.

(4) Construction plans

(a) Effective working days

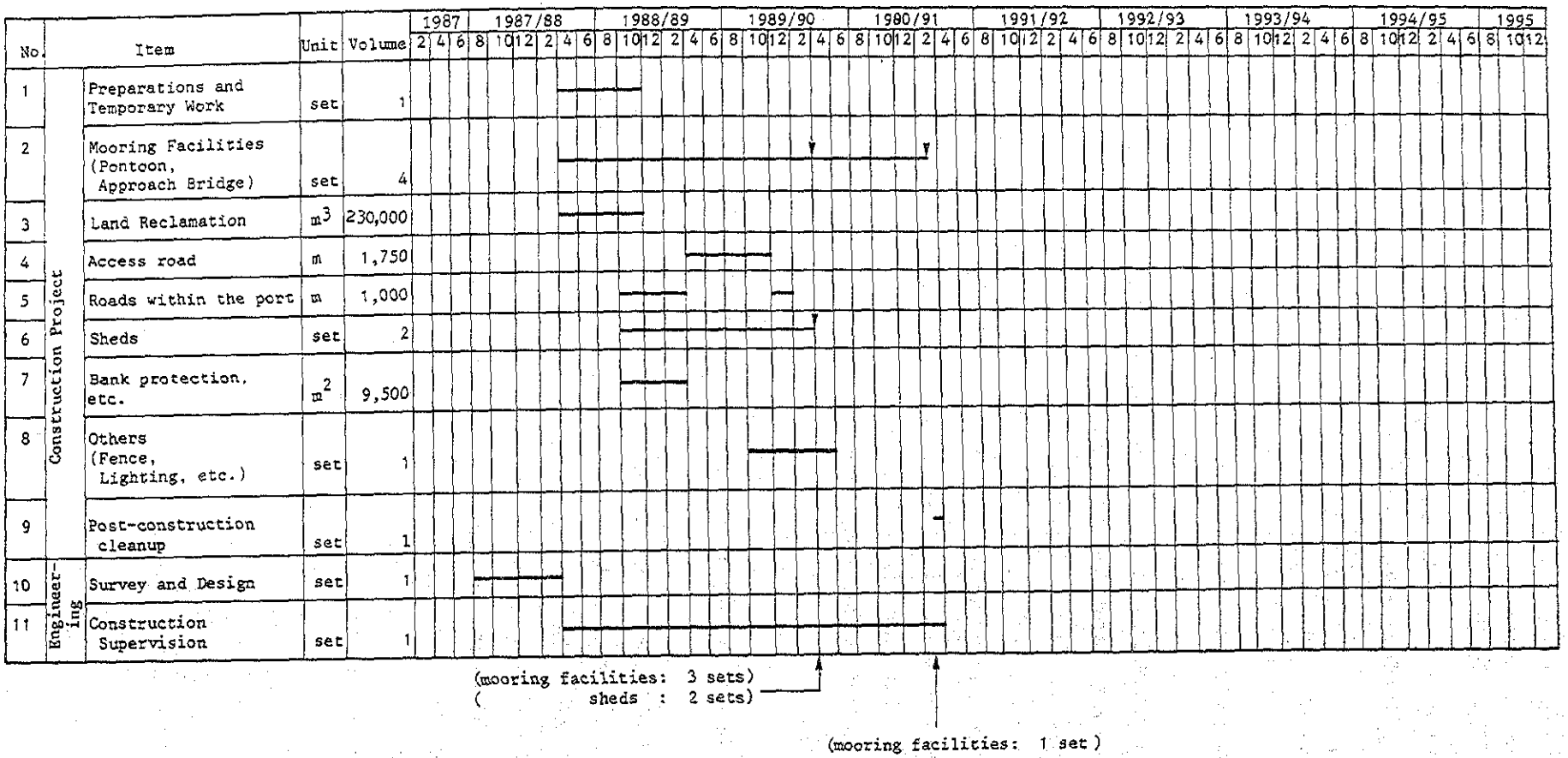
Effective working days are calculated giving consideration to rainy days and to the fasting month of Ramadan. Taking these factors into account, the effective number of working days is estimated to be about 290 days per year. During the dry season from November to March, it is possible to work almost every day. However, during the rainy season from May to August the number of effective working days decreases by 50%. Ramadan also contributes to a decrease in operating efficiency.

(b) Construction schedule

The construction schedule is shown in Table 10.2.3. As mentioned above in Chapter 8 (Master Plan), it is necessary to construct 3 berths by April 1990, and the 1 berth in 1991 in relation to the construction of the Buriganga Bridge.
Land reclamation is the first step of the main work and is very important from the view point of keeping on schedule. This work is assumed to be excuted with BIWTA's dredgers enganging in maintenance dredging in the inland water way.

Table 10.2.3 Construction Schedule for the Short-term Development Plan

No.		Item	Unit	Volume
1	Construction Project	Preparations and Temporary Work	set	1
2		Mooring Facilities (Pontoon, Approach Bridge)	set	4
3		Land Reclamation	m^3	230,000
4		Access road	m	1,750
5		Roads within the port	m	1,000
6		Sheds	set	2
7		Bank protection, etc.	m^2	9,500
8		Others (Fence, Lighting, etc.)	set	1
9		Post-construction cleanup	set	1
10	Engineering	Survey and Design	set	1
11		Construction Supervision	set	1



10.2.3 Construction Costs Estimation

The construction costs of the major facilities are estimated based on the construction plan found in section 10.2.2. Regarding construction materials and equipment which can be obtained in Bangladesh, the basic price is calculated by a local survey. Items which cannot be obtained locally are calculated as import items. In addition, the following assumptions are made when calculating construction costs.

(1) The currency values from 1986 are used and price increases are not considered. The exchange rate is considered to be as follows:

1 US dollar = 31.5 TK = 162 Yen
1 TK = 5.14 Yen

(2) Equipment shipped in from abroad will not include import duties. The CIF price will be taken as the price.

(3) Materials shipped in from abroad will consist of the CIF price plus import duties.

(4) Land acquisition costs and compensation incurred from moving homes to construct the facilities are not included in the total. But land acquisition cost for the general cargo terminal is included in Tables 10.2.4 and 10.2.5.

(5) Five percent of the total costs are included as a physical contingency.

(6) A price contingency is not included in the total.

Table 10.2.4 shows the construction costs for the short-term plan. The total investment is 302,300 thousand TK. The amount of the for foreign currency portion is 175,100 thousand TK which is 58% of the total. The following items are

included under the foreign currency portion.

(1) Special materials used in working such as steel materials and fenders, and scaffolding used to increase the accuracy of the construction and the working process.

(2) Shipping costs when bringing in ships and machinery from abroad as well as usage fees or purchase costs.

(3) As for personnel expenses, these apply to specialists in charge of quality control and other items as well as the costs for sending in skilled workers from abroad.

Table 10.2.5 shows the yearly funding for the short-term plan according to the stage of work.

Table 10.2.4 Project Cost of the Short-term Development Plan by Facility

Facilities	Volume	Unit	Amount ('000 Tk)		
			Foreign Currency	Local Currency	Total
Preparations and Temporary Work	1	set	15,700	11,100	26,800
Pontoons	4	set	59,200	44,700	103,900
Approach Bridges	4	set	7,100	8,100	15,200
Land Reclamation	230,000	m^3	12,500	8,900	21,400
Access Roads	1,750	m	13,600	8,600	22,200
Roads within the port	1,000	m	4,200	2,800	7,000
Sheds	2	set	18,300	16,000	34,300
Bank protection	9,500	m^2	1,400	2,500	3,900
Abutments for approach bridges	50	m	3,800	2,000	5,800
Others: Fence, lighting, etc.	1	set	5,800	3,700	9,500
Sub total			141,700	108,300	250,000
Engineering	1	set	25,000	-	25,000
Physical Contingency	1	set	8,400	5,400	13,800
Sub Total			33,400	5,400	38,800
Total			175,100	113,700	288,800
Land Acquisition	10.8	ha		13,500	13,500
Grand Total			175,100	100,200	302,300

Table 10.2.5 Yearly Investment Plan

(Unit: Thousand teka)

	Item	Volume	Unit	1987/88			1988/89			1989/90			1990/91			Total		
				Foreign Currency	Local Currency	Total	Foreign Currency	Local Currency	Total	Foreign Currency	Local Currency	Total	Foreign Currency	Local Currency	Total	Foreign Currency	Local Currency	Total
Construction Project	Preparations and Temporary Work	1	set	7,900	5,500	13,400	7,800	5,600	13,400							15,700	11,100	26,800
	Mooring Facilities	4	set	8,300	6,600	14,900	24,800	19,800	44,600	22,600	18,000	40,600	10,600	8,400	19,000	66,300	52,800	119,100
	Land Reclamation	230,000	m^3	6,300	4,400	10,700	6,200	4,500	10,700							12,500	8,900	21,400
	Access road	1,750	m				6,800	4,300	11,100	6,800	4,300	11,100				13,600	8,600	22,200
	Roads within the port	1,000	m				3,200	2,100	5,300	1,000	700	1,700				4,200	2,800	7,000
	Sheds	2	set				10,200	8,900	19,100	8,100	7,100	15,200				18,300	16,000	34,300
	Bank protection, etc.	9,500	m^2				5,200	4,500	9,700							5,200	4,500	9,700
	Others	1	set							5,800	3,700	9,500				5,800	3,700	9,500
	Sub Total			22,500	16,500	39,000	64,200	49,700	113,900	44,300	33,800	78,100	10,600	8,400	19,000	141,700	108,400	250,000
Engineering	Survey and design	1	set	6,500		6,500										6,500		6,500
	Construction supervision	1	set	2,000		2,000	6,200		6,200	6,200		6,200	4,100		4,100	18,500		18,500
	Sub Total			8,500		8,500	6,200		6,200	6,200		6,200	4,100		4,100	25,000		25,000
	Physical contingency	1	set	1,600	800	2,400	3,500	2,500	6,000	2,500	1,700	4,200	800	400	1,200	8,400	5,400	13,800
	Total			32,600	17,300	49,900	73,900	52,200	126,100	53,000	35,500	88,500	15,500	8,800	24,300	175,100	113,700	288,800
	Land Acquisition	10.8	ha		13,500	13,500											13,500	13,500
	Grand Total			32,600	30,800	63,400	73,900	52,200	126,100	53,000	35,500	88,500	15,500	8,800	24,300	175,100	100,200	302,300

CHAPTER 11
ECONOMIC ANALYSIS

CHAPTER 11 ECONOMIC ANALYSIS

11.1 General

The purpose of this chapter is to appraise the economic feasibility of the Short-term Development Plan presented in Chapter 9 from the viewpoint of the national economy. Thus, this chapter focuses on whether the net benefits of this project exceed those which could be derived from other investment opportunities in Bangladesh (e.g. the opportunity cost of capital).

All benefits and costs in the economic analysis are evaluated using economic prices based on the border price concept. There are various methods to evaluate the feasibility of this type of development project. Here, the economic internal rate of return (EIRR) based on cost-benefit analysis is used to appraise the feasibility of this project. In estimating the economic benefits and costs of the Short-term Development Plan, conversion factors are applied to domestic goods and to labor wages to convert the market prices into economic prices. Fig. 11.1.1 shows the process of the economic analysis.

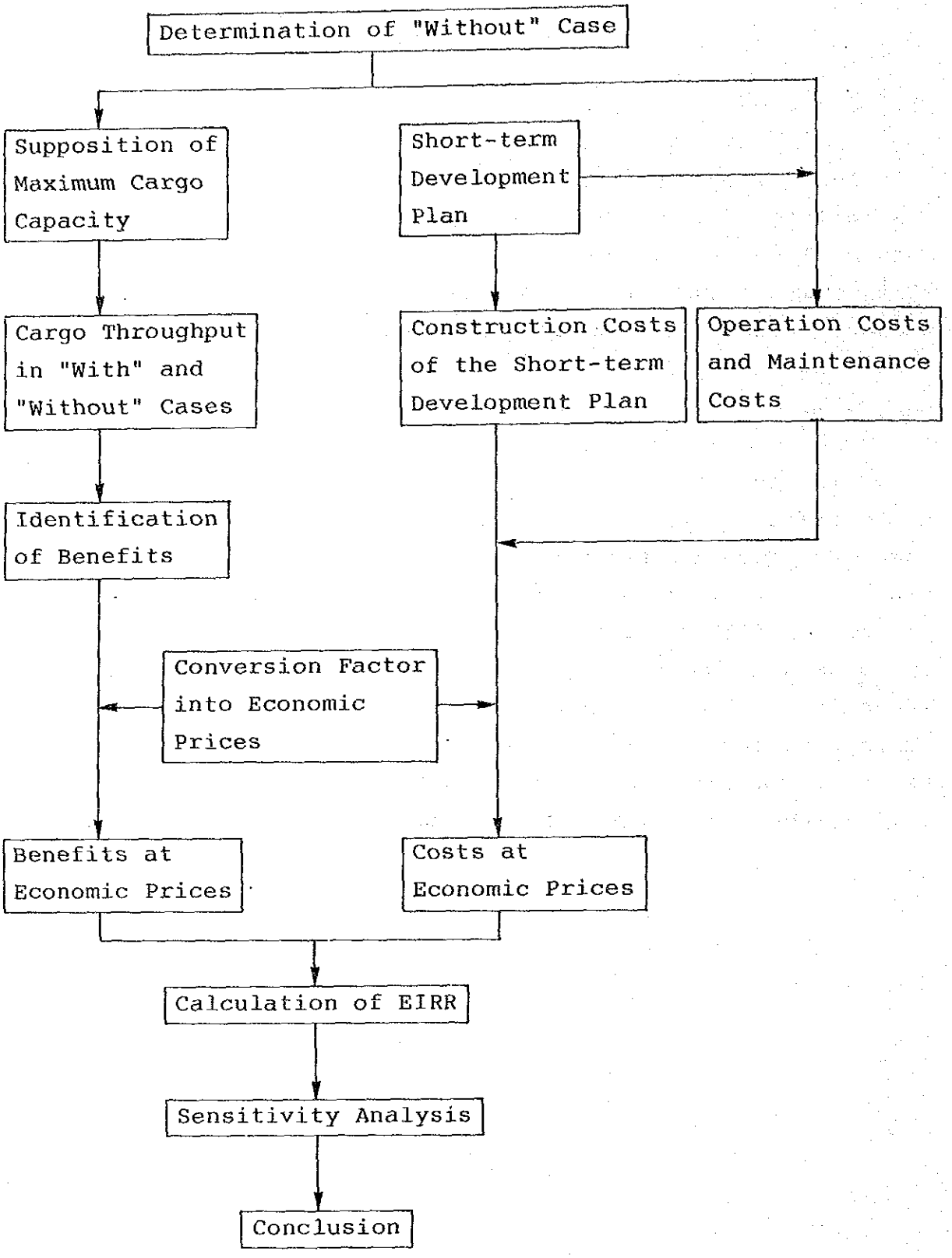


Fig. 11.1.1 **Process of the Economic Analysis**

11.2 Prerequisites of the Economic Analysis

11.2.1 "Without" Case

In the cost-benefit analysis, the costs and benefits are defined as the difference between the case "With" the project and the case "Without" the project. Therefore, defining the "Without" case is an importnat part of the economic analysis of the project. In this study, the following conditions are adopted as the "Without" case:

a) Additional investment to enlarge the handling capacity of existing berths will not be carried out.

b) The cargo volume exceeding the handling capacity of the existing berths will be transfered to alternative transport modes.

c) After completion of the Buriganga bridge in 1990, the navigation of coasters passing under the bridge will be restricted.

11.2.2 Prerequisites of the Economic Analysis

The following prerequisites are assumed for the analysis.

a) No additional investment will be made to enlarge the existing berths. However, required funds will be provided to maintain the existing facilities at their current level of services.

b) It is assumed that alternative transport modes have sufficient capacity to transport the excess cargo volume. Any required additional investment for the alternative modes is assumed to be included in their transport costs.

c) Existing berths will be operated at capacity.

d) The future cargo volume at Dhaka and Narayangnaj ports is based on the demand forecast and is the same for both the "With" and the "Without" cases within the project period.

e) Jute and Jute goods will continue to be handled at private berths which have a sufficient capacity to accommodate an increased volume in the future.

11.3 Economic Prices

11.3.1 Base Year

For the estimation, all costs and benefits are expressed in prices as of July 1986 when the price survey was conducted. The exchange rates are assumed as follows:

US $1 = 31.5 Taka = ¥ 162

11.3.2 Method for Converting to Economic Prices

For the economic analysis, prices are expressed in economic prices rather than market prices based on the border price concept. There are various methods for converting market prices into border prices. Here, the border prices (economic prices) are calculated by eliminating transfer items.

In general, all the costs and benefits are divided into three categories: labor, tradable goods and non-tradable goods. Labor is further classified in skilled labor and unskilled labor. As for skilled labor, the economic price is determined by multiplying the market wage by the conversion factor for consumption. On the other hand, the economic price of unskilled labor is determined by multiplying the nominal wage by the shadow wage rate and the conversion factor for consumption.

The prices of tradable goods are expressed in CIF and FOB values for import goods and export goods respectively. These are actual border prices. However, as the border value of non-tradable goods cannot be converted directly, the border value of the inputs needed to produce the non-tradable goods is considered. After some classification procedures, the economic price of a small amount of non-tradable goods is calculated by multiplying by the standard conversion factor directly.

11.3.3 Conversion Factors

(1) Standard Conversion Factor (SCF)

The standard conversion factor is used to determine the economic prices of certain goods which cannot be directly revalued at border prices. These include most non-tradable goods and services.

The standard conversion factor is expressed by the following equation:

$$SCF = \frac{X + M}{(X - Tx) + (M + Tm)}$$

where, X : value of exports
M : value of imports
Tx: value of taxes on exports
Tm: value of taxes on imports

The standard conversion factors within the past five years (1978/79-1982/83) are shown in Table 11.3.1. In this study, the average standard conversion factor over the five years, 0.884, is adopted.

Table 11.3.1 Standard Conversion Factor

(Unit:million Tk)

	1978/79	1979/80	1980/81	1981/82	1982/83	Total
Import (CIF)	22073	30525	37288	38729	45265	173880
Export (FOB)	9632	10997	11484	12387	18016	62516
Import taxes	4787	5638	5805	7968	8287	32485
Export taxes	295	584	393	198	107	1577
SCF	0.876	0.891	0.900	0.868	0.886	0.884

Source: Statistical Yearbook of Bangladesh (BBS, 1984/85)

(2) Conversion Factor for Consumption (CFC)

This conversion factor is used to convert the market prices of consumption goods into border prices. The conversion factor for consumption is usually calculated in the same manner as the SCF, replacing total imports and exports by those of consumption goods only.

However in this case, it is difficult to directly calculate the CFC due to the shortage of neccesary data such as import/export tax revenue figures on consumption goods. Therefore, in this study, the export tax rate is assumed to be 2%. The actual rates are very low due to the active promotion of exports. As for the average import tax rate, a value of 7% is assumed based on the 0% tax rate on food, the major import commodity, and the higher tax rates on other consumption goods.

Thus, the conversion factor for consumption has a value of 0.976 based on the above assumptions and the figures shown in Table 11.3.2.

Table 11.3.2 Foreign Trade

(Unit: million Tk)

	1978/79	1979/80	1980/81	1981/82	1982/83	Total
Export goods	9,632	10,997	11,484	12,387	18,016	62,516
Consumption goods	5,739	7,401	8,290	8,582	11,610	41,622
Intermediate goods	3,814	3,566	3,013	3,704	6,203	20,300
Capital goods	79	30	181	101	203	594
Import goods	22,073	32,525	37,288	38,729	45,265	173,880
Consumption goods	4,153	8,304	6,660	9,520	11,894	40,531
Intermediate goods	13,849	16,762	20,607	17,418	20,133	88,769
Capital goods	4,071	5,459	10,021	11,791	13,238	44,580

Source: Statistical Yearbook of Bangladesh (BBS, 1983/84)

(3) Conversion Factor for Capital Goods (CFCG)

The conversion factor for capital goods is normally calculated using a formula similar to the one used for the SCF, replacing total imports and exports by those of capital goods only. However, due to the lack of the required data, a value of 0.692 is adopted as the conversion factor for capital goods based on the following assumptions and the figures presented in Table 11.3.2. The average import tax rate is assumed to be 45% based on the average tax rate on imported machinary considering concessionary rates. The export tax rate is assumed to be 0% because of the active promotion of exports.

(4) Conversion Factor for Labor (CFL)

For economic analysis, labor costs are usually measured in terms of their opportunity costs, that is the value of the foregone marginal product from other alternate employment due to the employment of laborers for the project.

The cost of skilled labor is calculated based on actual market wages, assuming that the market mechanism is functioning properly. However, as these are domestic costs, they are converted into border prices by multiplying the market wage by the conversion factor for consumption.

Thus, the conversion factor for skilled labor

= (Market wage rate) x CFC

= 1 x 0.976

= 0.976

The cost of unskilled labor is calculated based on a simplified measure of the oppotunity cost. To measure the opportunity cost of labor, the simplified method presented by Little and Mirrless is adopted, which assumes that the marginal products of labor is approximately half the value of the average product of laborers in the agricultural sector. This

means that the marginal products of unskilled labor supplied from rural areas is less than the average product of laborers in those areas. This is due to the employment dynamics of the agricultural sector whereby marginal workers are generally employed rather than unemployed and the law of diminishing returns.

The value added in the agriculture sector in 1983/84 was 169,328 million Tk, and the total labor was approximately 5789 million person·days per year as shown in Table 11.3.3. Thus, the average labor product is 29.3 Tk/day. Therefore, the marginal product of unskilled labor is estimated as 14.65 Tk/day based on the simplified method. The average nominal wage rate was 19.6 TK/day in the same year, so the conversion factor is estimated as 74.7% of the nominal wage.

Thus, the conversion factor for unskilled labor

= (Nominal wage) x 0.747 X (CFC)

= 1 x 0.747 x 0.976

= 0.729

Table 11.3.3 Agricultural Workers

	Number ('000 persons)	Working days (days/year)	Total labor (million) (persons.days/year)
Employers and self-employed workers	10,686	300	3,205.8
Employees	5,544	300	1,663.2
Unpaid family workers	6,125	150	918.8
Total	22,355		5,787.8

Source: Statistical Yearbook of Bangladesh (BBS, 1983/84)
Yearbook of Labor Statistics (ILO, 1985)

(5) Conversion Factor for Construction

The conversion factor for construction is calculated as 0.781 as shown in Table 11.3.4, based on conversion of the local currency portion of cash of the development project works into border prices.

Table 11.3.4 Conversion Factor for Construction

Item	Composition Ratio (%) (1)	Foreign Currency			Local Currency					Conversion Factor (2)	(1) x (2)
		Tradable Goods (1.0)	Labor (1.0)	Taxes (0.0)	Tradable Goods (1.0)	N.Tradable Goods (0.884)	Skilled Labor (0.976)	Unskilled Labor (0.724)	Others (0.0)		
Site Preparation	9.3	29,9 0.299	9.0 0.090	14.9 0.000	15.4 0.154	1.9 0.017	14.1 0.137	2.5 0.055	7.3 0.000	100.0 0.752	0.070
Pontoon	34.7	26.1 0.261	20.0 0.200	18.7 0.000	7.7 0.077	1.3 0.011	16.9 0.165	6.1 0.044	3.2 0.000	100.0 0.759	0.263
Access Bridge	6.5	31.2 0.312	24.9 0.249	21.7 0.000	1.0 0.010	0.1 0.001	16.1 0.157	4.6 0.033	0.5 0.000	100.0 0.762	0.050
Land Reclamation	7.4	0.9 0.000	0.0 0.000	0.0 0.000	49.6 0.490	8.4 0.074	8.8 0.086	14.9 0.108	18.9 0.000	100.0 0.759	0.056
Access Road Road	7.7	4.5 0.045	0.0 0.000	0.0 0.000	44.5 0.445	5.8 0.051	10.6 0.103	14.6 0.166	20.0 0.000	100.0 0.751	0.058
Road	2.4	2.9 0.029	0.0 0.000	0.0 0.000	45.2 0.452	6.1 0.054	12.0 0.117	14.3 0.104	19.6 0.000	100.0 0.755	0.018
Transid Shed	11.9	29.9 0.299	4.1 0.041	12.8 0.000	15.1 0.151	1.7 0.015	21.9 0.214	6.9 0.050	7.6 0.000	100.0 0.770	0.091
Embankment	1.4	5.1 0.051	0.0 0.000	0.0 0.000	24.2 0.242	3.1 0.027	20.0 0.195	35.8 0.261	11.8 0.000	100.0 0.777	0.010
Bridge Foundation	2.0	50.0 0.500	0.0 0.000	20.7 0.000	11.2 0.112	1.4 0.012	4.3 0.042	7.1 0.052	5.3 0.000	100.0 0.718	0.014
Others	3.3	15.8 0.158	0.0 0.000	6.3 0.000	34.8 0.348	4.2 0.037	8.8 0.086	13.3 0.097	16.8 0.000	100.0 0.726	0.024
Engineering	8.7	0.0 0.000	100.0 1.000	0.0 0.000	0.0 0.000	0.0 0.000	0.0 0.000	0.0 0.000	0.0 0.000	100.0 1.000	0.087
Physical Contingency	4.8	20.3 0.203	19.6 0.196	12.0 0.000	16.6 0.166	2.4 0.021	14.0 0.137	7.9 0.058	7.3 0.000	100.0 0.780	0.037
Grand Total	100.0	20.4 0.204	19.5 0.195	12.0 0.000	16.6 0.166	2.4 0.021	13.9 0.136	7.9 0.058	7.3 0.000	100.0 0.779	0.779

Source: study team estimates

11.4 Cargo Handling Volume

The annual cargo handling volume of coasters at Dhaka and Narayanganj ports, which is forecast in the Demand Forecast and Port Facilities Planning sections, is 680 thousand tons and 1865 thousand tons in 1994/95 and 2004/05, respectively. Taking the introduction of container transport into account, the net cargo volume for coasters is presented in Table 11.4.1.

Table 11.4.1 Net Cargo Volume for Coasters

(Unit: 1000 tons)

Year	Coaster Cargo	Containerizable Cargo	Net Cargo
1985/86	253	0	253
87	283	0	283
88	313	0	313
89	351	0	351
1989/90	392	0	392
91	438	0	438
92	489	0	489
93	545	56	489
94	609	120	489
1994/95	680	191	489
96	752	227	525
97	832	246	586
98	920	266	654
99	1,018	288	730
1999/00	1,126	311	815
01	1,246	337	909
02	1,378	363	1,015
03	1,524	392	1,132
04	1,686	423	1,263
2004/05	1,865	455	1,410

11.4.1 "Without" Case

Under the "Without" case, the existing cargo handling facilities comprise 5 berths: 2 berths at Badamtali, 2 berths at Khanpur and Ghat No.5. After the completion of the Buriganga bridge construction work, however, the facilities at Badamtali will no longer accommodate coasters because the clearance under the bridge will severly restrict coaster navigation. The maximum annual cargo volume for the "Without" case is determined based on the maximum cargo handling capacity of the existing berths.

In this study, the maximum cargo handling capacity is set based on the berth occupancy ratio at which vessels will still be willing to wait for berthing in order to load/unload in the ports. Cargo exceeding the maximum handling capacity of the existing berths is assumed to be transported by other transport modes (i.e. roads or railways).

The projected annual cargo volume is shown in Table 11.4.2.

Table 11.4.2 Cargo Handling Volume in the "Without" Case

(Unit: 1000 tons)

Year	Net Cargo Volume	Handling Cargo Volume	Excess Cargo Volume
1985/86	253	253	0
87	283	283	0
88	315	315	0
89	351	351	0
1989/90	392	213	179
91	438	213	225
92	489	213	276
93	489	213	276
94	489	213	276
1994/95	489	213	276
96	525	213	312
97	586	213	373
98	654	213	441
99	730	213	517
1999/00	815	213	602
01	909	213	696
02	1,015	213	802
03	1,132	213	919
04	1,263	213	1,050
2004/05	1,410	213	1,197

11.4.2 "With" Case

Under the "With" case, the cargo handling facilities comprise the existing 5 berths and 4 new berths. In the "With" case, the maximum handling capacity and the number of new berths is determined based on the Short-term plan which is designed to minimize the overall cost taking both the vessel and the berth costs into consideration. (Optimum number and capacity of berths)

After the cargo exceeds the handling capacity, additional berths will have to be built or the cargo will have to be transported by other transport modes.

The projected annual cargo volume is shown in Table 11.4.3.

Table 11.4.3 Cargo Handling Volume in the "With" Case

(Unit: 1000 tons)

Year	Net Cargo Volume	Handling Cargo Volume	Excess Cargo Volume
1985/86	253	253	0
87	283	283	0
88	315	315	0
89	351	351	0
1989/90	392	392	0
91	438	438	0
92	489	489	0
93	489	489	0
94	489	489	0
1994/95	489	489	0
96	525	489	36
97	586	489	97
98	654	489	165
99	730	489	241
1999/00	815	489	326
01	909	489	420
02	1,015	489	526
03	1,132	489	643
04	1,263	489	773
2004/05	1,410	489	921

11.5 Benefits

11.5.1 Kinds of Benefits

The development of Dhaka and Narayanganj ports, which greatly influence inland cargo movement, has greatly contributed to the national economy. In line with the objectives of the development and the significance of the Short-term Development Plan, the following items are identified as benefits arising from the short-term development.

1 Savings in the waiting cost of vessels
2 Savings in transportation costs
(versus other transport modes)
3 Savings in the cargo handling cost at berth
4 Savings in the damage and pilferage of cargos
5 Promotion of regional economic development through development of port-related industries
6 Increse in employment opportunities and incomes

It is impossible to evaluate all the benefits in monetary terms, but here the following items are considered countable and the monetary benefits of these items are calculated.

1 Savings in berth waiting cost
2 Savings in transportation cost
3 Savings in cargo handling cost
4 Savings in damage and pilferage

The following benefits are considered uncountable and only a qualitative analysis is undertaken.

1 Development of port-related industries
2 Increase in employment opportunities

11.5.2 Calculation of Benefits

(1) Savings in Berth Waiting Cost

(a) Average Waiting Time and Benefit

Accoridng to the queuing simulations which consider the annual cargo volume and the traffic intensity, the average annual berth waiting time is calculated as shown in Table 11.5.1.

The benefits derived from the reduction of the berth waiting cost of vessels is calculated based on the following formula.

Savings in berth waiting costs	=	Difference of Waiting time between "With" and "Without"	x	Ship Cost (unit cost)

(b) Ship Cost (Unit Cost)

The ship cost is set a equal to the fixed vessel cost which is calculated in Appendix 7.

Table 11.5.1 Ship Waiting Time

Year	"Without" Case			"With" Case		
	Average Waiting Time (days/vessel)	Number of Vessel	Total Waiting Time (days)	Average Waiting Time (days/vessel)	Number of Vessel	Total Waiting Time (days)
1985/86	0.133	338	45.0	0.133	338	45.0
87	0.371	378	140.2	0.371	378	140.2
88	0.688	420	289.0	0.688	420	289.0
89	1.108	468	518.5	1.108	468	518.5
1989/90	2.649	284	750.3	0.567	523	296.5
91	2.642	284	750.3	0.346	584	202.1
92	2.642	284	750.3	0.579	652	377.5
93	2.642	284	750.3	0.579	652	377.5
94	2.642	284	750.3	0.579	652	377.5
1994/95	2.642	284	750.3	0.579	652	377.5
96	2.642	284	750.3	0.579	652	377.5
97	2.642	284	750.3	0.579	652	377.5
98	2.642	284	750.3	0.579	652	377.5
99	2.642	284	750.3	0.579	652	377.5
1999/00	2.642	284	750.3	0.579	652	377.5
01	2.642	284	750.3	0.579	652	377.5
02	2.642	284	750.3	0.579	652	377.5
03	2.642	284	750.3	0.579	652	377.5
04	2.642	284	750.3	0.579	652	377.5
2004/05	2.642	284	750.3	0.579	652	377.5

Source: Study Team Calculation

(2) Savings in Transportation Cost

According to the projected cargo handling volume presented in section 11.4, a significant volume of cargoes will exceed the cargo handling capacity of the ports after the completion of the bridge in the "Without" case. These cargoes would have to be transported by other transportation modes at a somewhat higher transport cost. However, due to the cargo handling capacity of the new berths under the "With" case, the excess cargo volume can be transported by I.W.T. under the Short-term Development Plan.

Therefore, the benefit derived from the reduction of the transportation cost is calculated by the following formula.

Savings in transport cost	=	Difference of excess cargo volume under the "With" and "Without" case	x	Difference of transport cost between IWT and alternatives

(a) Transportation Cost

The transportation cost of each transport mode for Railways, Roads and Inland Waterways is calculated based on the operation performance which is detailed in Appendix 7.

In order to estimate the total door to door transportation cost, handling and transfer (or feeder) costs are taken into consideration.

(b) Transfer Costs

In order to provide door to door service, transfer or feeder costs must be considered for the Rail and Inland Water Transport modes. Thus, the relative transport costs of all three modes can be compared on a door to door basis. Based on the market prices, a unit cost of

5 Tk/t-km is adopted for an assumed cargo feeding distance of 10 km by truck. The economic cost is derived by multiplying this figure by the conversion factor of truck transport which calculated as 0.748.

(c) Handling Costs

The handling cost at both the origin and the destination of the cargo is considered. The unit cost is 25 Tk/ton, and the economic cost is calculated by multiplying this cost by the conversion factor for unskilled labor.

Handling cost = 25 Tk/ton x (CFL)
= 25 x 0.729
= 18.23 Tk/ton

Truck : cargo is handled two times: once at the origin and once at the destination

I.W. and Rail : cargo is handled four times: at origin and destinatin and on and off the feeder service

(d) Total Transportation Cost

The total transportation cost of each mode measured in ton-km is calculated on the basis of the door to door cost as shown in Table 11.5.2.

According to the cargo handling volume by coasters, 60% of the total volume is assumed as incoming cargo from Chittagong and the rest is outgoing cargo to Barisal and Khulna. Hence, the cargo movement by route is assumed as follows:

Table 11.5.2 Transportation Cost

(Unit: Tk/ton.km)

Distance (km)	25	50	75	100	150	200	250	300	350	400
Truck										
Transport Cost	2.86	2.14	1.89	1.77	1.65	1.59	1.56	1.53	1.51	1.50
Handling Cost	1.46	0.73	0.49	0.36	0.24	0.18	0.15	0.12	0.10	0.09
Transfer Cost	-	-	-	-	-	-	-	-	-	-
Total	4.32	2.87	2.38	2.13	1.89	1.77	1.71	1.65	1.61	1.59
Coaster										
Transport Cost	4.60	2.45	1.74	1.38	1.02	0.84	0.74	0.66	0.61	0.57
Handling Cost	2.92	1.46	0.97	0.73	0.49	0.36	0.29	0.24	0.21	0.18
Transfer Cost	1.50	0.75	0.50	0.37	0.25	0.19	0.15	0.12	0.11	0.09
Total	9.02	4.66	3.21	2.48	1.76	1.39	1.18	1.02	0.93	0.84
Train										
Transport Cost	7.73	4.24	3.10	2.49	1.91	1.62	1.41	1.32	1.24	1.19
Handling Cost	2.92	1.46	0.97	0.73	0.49	0.36	0.29	0.24	0.21	0.18
Transfer Cost	1.50	0.75	0.50	0.37	0.25	0.19	0.15	0.12	0.11	0.09
Total	12.15	6.45	4.57	3.59	2.65	2.17	1.85	1.68	1.56	1.46

Source: Appendix 7

Route	Allocation of Cargo	Distance (km) IWT	Road	Rail
Dhaka-Chittagong	60 %	350	240	340
Dhaka-Barisal	30 %	170	230	-
Dhaka-Khulna	10 %	360	280	620

In order to estimate the difference of the transportation cost between I.W.T. and the alternative modes, the least expensive alternative (either road or rail) is selected for each route.

A comparison of the transportation cost of each mode by route is summarized below.

Route	Transportation cost (Tk/t) IWT	Road	Rail	Difference (Tk/t)
Dhaka-Chittagong	326	413	539	87
Dhaka-Barisal	274	399	-	125
Dhaka-Khulna	328	469	630	141

Source: Table 11.5.2

(3) Savings in Cargo Handling Cost

One of the objects of this development project is to improve the efficiency of cargo handling. In this sense, the handling operations (manual labor in the "Without" case and mechanical handling in the "With" case) are examined, and the difference of cargo handling efficiency is expressed as the savings in cargo handling cost from the viewpoint of the national economy.

In this study, however, improved operations are only introduced at the proposed new four berths in light of the existing circumstances. It is not appropriate to change the cargo handling system at the existing berths considering the abundant labor pool and the employment situation.

Therefore, the benefit derived from the reduction of the cargo handling cost is calculated by the following formula.

Savings in cargo handling cost	=	Cargo handling volume	x	Difference of handling cost

(a) Cargo Handling Cost

According to the Port Facilities Planning section of this study, the per berth cargo handling volume is set at 300 tons per day. The handling cost is estimated as follows:

i) Conventional cargo handling

Conventional cargo handling means operation by manual laborers (head loaders). The cargo handling capacity of head loaders is set at 2.3 tons/day*person, and the unit cargo handling cost is 15.9 Tk/ton. (See Appendix 7)

ii) Improved cargo handling

Improved cargo handling means operation by forklifts with a lifting capacity of 2 tons. The cargo handling capacity of forklifts is set at 173 tons/day, and the unit cargo handling cost is 7.6 Tk/ton. (See Appendix 7)

(4) Savings in Damage and Pilferage

In this Short-term Development Plan, the introduction of the transit sheds at the new berths under an appropriate management system will protect the cargoes against damage and pilferage. The reduction of damage and pilferage can be generally assumed to be 1%- 2% of the value of the cargo volume.

The benefit is calculated by the folowing formula.

Savings in damage and pilferage	=	Handling cargo Volume	x	Percentage of cargo handled at the sheds	x	Unit value of savings

According to section 8.8.4 (General Cargo Berth Planning) 30% of the forecast cargo volume for new general cargo berths will be handled through the transit sheds. As for the unit cost of the cargo, the average unit value of handling cargo is assumed as 5205 Tk/ton at economic price. The unit value of savings is assumed to be equal to 1% of the cargo value.

Table 11.5.3 Cargo Volume through Transit Sheds

(Unit: 1000 ton)

Year	Cargo Volume		Year	Cargo Volume	
	Total	through T.S.		Total	through T.S
1985/86	253	0	1995/96	489	83
87	283	0	97	489	83
88	315	0	98	489	83
89	351	0	99	489	83
1989/90	392	53	1999/00	489	83
91	438	68	01	489	83
92	489	83	02	489	83
93	489	83	03	489	83
94	489	83	04	489	83
1994/95	489	83	2004/05	489	83

Note: T.S. means transit shed

11.5.3 Uncountable Benefits

(1) Development of Port-related Industries

Without the implementation of the development project, the ports of Dhaka and Narayanganj will handle a limited cargo volume, and the development or expansion of industries which are dependant on the port will be stagnant. On the other hand, the new development project at the new site will induce port-related industries to develop, and the value added derived from those industries is therefore an economic benefit of the development project. Furthermore, the development of infrastructure will also contribute to the regional development.

(2) Increase in Employment Oppotunities

As for the additional employment directly arising from the project, employment for construction during the construction period and for operations after the facilities are completed are considered.

The construction will provide employment for people who would remain unemployed if the project does not take place due to the excess supply of laborers. This employment is one of the major benefits of the project. Table 11.5.4 shows the annual allocation of this employment effect.

Table 11.5.4 Annual Allocation of Employment

(Unit:100 person-days)

	1987/88	1988/89	1989/90	1990/91	Total
Skilled	573	1,708	1,415	814	4,510
Unskilled	326	1,034	595	312	2,267
Total	899	2,742	2,010	1,126	6,777

Along with the increased direct employment, a secondary employment effect will also occur based on the new demand from

the newly-established port-related industries. Similarly, the income of already employed local workers is also expected to rise.

11.5.4 Benefits

All the countable benefits measured at economic prices are summarized in Table 11.5.5.

Table 11.5.5 Benefits at Economic Prices

(Unit: 1000 Taka)

Year	Berth Waiting Costs	Trans-portation Costs	Cargo Handling Costs	Damage and Pilferage	Total Benefits
1987/88					
89					
1989/90	7,575	18,580	2,291	4,138	32,584
91	9,151	23,355	2,291	5,309	40,106
92	6,223	28,649	2,291	6,480	43,643
93	6,223	28,649	2,291	6,480	43,643
94	6,223	28,649	2,291	6,480	43,643
1994/95	6,223	28,649	2,291	6,480	43,643
96	6,223	28,649	2,291	6,480	43,643
97	6,223	28,649	2,291	6,480	43,643
98	6,223	28,649	2,291	6,480	43,643
99	6,223	28,649	2,291	6,480	43,643
1999/00	6,223	28,649	2,291	6,480	43,643
01	6,223	28,649	2,291	6,480	43,643
02	6,223	28,649	2,291	6,480	43,643
03	6,223	28,649	2,291	6,480	43,643
04	6,223	28,649	2,291	6,480	43,643
2004/05	6,223	28,649	2,291	6,480	43,643

11.6 Costs

11.6.1 Construction Costs

Like the project benefits, the project costs must also be converted from the market prices into the economic prices for the economic analysis. Construction costs are converted by multiplying the market costs by the conversion factor for construction. The annual construction costs at economic prices are shown in Table 11.6.1, based on the construction schedule.

11.6.2 Maintenance Costs

The economic maintenance costs for the fixed assets are set at 0.5% of the economic construction costs.

11.6.3 Operation Costs

The operation costs consist of personnel costs and administrative costs.

(1) Personnel Costs

The personnel costs which are considered in the following chapter are considered at economic prices.

(2) Administrative Costs

Based on the analysis of historical data, the administrative costs are set at 52% of the personnel costs. The economic prices of the administrative costs is calculated by multiplying the market costs by the standard conversion factor.

11.6.4 Handling Equipment Costs

As the development project includes the introduction of mechanical equipment, the equipment costs are considered as a part of the project costs. The costs of the Short-term Development Plan include the purchase prices and maintenance costs at economic prices of eight forklifts with a lifetime of 8 years.

11.6.5 Land Costs

In order to develop the port facilities and the infrastructure, land which would otherwise be used for cultivation is utilized for the development project. Therefore, the land costs in the economic analysis are defined as the foregone product which is measured based on the value added of cereal production.

Table 11.6.1 Costs at Economic Prices

(Unit: 1000 Taka)

Year	Construction Costs	Maintenance Costs	Operation Costs		Equipment Costs*		Land Cost	Total Costs
			Personnel, Adm.		Investment, Maint.			
1987/88	38,921						62	38,983
89	98,314						62	98,376
1989/90	68,842	892	184	116	2,670		62	72,766
91	18,898	974	241	152	890	277	62	21,494
92		974	241	152		370	62	1,799
93		974	241	152		370	62	1,799
94		974	241	152		370	62	1,799
1994/95		974	241	152		370	62	1,799
96		974	241	152		370	62	1,799
97		974	241	152		370	62	1,799
98		974	241	152		370	62	1,799
99		974	241	152	2,403	370	62	1,799
1999/00		974	241	152	801	370	62	4,202
01		974	241	152		370	62	2,600
02		974	241	152		370	62	1,799
03		974	241	152		370	62	1,799
04		974	241	152		370	62	1,799
2004/05		974	241	152		370	62	1,799
06		974	241	152		370	62	1,799
07		974	241	152		370	62	1,799
08		974	241	152	2,403	370	62	1,799
09		974	241	152	801	370	62	4,202
2009/10		974	241	152		370	62	2,600
11		974	241	152		370	62	1,799
12		974	241	152		370	62	1,799
13		974	241	152		370	62	1,799
14		974	241	152		370	62	1,799
2014/15		974	241	152		370	62	1,799

* Equipment investment costs are added every 8 years.

11.7 Evaluation

11.7.1 Calculation of the EIRR

The lifespans of the various port facilities and infrastructures vary. Here, the lifetime of the pontoon which is key strucure is taken as the project lifetime. The cost-benefit evaluation is carried out starting in 1987/88 (the first year of the investment schedule) and ending in 2014/15 (the 25th year from the start of the operations of the general cargo berths in 1989/90).

The required replacement cost of handling equipment such as forklifts during the calculation period is taken into account and the residual value of the fixed assets which are pontoons, access bridges, sheds and forklifts in the last year 2014/15 is also taken into account for the calculation.

The EIRR is calculating using the following equation.

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

where, Bi : Benefit in the i-th year
Ci : Cost in the i-th year
r : Discount rate
n : Calculation year

The value of "r" which satisfies the equation is the internal rate of returns (IRR).

11.7.2 Results and Evaluation

The EIRR of the Short-term Development Plan is 17.8% as shown in Table 11.7.2. There are various views concerning the appropriate IRR level used to guide the judgement as to whether a project is feasible or not. The leading view is that the

project is feasible if the IRR exceeds the opportunity cost of capital.

The opportunity cost of capital in developing countries ranges from 8% to 15% as shown in Table 11.7.1. It is generally considered that an IRR of more than 10% is economically feasible for infrastructure or social service projects. Therefore, the result of the EIRR calculation, 17.8%, only taking into account the four quantifiable benefits shows that this Short-term Development Project is reasonably feasible from the viewpoint of the national economy.

Table 11.7.1 Opportunity Cost of Capital

Nation	Sector	IRR (%)
India	Manufacturing	10 - 12
Pakistan	Agriculture	10
	Manufacturing	10
Bangladesh	Manufacturing	15
Nepal	Transport	8
Egypt	Manufactuing	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

Table 11.7.2 EIRR Calculation

Project Name : Short-Term Development Plan
I.R.R. (%) : 17.84

NO.	YEAR	COST	BENEFIT	BNFT.-COST	P. COST	P. BNFT	P.VALUE
1	1987/88	38983.00	0.00	-38983.00	38983.00	0.00	-38983.00
2	1988/89	98376.00	0.00	-98376.00	83481.90	0.00	-83481.90
3	1989/90	72766.00	32584.00	-40182.00	52400.40	23464.50	-28935.90
4	1990/91	21494.00	40106.00	18612.00	13134.90	24508.60	11373.70
5	1991/92	1799.00	43643.00	41844.00	932.92	22632.20	21699.30
6	1992/93	1799.00	43643.00	41844.00	791.68	19205.70	18414.00
7	1993/94	1799.00	43643.00	41844.00	671.82	16298.00	15626.10
8	1994/95	1799.00	43643.00	41844.00	570.10	13830.50	13260.30
9	1995/96	1799.00	43643.00	41844.00	483.79	11736.50	11252.70
10	1996/97	1799.00	43643.00	41844.00	410.54	9959.61	9549.07
11	1997/98	1799.00	43643.00	41844.00	348.39	8451.73	8103.34
12	1998/99	4202.00	43643.00	39441.00	690.54	7172.14	6481.60
13	1999/ 0	2600.00	43643.00	41043.00	362.59	6086.28	5723.69
14	2000/ 1	1799.00	43643.00	41844.00	212.90	5164.82	4951.92
15	2001/ 2	1799.00	43643.00	41844.00	180.67	4382.86	4202.20
16	2002/ 3	1799.00	43643.00	41844.00	153.31	3719.30	3565.99
17	2003/ 4	1799.00	43643.00	41844.00	130.10	3156.20	3026.10
18	2004/ 5	1799.00	43643.00	41844.00	110.40	2678.35	2567.95
19	2005/ 6	1799.00	43643.00	41844.00	93.69	2272.85	2179.16
20	2006/ 7	1799.00	43643.00	41844.00	79.50	1928.74	1849.24
21	2007/ 8	4202.00	43643.00	39441.00	157.59	1636.73	1479.14
22	2008/ 9	2600.00	43643.00	41043.00	82.74	1388.93	1306.18
23	2009/10	1799.00	43643.00	41844.00	48.58	1178.64	1130.06
24	2010/11	1799.00	43643.00	41844.00	41.23	1000.20	958.97
25	2011/12	1799.00	43643.00	41844.00	34.99	848.77	813.78
26	2012/13	1799.00	43643.00	41844.00	29.69	720.27	690.58
27	2013/14	1799.00	43643.00	41844.00	25.19	611.22	586.02
28	2014/15	1799.00	53091.00	51292.00	21.38	630.96	609.58
	TOTAL	281203.00	1129570.00	848367.00	194664.00	194664.00	-0.04

UNIT = 1000 Tk

Note : P.COST --- Present Value of Cost
: P.BNFT --- Present Value of Benefit

11.7.3 Sensitivity Analysis

(1) Idetification of Cases

In order to estimate the variation of the EIRR, the following cases are chosen for the sensitivity analysis.

Case A : The cost increases by 10%
Case B : The benefit decreases by 10%

(2) Results of Sensitivity Analysis

The results of the sensitivity analysis are as follows:

Case	EIRR (%)
A	16.05
B	15.86
Base	17.84

The EIRR is always over 15 % based on the sensitivity analysis. Therefore, the project is considered feasible under all probable circumstances.

CHAPTER 12
FINANCIAL ANALYSIS

CHAPTER 12 FINANCIAL ANALYSIS

12.1 Financial Situation of BIWTA

BIWTA is a subordinate organization of MOPSIWT, and is engaged in the operation and maintenance of inland waterways and inland river ports. The scale of BIWTA's general budget is about 200 million taka. In the 1985/86 budget, the main revenue items are government grants (46 million taka), port revenue (47.5 million taka) and dredger revenue (60 million taka). The expenditures are allocated to each department for wages and salaries, administration costs and repair/maintenance costs of facilities. In addition, about 100 million taka are allocated to BIWTA for the execution of the annual development projects.

The Dhaka Port Office collects various charges and fees. In 1985/86, the 9.8 million taka of the lease/license fees represent 58% of the total 16.9 million taka revenue. The landing & shipping charges (for cargoes) and the termainal charges (for passengers) are 3.2 million taka and 2.3 million taka, respectively. The berthing charges are only 0.8 million taka.

Judging from the above mentioned facts, the revenue from the berthing charges and the landing & shipping charges at the public port facilities cover only a part of the operation and maintenance costs of the existing facilities.

12.2 Methodology

The construction cost for the Short-term Development Plan amounts about 300 million Taka. In order to amortize this cost during 20 - 30 years in other words, to calculate a financial internal rate of return, an annual port revenue of at least 15 million Taka is required. As described in the following section, however, the projected annual port revenue does not reach 3.5 million Taka according to the existing tariff. It means that the

existing tariff should be raised to the level of 4 to 5 times to recover the investment and operating cost.

According to the economic analysis, this project is valuable as a national development scheme (as Chpater 11). Therefore, it is considered to be admitable that the national government pay the most part of the capital investment cost. Considering that raising of the changes and fees would be rather difficult under the existing situation in Bangladesh, the following analysis is aimed to clarify the payable initial investment cost for BIWTA and the financial condition of the project based on the existing tariff.

12.3 Assumptions for Individual Items

12.3.1 Revenues

(1) Revenue from Berthing Charges

a. Berthing charges

Based on the existing tariff, Tk 140 per vessel per day is used for cargo vessels with a carrying capacity from 1000 tons upto 1500 tons.

b. Average berthing days

2.5 days is adopted according to the port plan.

c. Number of calling vessels

750 tons per vessel is assumed for obtaining the following table.

Year	Number of vessels
1989/90	239
1990/91	300
1991/92 and after	368

(2) Revenue from Landing & Shipping Charges

a. Landing & Shipping charges

Based on the existing tariff, Tk 5.36 per ton is adopted.

b. Cargo handling volume

According to the demand forecast, the cargo handling volume is as follows:

Year	Cargo handling volume ('000 tons)
1989/90	179
1990/91	225
1991/92 and after	276

(3) Revenue from storage charges

a. Storage charges

Tk 0.50 per square feet per day is used as for "Foreshore covered" according to the current tariff. Practically Tk 1.79 per ton per day is used as a converted result assuming 3 tons per square meter.

b. Average staying days

7 days is adopted assuming that stays over 7 days will require an additional charge following the prevailing practice in foreign countries.

c. Storage cargo volume

30% of the cargo handled at general berths is assumed to be stored in transit sheds.

Year	Storage cargo volume ('000 tons)
1989/90	54
1990/91	68
1991/92 and after	83

(4) Revenue from road charges

a. Road charges

Based on the existing tariff, the following charges are used.

Type	Road charges
Loaded trucks	Tk 14.00 per trip
Empty trucks	Tk 6.00 per trip

b. Number of truck trips

Assuming that the average loading volume per truck is 7 tons and that the loading rate is 0.5, the number of related trips is estimated as shown in the following table.

Year	Number of trips ('000 trips)	
	Loaded	Empty
1989/90	26	26
1990/91	32	32
1991/92	39	39

12.3.2 Expenditures

(1) Wages and Salaries

a. Number of employees

The number of employees by position is set as shown in the following table based on discussions with the members of the Ports & Traffic Department.

Position	1989/90	1990/91 and after
Traffic inspector	1	1
Supervisor	1	1
Toll collector	6	8
Toll guard	6	8
Sweeper	1	2

b. Salary levels

The annual salary by position (including honorarium and allowances) is calculated by the Accounts Department as shown in the following table.

Position	Annual salary (Tk)
Traffic inspector	21,450
Supervisor	20,700
Toll collector	18,375
Toll guard	14,175
Sweeper	14,175

(2) Administration cost

It is assumed that the administration cost amounts to 52% of the wages and salaries, considering the past records of the Dhaka Port Office.

(3) Repair/maintenance Cost

It is assumed that the yearly repair/maintenance cost is 0.5% of the accumulated construction cost.

12.4 Comparison of Alternative of Investment by BIWTA

12.4.1 Alternative Cases of Investment by BIWTA

If BIWTA pays the total capital investment cost, it is obvious that the agnecy will suffer the great loss financially. So the following cases are selected for the comparison.

(a) Pay land acquisition cost
(b) Pay land acquisition and reclamation cost
(c) Pay land acquisition and access road construction cost
(d) Pay land acquisition, reclamation and access road construction cost
(e) Pay land acquisition, reclamation, access road roads within port, sheds and other misscellaneous construction cost.

From Case 'a' to Case 'd' the charges and fees are fixed at the existing level, but in Case 'e' the berthing charges and land & shipping charges are raised to 2 times and the storage charges and road charges to 1.5 times.

12.4.2 Results of Alternative FIRR

The investment plan, the projected operating revenue flown and the projected operating cost flow for calculating the FIRR of each case are shown in the following Table 12.4.4.

Table 12.4.1 Investment Plan for Financial Analsis

(Unit: 1000TK)

	1987/88	1988/89	1989/90
Land Acquisition	13,500		
Land Reclamation	11,200	11,200	
Access Road		11,600	11,600
Roads within Port		5,600	1,800
Sheds		24,200	11,900
Others'			10,000

Note: Physical contingency is included in the construction cost.

Table 12.4.2 Projected Operating Revunue Flow (Case a to Case d)

(Unit: 1000 TK)

	1989/90	1990/91	1991/92 - 2014/15
Berthing Charges	84	105	129
L & S Charges	959	1,206	1,479
Storage Charges	677	852	1,040
Road Charges	520	640	780
Total	2,240	2,803	3,428

Table 12.4.3 Projected Operating Revenue Flow (Case e)

(Unit: 1000 TK)

	1989/90	1990/91	1991/92 - 2014/15
Berthing Charges	168	210	258
L & S Charges	1,918	2,412	2,958
Storage Charges	1,016	1,278	1,560
Road Charges	780	960	1,170
Total	3,882	4,860	5,946

Table 12.4.4 Project Operating Cost Flow

(Unit: 1000TK)

	1989/90	1990/91	1991/92 - 2014/15
Wages & Salaries	252	331	331
Administration	131	172	172
Repair & Maintenance	784	1,155	1,250
Total	1,167	1,658	1,753

The calculated FIRR is shown in Table 12.4.5.

Table 12.4.5 FIRR of Each Case

(Unit: %)

Case	FIRR
a	10.4
b	4.3
c	2.7
d	1.5
e	1.7

The FIRR of each case is very low except Case a, which assumes that BIWTA pays only the land acquisition cost. Under the existing tariff, the maximum payable portion of the initial investment cost by BIWTA is limited to about 20% of the total, which is equivalent to Case 'd'. In this case, it is required that the most part of investment fund is the own capital and that the interest rate of loan is very low. If such raising of the tariff as assumed in Case e is possible, BIWTA can pay about one thirds of the total investment cost, on the condition that they get a loan of extremely low rate.

12.5 Financial Analysis in Case a

The projected profit/loss statement and the projected cash flow table are prepared for Case 'a'. It is assumed that the

land is acquired by the own capital of BIWTA and that the surplus of cash flow is deposited at 10% interest rate.

The results is shown in Table 12.5.1. From the table it can be observed that in the profit/loss statement the net income will turn to plus in 2004 and the accumnlated net income will turn to plus in 2014.

In the cash flow table BIWTA will obtain a re-investment fund of 171 million Taka, in 2015. The amount is equivalent to the total constuction cost of mooring facilities (125 million Taka), sheds(36 million Taka) and other miscellaneous facilities (10 million Taka).

This result shows that if BIWTA gets rid of debt service they will be able to re-invest the deposited fund for the depreciable port facilities. In other words, if they make use of loan and want to reinvest, it is necessary to raise the cahrges and fees equivalent to debt service.

Table 12.5.1 Projected Cash Flow Table and Profit/loss Statement

(Unit: 1000 Taka)

	87/88	88/89	89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/2000	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08	08/09	09/10	10/11	11/12	12/13	13/14	14/15
Beginning Cash Balance	0	0	0	1,073	2,325	4,233	6,331	8,639	11,178	13,971	17,043	20,422	24,139	28,228	32,726	37,674	43,116	49,103	56,688	62,932	70,900	79,665	89,307	99,913	111,579	124,412	138,529	154,056
Cash Inflow	13,500	0	2,240	2,910	2,661	3,851	4,061	3,851	4,061	4,825	5,132	5,470	5,842	6,251	6,701	7,195	7,740	8,338	8,997	9,721	10,518	11,395	12,359	13,419	14,586	15,869	17,281	18,834
Port Revenue			2,240	2,803	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,423	3,438	3,428
Interest Received				107	233	423	633	864	1,118	1,397	1,704	2,042	2,414	2,823	3,273	3,767	4,312	4,910	5,569	6,293	7,090	7,567	8,931	9,991	11,158	12,441	13,853	15,406
Equity	13,500																											
Cash Outflow	13,500	0	1,167	1,658	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753
Operating Exp.			1,167	1,658	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753
Investment	13,500																											
Cash In - Cash Out	0	0	1,073	1,252	1,908	2,098	2,308	2,539	2,793	3,072	3,379	3,717	4,089	4,498	4,948	5,442	5,987	6,585	7,249	7,968	8,765	9,642	10,606	11,666	12,833	14,116	15,528	17,081
Ending Cash Balance	0	0	1,073	2,325	4,233	6,331	8,639	11,178	13,971	17,043	20,422	24,139	28,228	32,727	37,674	43,116	49,103	55,688	62,932	70,900	79,665	89,307	99,913	111,579	124,412	138,528	154,056	171,137
Port Revenue			2,240	2,803	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428	3,428
Interest Revenue				107	122	312	633	864	1,118	1,397	1,704	2,042	2,414	2,823	3,273	3,767	4,312	4,910	5,569	6,293	7,090	7,967	8,931	9,991	11,158	12,441	13,853	15,406
Operating Expenses			1,167	1,658	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753	1,753
Depreciation			3,178	5,194	5,954	5,954	5,954	5,954	5,954	5,954	5,954	5,954	5,954	5,954	5,954	5,954	5,954	5,954	5,954	5,954	5,954	5,954	5,954	5,954	5,954	5,954	5,954	3,583
Net Income			-2,105	-3,902	-4,046	-3,856	-3,646	-5,415	-3,161	-2,882	-2,575	-2,237	-1,865	-1,456	-1,006	-512	33	631	1,290	2,014	2,811	3,688	4,652	5,712	6,879	8,112	9,574	13,498
Accumulated Net Income			-2,205	-6,047	-10,093	-13,949	-17,595	-21,010	-24,171	-27,053	-29,628	-31,865	-31,863	-33,930	-25,186	-31,704	-36,671	-36,040	-34,750	-32,736	-29,925	-26,237	-21,585	-15,873	-8,914	-832	8,742	22,240

12.6 Some Suggestions

Based on the above mentioned study some suggestions for BIWTA to conduct this project financially are described below.

(a) In case that BIWTA pays a part of the initial investment cost (for example, land acquicition cost), it is desirable to use own capital.

(b) The surplus of cash flow should be deposited as a reinvestment fund.

(c) In case of getting loan (for example, land reclamation cost or access road consturction cost) raising of the charges and fees should be done according to the amount and period of debt service.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