3-4 PRESENT CONDITIONS OF CHITTAGONG DRY DOCK

3-4-1 Environmental Conditions

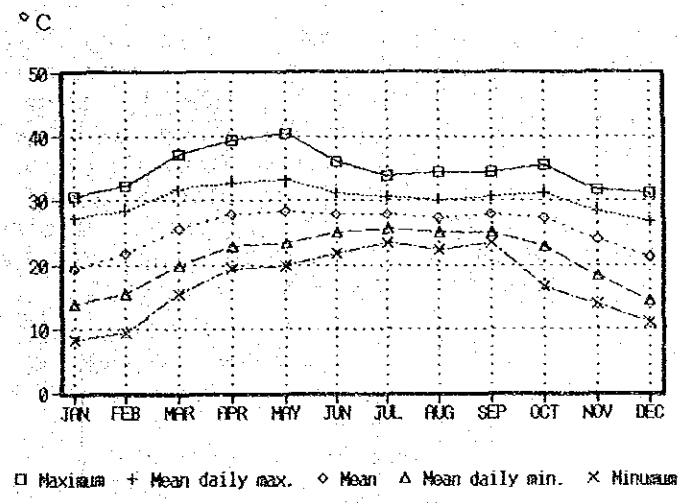
(1) Meteorological Conditions

1) Climate

Chittagong is situated in the tropical monsoon zone and as such it is subjected to a tropical climate. Chittagong is remarkable for its uniform temperatures, high humidity and heavy rainfall from May to October. October to November usually has some rainy days, but otherwise the weather is fine and dry. January and February are cool and dry. March, April and May are hot but have some wet days.

2) Temperature

The average lowest minimum temperature in Chittagong is recorded in December and January, which is 10°C and highest in April which is 40°C giving a difference of 30°C. The difference in minimum and maximum average temperature is nearly double rising from 17°C in January to 35°C in June.

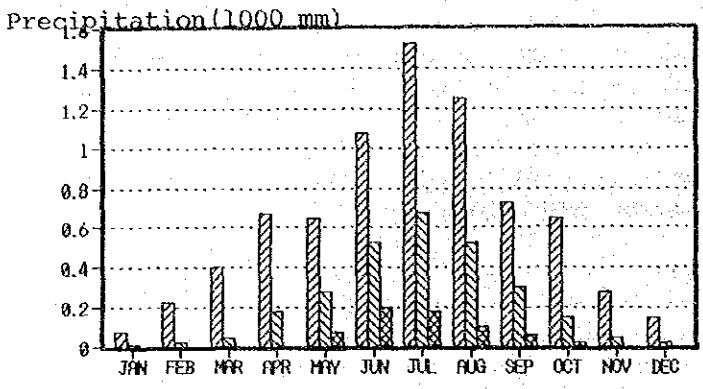


Source: Chittagong Port Authority (CPA)

Fig. 3-4-1 Monthly Temperature

3) Rainfall

The average mean monthly rainfall for the rainy season of May to October is 250 to 600 mm, since rainfall for the dry season of the month from November to April varies between 20 to 60 mm. The heaviest rainfall is observed in August and since 1954, the maximum rainfall of 1500 mm was observed.

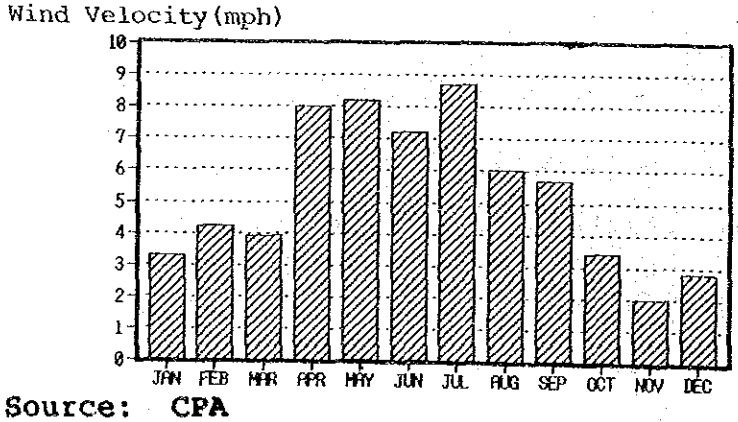


Source: CPA

Fig. 3-4-2 Monthly Rainfall

4) Wind

In the Chittagong area, the velocity of wind is generally weak except during a cyclone storm. In October, the wind blows most frequently from the north, and during the next four months with a steady and slow change of direction, the wind blows from the west. During monsoon season, the wind blows from south-east. The average wind velocity of 2 to 3 knots has been recorded during October to March and the velocity of winds greatly increases from May to July.



Source: CPA

Fig. 3-4-3 Monthly Mean Wind Velocity

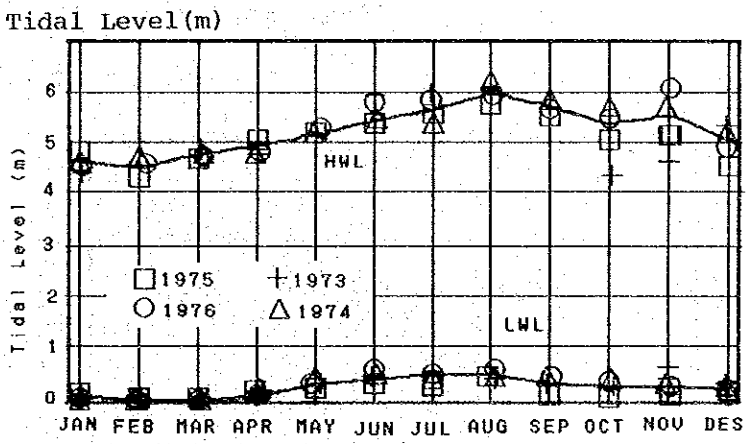
5) Cyclones

In the Bay of Bengal, the frequency of cyclone occurrence is the highest in May and October. A tropical cyclone generally originates in the warm moist air overlying the ocean near the south of latitude 20. The wind velocity of cyclonic storms varies from 15 to 150 mph. In the Chittagong area, 13 notable cyclones and storm surged since 1973.

(2) Oceanographic Conditions

1) Tide

The Chittagong port area, particularly the lower reaches of the Karnaphuli River, is subjected to wide tidal fluctuations. The range between the high and low monsoon tides goes up to 6.7 m while the winter tide fluctuates between 3 to 5 m. The neap tide range during the monsoon goes up to 3 m while that during the winter is from 1.7 to 2.7 m. An abnormal situation in water level and velocity of discharge is caused during continuous heavy rainfall with the full or new moon tidal actions.



Source: CPA

Fig. 3-4-4 Monthly Tidal Level

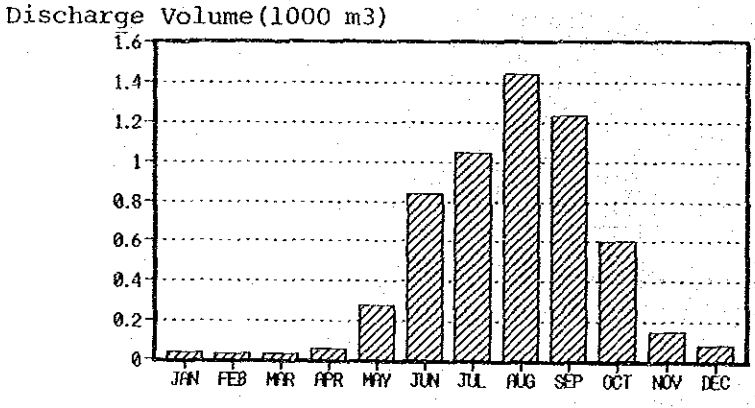
2) Current

In the lower reach of the Karnaphuli a current ranges from 4.5 to 5.5 knots of the ebb tides of the spring and 2.5 to 3.5 knots of the neap tide during the monsoon. The velocity during the winter months is about 3 knots and 2 knots respectively for the spring and neap tides.

3) Discharge

The total drainage area of the Karnaphuli River is 5,000 square miles lying mostly within Chittagong district and Chittagong hill. The total length of the river to the Bay mouth is about 130 miles. It passes through 20 miles of alluviums to the Bay of Bengal, with an average gradient of three inches per mile.

Discharge records are not presently maintained at Chittagong, however discharge data at Rangamati on the Kaptai Lake is available. Fig. 3-4-5 shows the average monthly discharges computed for the Kaptai Dam site on the basis of observations. The average discharge from the 1962 to 1969 was about 540 m^3/s, the peak discharge of 10,500 m^3/s was observed in 1969, however the peak discharge during the monsoon season is mostly limited to about 3,000 m^3/s.



Source: CPA

Fig. 3-4-5 Discharge Volume

4) Siltation

A siltation phenomena is serious in the Karnaphuli River and its maintenance dredging work of about 4,000 m^3 is carried out annually in front of the dock entrance. According to the report of "Trial Dredging of the Port of Chittagong" by CPA, total dredging volume needed for the vessels of 9.15 m draught amounts to 1.35 million cubic meters between the river mouth to the Chittagong Port. Siltation problems occurring around the dock entrance should be carefully analyzed when the new dock facilities are planned to be built.

(3) Subsoil Conditions

Subsoil conditions around CDD area have already been investigated by DEVCON in 1966 and by SOILTECH INTERNATIONAL LTD in 1979. In accordance with those investigation results, it can be said that the subsoil conditions of the area are comparatively good due to the following reasons.

- The subsoil mainly consists of sandy soil, and clayey layer involving a problem such as consolidation settlement could not be found.

- The bearing layer for the pile foundation appears at a shallow depth.

1) Subsoil formation

Fig. 3-4-6 shows the subsoil profile around the existing dry dock area. The subsoil of the area is composed of three soil layer from the top, clayey layer, sandy layer and silty sand or sandy silt layer respectively. The top of the two layers is assumed to be marine or river deposits in the Alluvial era and the underneath layers will be assumed to be residual soil which is highly weathered material of bedrock in the Tertiary era.

2) Soil properties

Fig. 3-4-7 shows the soil properties. Brief descriptions of soil properties for each layers are as follows:

i) Clayer layer

The soil consists of approx. 90% of clay and silt particle and 10% of sand. The N value (penetration resistance by standard penetration test) ranges from 3 to 10, the soil has stiffness of soft to medium stiff.

The liquid limit ranges from 40 to 50%, and plastic limit ranges around 20% and plasticity index ranges from 10 to 20. Consequently, the soil is classified as low plasticity clay or silt. As natural moisture content ranges along plasticity limit, the soil is stable.

The unconfined compression strength ranges from 0.5 to 2.0 kg/cm^2, the soil has relatively high compression strength as alluvial clay.

ii) Sandy soil

The soil consists of approx. 30% of clay and silt and 70% of sand particles. The sand is composed of fine to medium particles.

As N value ranges from 20 to 40, the layer has a relative density of medium to dense.

iii) Sandy silt or silty sand layer

This layer is assumed as a sandwiched layer of sandy soil and clayey soil. The N value ranges more than 50 and this layer has sufficient bearing capacity for structures.

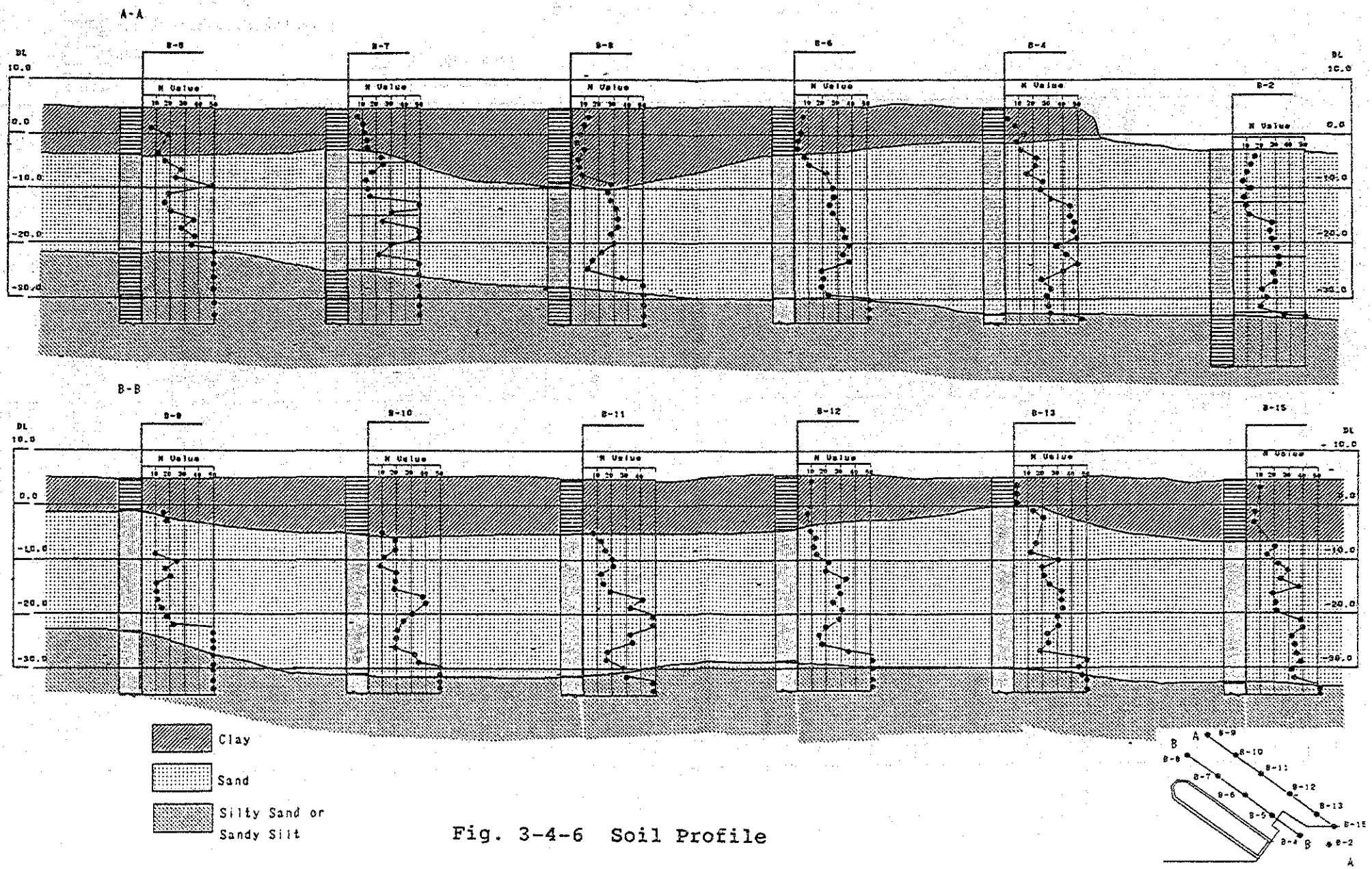


Fig. 3-4-6 Soil Profile

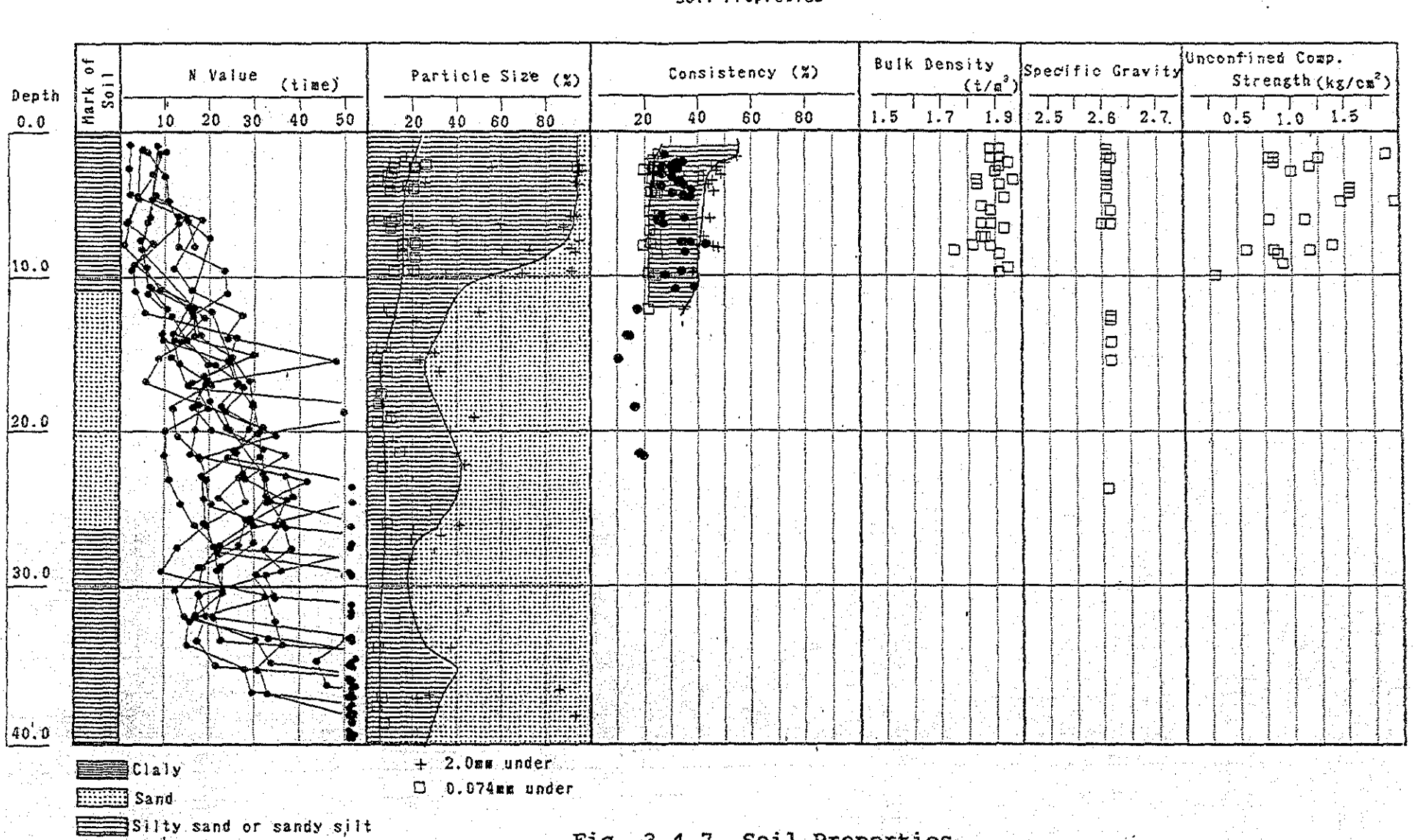


Fig. 3-4-7 Soil Properties

(4) Infrastructure

1) Road

CDD faces the road linking Chittagong city with the air port. This two lane road of 8 m width is currently utilized as an access road for the factories located along the Karnaphuli river.

CDD is also using this road efficiently for transportation and it may not be a hindrance in the future activity of CDD, even though insignificant traffic jams have been caused near the downtown area.

2) Railway

A railway line is located parallel with the above mentioned road, however CDD has not used this railway. The utilization rate of this railway seems to be low at present.

3) Port

The port of Chittagong is the principal port of Bangladesh. It is situated on the right bank of the Karnaphuli River with a distance of about 15 km from the river mouth and just upstream from the CDD. Seagoing vessels have to be guided up the river by local pilots from the Patenga lighthouse. There are three sandbars to be crossed the Outer Bar, Inner Bar and Gupta Bar with depths varying from seven to ten meters depending on the tides. The port has made Chittagong the commercial centre of Bangladesh.

The Chittagong port has been handling 76% of import and 50% of export cargo in 1987/88. There are 17 jetties including 2 pontoon jetties with the jetty face ranging from 133 m to 183 m in length. The port is connected with the hinterland by the railway, road and the inland water way.

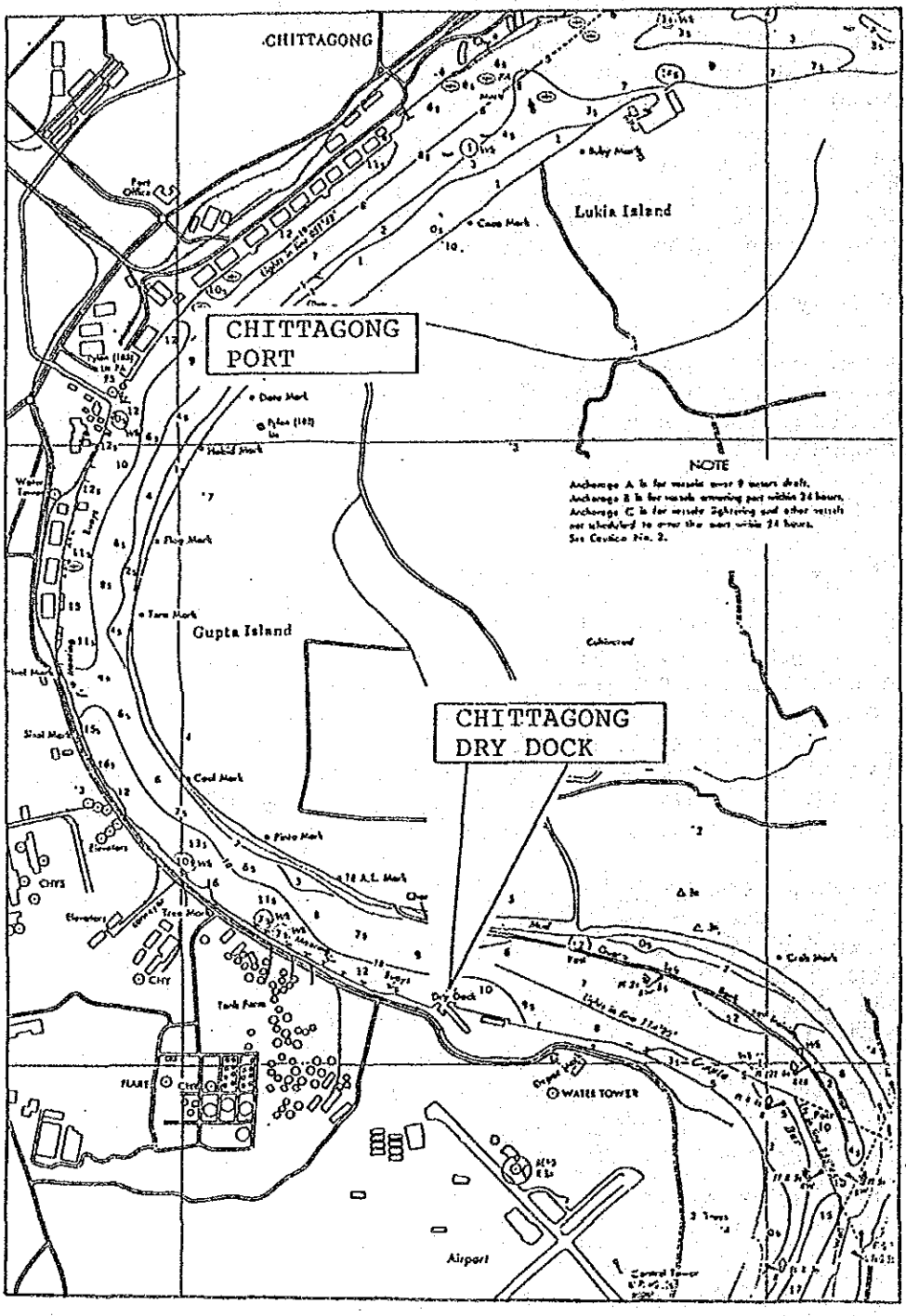


Fig. 3-4-8 Location of Chittagong Port

(5) Utilities

1) Water

At present, fresh water including drinking water for dockyard use is supplied from the Karnaphuli River through their own water treatment plant. Since the main water supply line of CDD is connected to Water Supply and Sewerage Authority (WASA) water supply line, water can be always supplied even in an emergency case such as a water pump failure. The current supply capacity of CDD depends on the capacity of 150 tons in the treated water reservoir. Future expansion to increase supply capacity can be done with installation of additional treated water reservoir(s). As regards the treated water quality, salinity is very high, especially in the dry season, due to mixing with sea water resulting in unsuitable water for drinking. It is recommendable to make an exclusive drinking water line from WASA or to provide an additional salinity removal plant.

Chittagong WASA has enough supply capacity to meet current demands, and also they are preparing a future expansion program. The water quality of WASA is acceptable as drinking water.

2) Electric power

Presently, electric power in the Chittagong area is generated by means of a hydroelectric, steam turbine and diesel generator. Gas turbine generators of the barge mounted type are also provided. Total supply capacity in this area is 360 MW and all supply lines are connected to the East National Grid Line.

Electric power of CDD is supplied from the East National Grid Line through Halisahar and Patenga substations. Although CDD has two independent incoming lines from the Patenga substation, the supply line from Halisahar to Patenga has not been completed yet and is scheduled to be completed at the end of 1989.

Since the peak hours of power consumption in the Chittagong area is from 5 PM to 11 PM, and considering link power supply system of the National Grid Line in the Chittagong area, supply capacity of the Power Development Board (PDB) is considered to be enough.

3) Gas, oxygen, etc.

Industrial gases are supplied from Bangladesh Oxygen Ltd. (BOL) which is the only supplier of various gases in the country having manufacturing plants and distribution shops in Dhaka, Khulna and Chittagong. Almost all gases used in ship repair and allied works, such as industrial oxygen, dissolved acetylene, nitrogen, carbon dioxide, argon, freon LPG can be supplied. Supply capacity and stock position of BOL Chittagong are considered to be enough for the future work volume of CDD and other industrial fields.

4) Communication system

Communication between CDD and the outside is mainly done with telephones. CDD is also providing telex equipment which can be connected with the country and abroad. Telephone system in Chittagong area works quite well, while communication between Dhaka and other cities is troublesome occasionally.

5) Tug boat, floating crane, etc.

At present the towing works of docking, undocking vessels mainly depends on tugs hired from Chittagong Port Authority (CPA). CPA has enough tug boats which can be hired easily. CPA also owns floating cranes of 120 ton capacity which can be used on fee bases with prior bookings.

3-4-2 Physical Facilities

(1) Brief Particulars

Layout : General layout of CDD is shown in Fig. 3-4-9.

Land :

Plant area	145,000 sq. meters
(Covered area	32,400 sq. meters)
Housing area	33,400 sq. meters
Total area	210,800 sq. meters

Capital Investment:

Local currency	10,643.84 lac taka
Foreign currency	6,137.91 lac taka
Total	16,781.75 lac taka

* As on date of commercial operation, 1-7-1985

Source of Foreign Exchange :

Yugoslav credit	US$20.7 million
Yen credit (Japan)	¥3,000 million (US$15 million)

(2) Main Facilities

The dockyard is equipped with a modern dry dock which can dock all types and sizes of vessels up to 16,500 DWT.

The dockyard has the necessary workshops, outfitting quay and facilities to carry out work in connection with docking and repairing. The workshops are equipped with necessary machinery and equipment as stated below:

The details of the machinery and equipment are shown in APPENDIX 1.

1) Dry dock

L x B x D	183 m x 27.4 m x 13.1 m	
Ship size to be accommodated	Max. LOA x B	173.7 m x 24.4 m
	Max. DWT	16,500 tons
Cranes	Port	40/10T at 24.3/37.2m
	Stbd.	15/5T at 30.5/37.5m
Capstans	20 tons x 2 nos. 15 tons x 2 nos.	
Winch	15 tons x 1 no.	
Main dewatering pumps	6,000 tons/hour x 3 nos.	
Dock drainage pumps	360 tons/hour x 4 nos.	

Dock dewatering time	3.5 hours with two main pumps
Dock gates	Floating caisson gate x 1 no. Pen stocks/electro-hydraulic sluice gate x 2 nos.
Bilge blocks	Electro-hydraulic remote controlled x 22 nos.

2) Fitting out quay

Length	342 m for mooring and berthing of 2 nos. 16,500 DWT vessels at a time.
Cranes	50/15T at 24.3/37.2 m 15/5T at 30.5/37.5 m

3) Workshop complex

- Machine shop;
  120m x 60m (nine bays) workshop equipped with different turning, milling, drilling machine tools for metal and wood working, and also with 10 nos. EOT (Electric overhead travelling) cranes having lifting capacity ranging from 3.2 tons to 25 tons.

- Fabrication shop;
  60m x 36m (two bays) workshop equipped with different machines (Cutting, shearing, bending, pressing, rolling, welding) and tools for steel and pipe fabrication work and also with 4 nos. of EOT cranes having a lifting capacity ranging from 3.2 tons to 12.5 tons.

- Miscellaneous;
  In addition to the above, CDD has inspection and testing equipment like portable ultrasonic thickness meters, ultrasonic crack detectors, X-ray devices, injector testing equipment, etc.
  CDD also has got mobile cranes, forklifters and transporting equipment.

4) Power supply installations

The yard has three transformer stations and standby generators. The power system is 380V AC 3 phases 50HZ and 380V, 440V AC 3 phases 50HZ, 110V, 220V DC for shore supply.

TS-1 Transformer	630 KVA x 3 nos.
TS-2 Transformer	630 KVA x 3 nos.
	250 KVA x 2 nos.
TS-3 Transformer	630 KVA x 3 nos.
Standby generator	250 KVA x 2 nos.

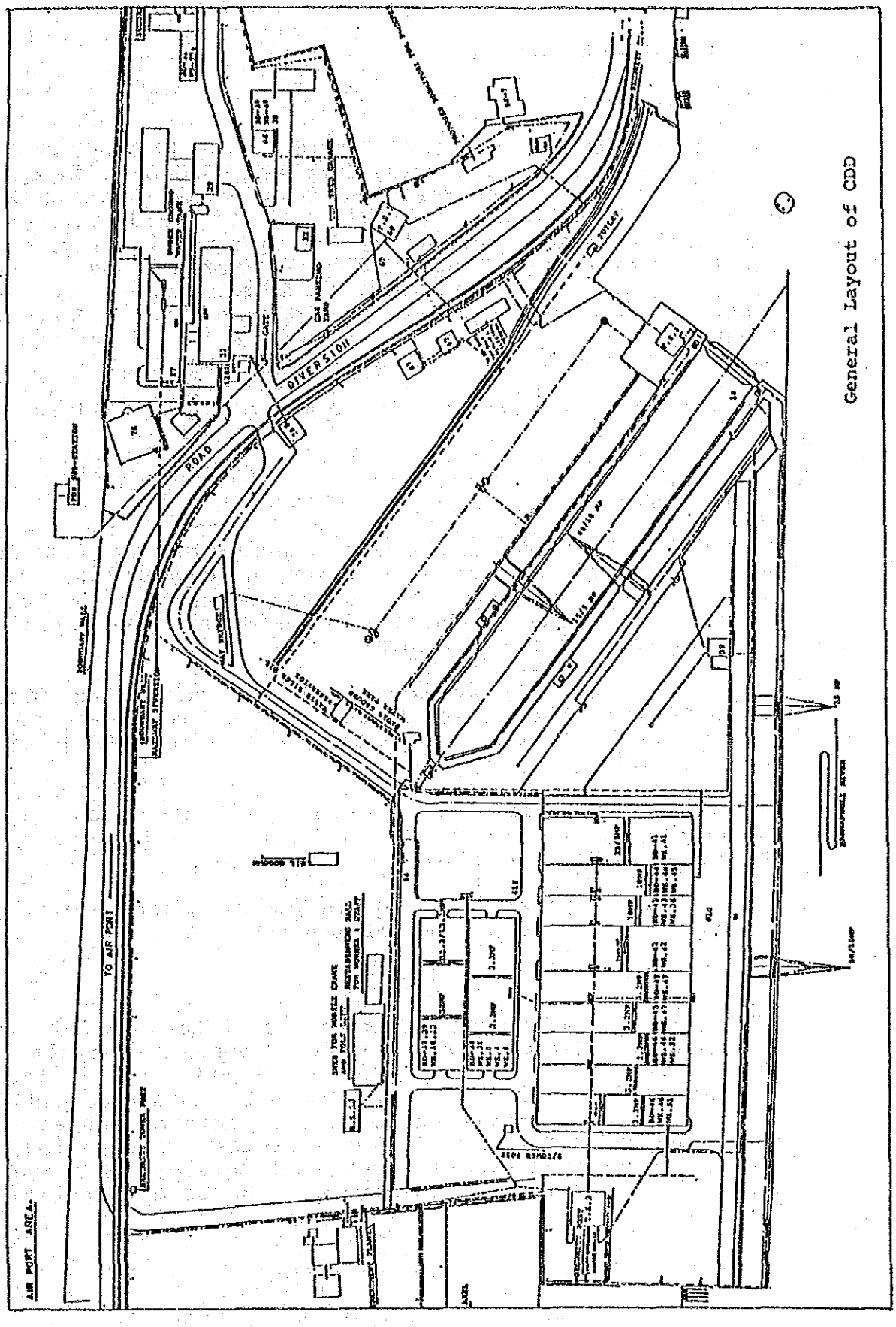


Fig. 3-4-9 General Layout of CDD

3-4-3 Management and Manpower

(1) Organization

CDD is a limited company, organizationaly and wholly owned by BSEC. As a holding company, BSEC sets dockyard policy and also undertakes various administrative and managerial functions on behalf of the yard including financial planning, marketing, development planning, etc. Regular management of CDD is taken under the responsibility of the local manager headed by the Managing Director. CDD has seven departments. They are Planning, Ship Repair, Engineering, Maintenance, Accounting, Commercial, and Administration.

The organization chart of CDD is given in Fig. 3-4-10.

(2) Sales Promotion

1) Sales promotion at CDD

Current activities of the sales promotion at CDD are mainly carried out by the Planning Department. The Department is responsible for the marketing of ship repairs and allied products. The major actions taken by the Department are as follows:

a) Business calls on customers such as Chittagong Steel Mills, Cement Plant Factories, etc. by representatives from the Planning Department and/or Production Department.

b) Constant observation of tender invitations on major newspapers to participate in the respective tenders by a staff exclusively appointed for that duty.

c) Promotional approach to foreign/local contractors of various projects funded by foreign countries.

2) Role of BSEC

BSEC has a key central marketing function for its enterprises. Since the public sector controls a substantial part of the economic activity, a large portion of their business is within the ministry. BSEC, therefore, undertakes tasks of market development and of generating enquiries for its enterprises. On occasion, a contract may be directly negotiated between BSEC and a client Ministry without the requirement of a competitive tender.

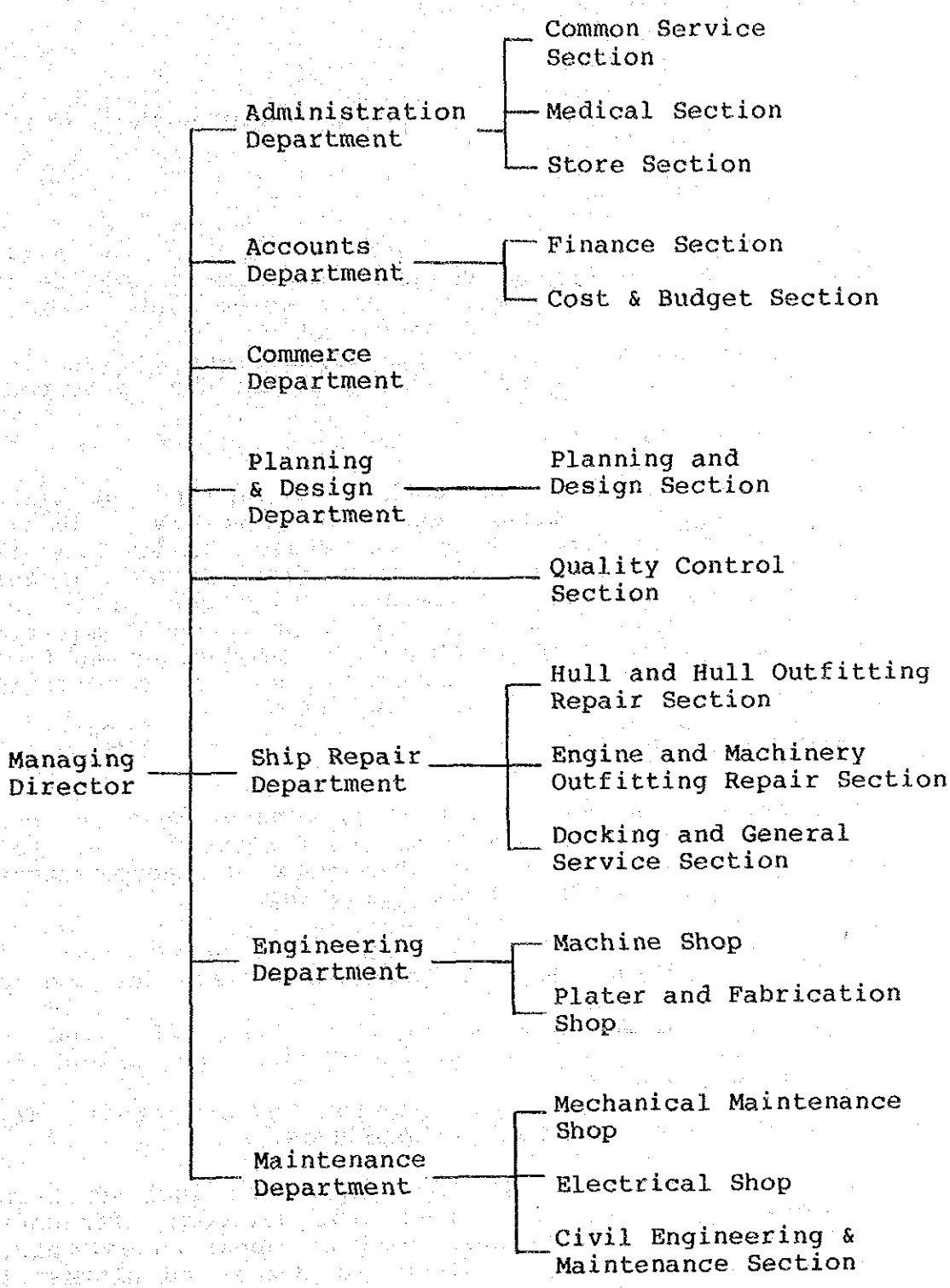


Fig. 3-4-10 Organization Chart of CDD

(3) Technology and Work Procedure

1) Production procedure

The principal steps in the production procedure at CDD are summarized in Fig. 3-4-11.

2) Production planning

The production planning of both ship repair and allied products is done by the Planning Department considering delivery period of products, work volume and dockyard capacity. A bar chart of each job is prepared by the Department and delivered to all departments and sections concerned, where detailed workshop planning is prepared.

3) Progress control

The progress control for both ship repair and allied products in CDD are mainly done through weekly production coordination meetings held on every Sunday in the presence of officers and staff from Planning, Ship Repair, Engineering, Maintenance Department and other sections concerned. Work progress, position of material stock and procurement, problems on production control, etc. are discussed and necessary action to maintain schedules and quality of work is taken.

4) Quality control

Recently, CDD has set up a Quality Control Section under the direct control of the Managing Director. Two staff members are now engaged in this work and have started their duties, as shown in the following:

i) Pre-inspection and attendance for survey by ship classification society and shipowner for docked vessel.
ii) Pre-inspection and attendance for all kind of inspection done by authorized bodies and client for allied products.
iii) Inspections during construction and/or repair works of ship repair and allied products.

CDD has appropriate inspection equipment such as X-ray devices, magna-flux crack detecting devices, ultrasonic crack detectors, ultrasonic gauging apparatuses, etc. Due to lack of proper knowledge of X-ray and ultrasonic apparatuses, CDD has left the operation of equipment to the subcontractors who are authorized by classification societies and governmental bodies.

5) Skill of workers and training system

At present, there are no regular training programms in CDD.

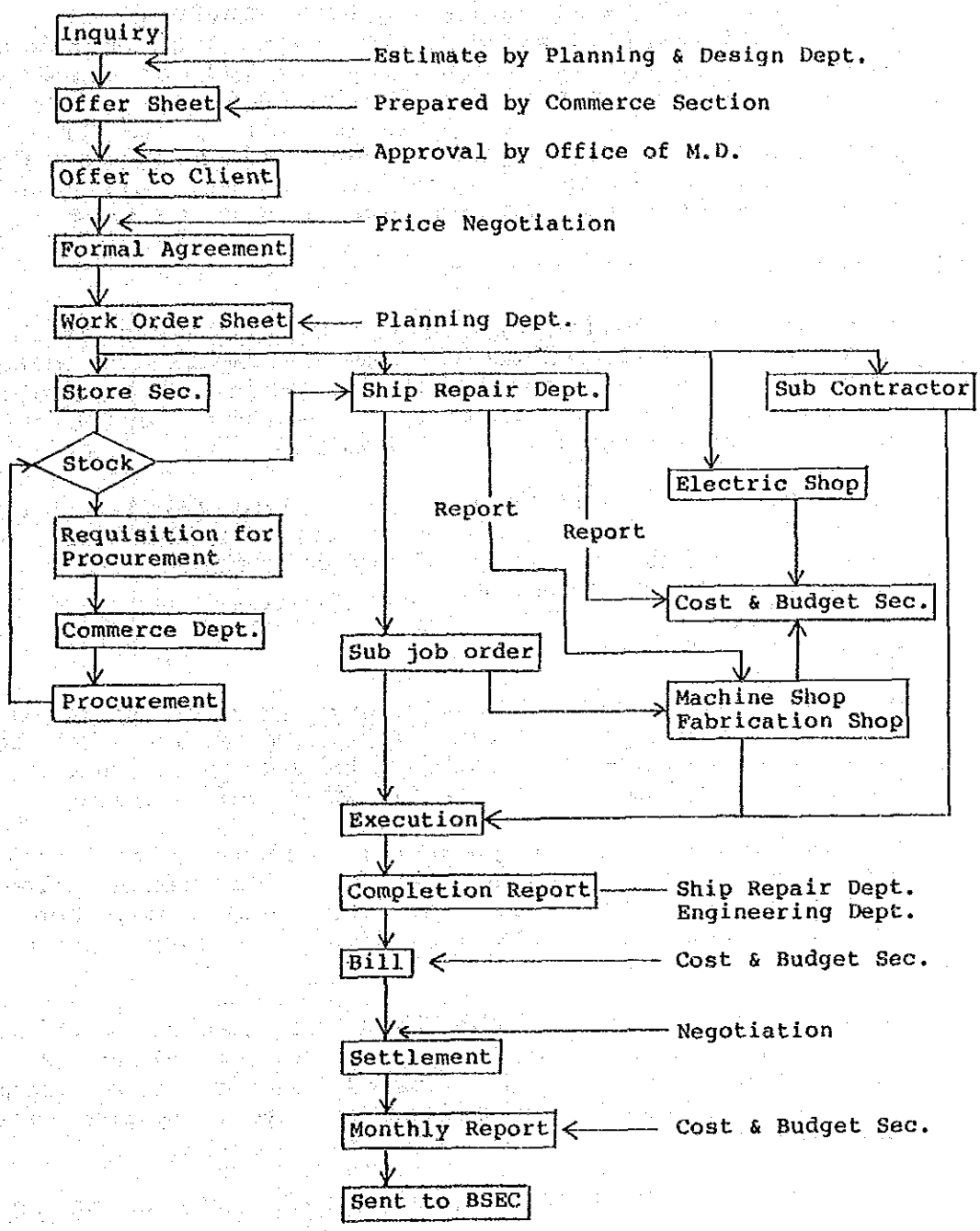


Fig. 3-4-11 Overall Job Flow of CDD

However, technical assistance from Singaporean shipyard was conducted under the UNDP Project in the field of ship repair, plant maintenance, machine operation, welding, hydraulic systems as well as safety control.
Most of the skilled workers are upgraded and possess fair knowledge in their respective fields or professions through on-the-job training of the Project.

With regard to the welding, Bangladesh Oxygen Company (BOL) has training courses for almost all kinds of welding methods and CDD can send welders to them.

(4) Material Control System

The material storing and procurement systems at CDD are based on the BSEC Manual. Commerce Department and Store Section are mainly responsible for material control.
As the occasion arises, the Planning Department and relevant departments are involved.

The store is divided into three categories, i.e., locally procured materials, imported materials and fast moving materials which consist of daily consumables for the yard operation and maintenance.

1) Materials stock and issue

As the need arises, the relevant production department submits Store Requisitions and Issue Notes (SR) to the Store Section, while a copy of this slip is submitted to the Accounts Department for further confirmation.

In the case that the requested materials is in stock, the Store Section issues a Receipt and Issue Card and delivers the materials. At the same time, the Store Section checks the stock position and records the balance in Master List.

On the other hand, if the requested material is not in stock, the Store Section prepares a Store Purchase Requisition (SPR) and submits it to the Commerce Department through the office of the Managing Director for approval.

The material stock and issue procedure is shown in Fig. 3-4-12.

2) Procurement of materials

The process of procurement is initiated by the Planning Department, production departments, and the Store Section raising a SPR, specifying specifications, desired time of delivery, etc. for required materials.

The SPR is routed through the office of the Managing Director for approval to the Commerce Department which initiates procurement action by press advertisement, limited tender, cash purchase, etc. In this stage, the Accounts Department checks the availability of funds and budgetary provisions. Cash purchase is made by the Emergency Procurement Committee with the approval of the office of the Managing Director for the item up to TK10,000 per item. The procurement procedure is given in Fig. 3-4-13.

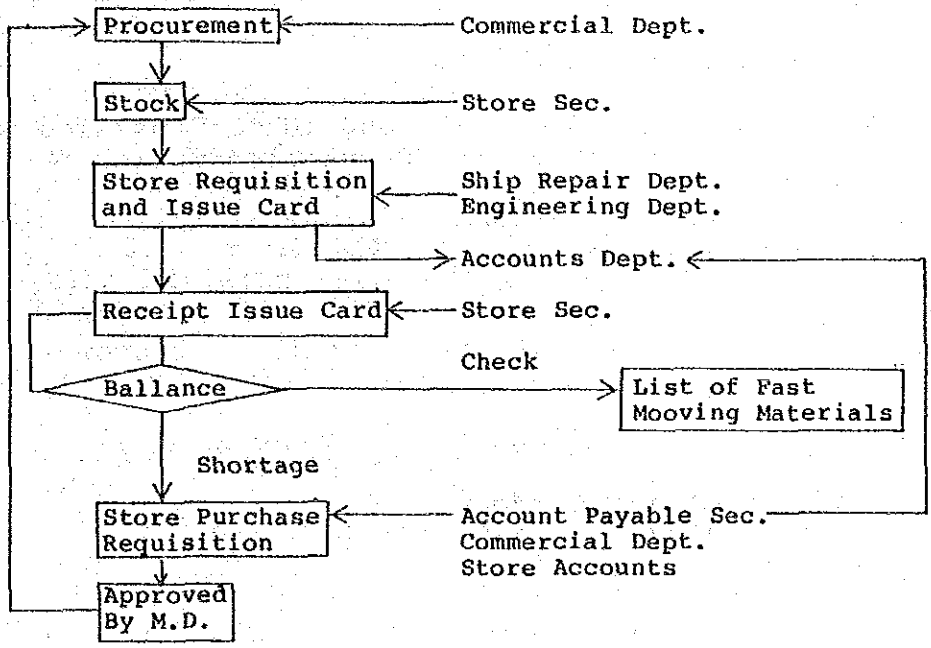


Fig. 3-4-12 Material Stock and Issuing Procedure

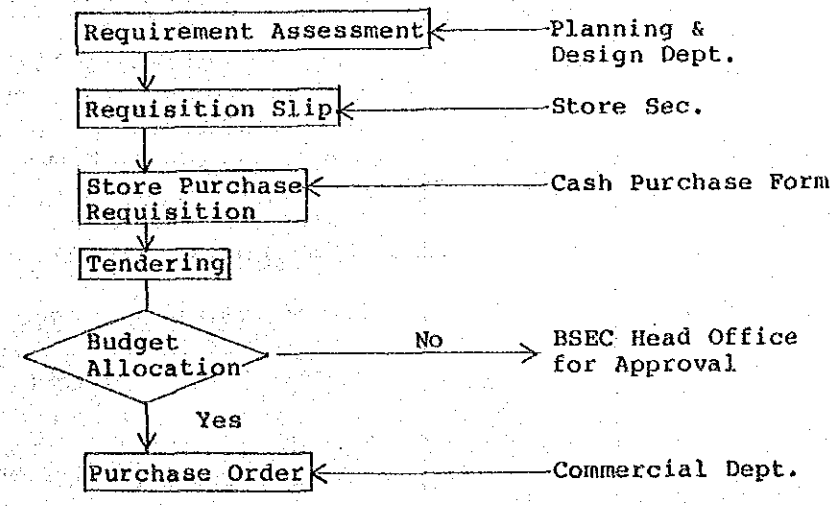


Fig. 3-4-13 Procurement Procedure for Imported Materials/Spares

(5) Current Strength of Manpower

The employees of CDD consist of Officers, Staff and Workers. This designation is summarized in the following:

1) Officers
   Technical officer — Engineer, Assist. Engineer and Sub. Assist. Engineer
   General officer

2) Staffs
   Technical staff — Supervisor and Draftman
   General staff

3) Workers — Gang leader, skilled worker and un-skilled worker

Current strength of man-power as of April, 1989, is shown in Table 3-4-1 and 3-4-2.

Table 3-4-1 Current Strength of Manpower

	Technical	Non-technical	Total
Officer	55	34	89
Staff	26	190	216
Worker	257		257
Total	338	224	562

Table 3-4-2 Job-wise Distribution of Workers

Fitter	67	Fitting of propeller, rudder, valve, pipe, aux. machinery
Turner	7	Lath machine operator
Dock sailor	31	Docking, undocking, servicing
Welder	45	
Plater	16	Steel plate work
Machinist	7	Operator of machine tools
Painter	14	
Auto mechanic	6	Maintenance of engine for crane, fork lift, vehicle,
Carpenter	4	Including lignum-vitae work
Plumber	3	
Black smith	2	
Operator	33	Crane, fork lift, pump, etc.
Electrician	18	
Total	257	

3-4-4 Business Performance

(1) Ship Repair

CDD mainly repairs vessels owned by BSC which are instructed by the Ministry of Shipping to dock their vessels at CDD except in cases of accidents and/or emergencies. On the other hand, docking and repairing of vessels owned by other public sectors, private shipping companies and foreign owners are also carried out at the dry dock.

1) Business overview

According to statistics published by BBS shown in Table 3-4-3, the gross output of ship building and repairing shared about 0.3% of the large scale manufacturing industry and amounted to 78 million taka in terms of census values added in 1984/85. The large scale of this sector shared 4.6% of GDP at current price in 1984/85. Thus, ship building and repairing can be roughly estimated to be 0.014% of GDP.

Table 3-4-3 Shipbuilding & Repairing Industry

(Million taka)

Industry	No. of Establishment	Gross Output	Value Added	Persons Engaged	Man-days Worked
Shipbuilding & Repairing	9	238	84	2,186	446,080
Transport Equipment	21	1,062	278	4,429	804,587
Manufacturing Industries	3,934	69,917	23,956	480,827	102,683,705

Source: Census of Manufacturing Industries in 1984/85 by BBS

CDD recorded 42 Million taka of sales in 1984/85 (Table 3-4-4) and shared about 17.6% of total ship building and repair industry showing the above figure, 238 Million taka, in terms of gross output.

2) Past CDD's performance

Sales amount for repair increased very rapidly for both dry docking and afloat repairing in accordance with the number of vessels. Allied works increased its share of total sales amount to 23% in 1987/88 shown in Table 3-4-4.

Due to the infrequency of docking of seagoing vessels, CDD has docked and repaired fishing trawlers and other small vessels to fill the gap.

Ship repair for the BSC fleet is limited to dry dock work, which comprise dockings and underwater repair work on hull, shafting, etc. A list of ship repair work is shown below. All other repair work of machinery, electrical installations, pipings, etc. are undertaken by BSC's own workshops, which have its own machinery and spare parts stock covering the machinery and equipment installed in the vessels.

List of Ship Repair Work done at CDD

- Hull cleaning, painting including draft marks, plimsoll marks, ship's name, port of registration
- Sea chest work
- Anchor and anchor chain work (covering all items)
- Chain locker work
- Rudder work: Measurement of clearance, repacking, renewal of bush, unshipping of rudder, pressure testing of rudder, swing test
- Hull plate work (fairing and renewal)
- Cathodic protection work (Hull anode and tank anode)
- Shafting work: Wear down measurement, guarding removal and refitting repack stern gland, withdrawal of tail shaft, magnaflux test of taper and key way, renewal of stern tube lignum vitae bush, internal bearing survey, renewal of simplex seal, dye penetration test, resleeving and skimming of tail shaft, intermediate shaft bearing remetalling, shafting alignment, etc.
- Propeller work: Polishing, fairing, unshipping, repair, crack test (dye penetration), static balancing (for small and medium size propeller)
- Valve work (all types): Over hauling, servicing, reconditioning
- Pipe work: Repair, renewal etc.
- All type of tank work
- Repair and renewal of hatch covers and hatch cover handling gears

As a result, although dry docking vessels for ship repair at CDD increased very rapidly and the dock was occupied almost completely in recent years, work volume and sales amount was still small compared with the scale of the facilities. Therefore, CDD should take measures to improve its work efficiency and expand its limited work items by introducing new technology and facilities soon.

CDD has carried out afloat repair at its own repair quay and Chittagong Port.

Table 3-4-4 Past Production Performance of CDD

		1983/84	1984/85	1985/86	1986/87	1987/88
Dry Dock/Repair						
Number of vessels	-Local	18	15	27	50	40
	-Foreign			4		3
Days occupied	-Local	251	237	259	313	302
	-Foreign			30		15
Afloat Repair						
Number		72	85	101	160	171
Days		653	617	668	514	732
Sales (Lac. taka)						
Dry Dock/Repair		309.9	356.7	394.5	393.9	482.5
Afloat Repair		23.6	31.5	40.8	35.6	48.9
Allied Products		1.7	31.6	53.9	159.9	159.7
Total		335.1	419.9	489.2	589.4	690.6

Source: CDD

3) BSC vessels

Repair performance for BSC fleet in the past five years is summarized in the following derived from Table 3-4-5.

- Average frequency for repair per year : 0.37 times
- Average days spent per vessel : 17 days
- Average price paid per vessel : 22.1 Lac. taka
- Average price paid per day : 1.3 Lac. taka

Table 3-4-5 Docking Records of BSC at CDD

(Lac. taka)

	Total vessels	Docked vessels	Days spent	Price paid	Ave. freq.	Ave. day	Ave. price	Ave.price per day
	1	2	3	4	2/1	3/2	4/2	4/3
1984/85	21	9	171	301.8	0.43	19	33.5	1.8
85/86	20	6	122	169.0	0.30	20	28.2	1.4
86/87	20	5	59	62.5	0.25	12	12.5	1.1
87/88	21	11	196	171.5	0.53	18	15.6	0.9
88/89	22	7	104	134.3	0.32	15	19.2	1.3
Total	104	38	652	839.1	0.37	17	22.1	1.3

Source: BSC

4) Private vessels

Repair performance for private vessels in the past four years is summarized in the following derived from Table 3-4-6.

- Average days spent for repair : 6 days
- Average price paid per vessel : 8.5 Lac. taka
- Average price paid per day : 1.5 Lac. taka

Table 3-4-6 Docking Records of Private Vessels at CDD

(Lac. taka)

	Docked vessels	Days spent	Price paid	Ave. days	Ave. price	Ave. price per day
	1	2	3	2/1	3/1	3/2
1984/85	6	66	54.9	11	9.2	0.8
85/86	25	167	225.5	7	9.0	1.4
86/87	45	254	331.4	6	7.4	1.3
87/88	32	121	310.5	4	9.7	2.6
Total	108	608	922.3	6	8.5	1.5

Source: Study Team

Ship repairing frequencies should be divided by two categories for analysing private vessels.

- Share of repairing vessels at CDD in total registered number (CDD's vessel)

- Frequency of repairing CDD's vessels per year

The past performance shows the above frequencies as in Table 3-4-7 derived from Table 3-4-8.

Table 3-4-7 Docking Frequencies of Private Vessels

	Share of CDD	Frequency*	Share x Frequency
Seagoing cargo (private)	0.4 (10/25)	0.24 (12/50)	0.1
Coastal vessel	0.03 (3/114)	0.2 (3/15)	0.006
Tanker	0.15 (8/53)	0.2 (9/40)	0.03
Fishing Trawler	0.41 (27/66)	0.41 (55/135)	0.17

Source: CDD

Note: * The figure of 0.24 means that ten vessels docked twelve times for repair at CDD during five years.

Table 3-4-8 Past Five Year Docking Record of CDD by Type of Vessel

	Total No. of vessels	Docked vessels	Estimated frequency
1. Seagoing cargo (private)	10	12	
- Atlas Shipping Line	3	6	0.4
- Hegge & Co.	1	3	0.6
- Maritime Orient	2	1	-
- Bulk Carriers	2	1	-
- Maritime Transport	2	1	-
2. Coastal vessel	114	3	0.005
3. Floating Crane	1	1	0.2
4. Tanker			
- Jamuna & Oil	1	2	0.4
- Other	52	7	0.03
5. Fishing Trawler	27	55	
- Bengali Fisheries	4	21	1.0
- Seas Bangladesh	2	6	0.6
- Sea Fisheries	4	6	0.3
- Ahmad & Hakodate	2	3	0.3
- Sirajul Islam	2	2	0.2
- Imam Fishing	3	4	0.3
- Trimar	2	2	0.2
- Friends Fishing	2	5	0.5
- Meenhar Sea	2	2	0.2
- Other	4	4	0.2

Source: CDD and FGSS No. 7

(2) Steel Structural Works

CDD has carried out manufacturing of different light and heavy steel structural works like portable steel bridges, chemical storage tanks, racks, lighting towers, heat exchangers, steel structures for chemical plant, rollers, tubular pipes, gears, etc.

Allied products and miscellaneous services increased its share of total CDD's sales amount from 0.5% in 1983/84 to 23% in 1987/88. Steel structural products including different types of light and heavy structures, shared about 80% of the allied products.

The past production amount is summarized in Table 3-4-9. CDD produced small amounts of many products. Production of steel racks, bridges and landing pontoons were relatively higher among the products.

Table 3-4-9 Production Amount of Steel Products in CDD

(1,000 taka)

Products	1985/86	1986/87	1987/88	Total
Carrier Rollers	514			514
Fishing Boom	110		221	331
Steel Racks	1,428	3,397	323	5,148
Pipes	1,320			1,320
Gas Turbine	4,148			4,148
Heat Recuperator	1,189			1,189
Steel Bridge		1,203	3,663	4,866
Steel Pipe		496		496
Landing Pontoon		1,627	3,992	5,619
Steel Roller		109		109
Cooling Pipe		153	1,328	1,481
Joint			722	722
Lighting Tower			4,009	4,009
Water Tank			1,740	1,740
Heat Stock			720	720
Platform			2,934	2,934
Total	8,709	6,985	19,652	35,346

Source: CDD

Steel bridges are considered to have a high potential for future production since a decision has been made by the Ministry of Local Government in the meeting of the Past Flood Rehabilitation and Resistance Committee held on Dec. 6, 1988 that steel/iron bridge manufactured by BSEC must be used for construction of bridges.

Table 3-4-10 List of Steel Portable Bridges Supplied by CDD

No.	Type	Number and Client
1.	15 ton capacity, 3.32 m wide, 15 m long single-single type	1 No. bridge supplied to Ranagamati R&H Hill tracts division in 1986
2.	15 ton capacity, 3.32 m wide, 15 m long single-single type	2 No. bridge supplied to BWAPDA, Chittagong in 1987
3.	30 ton capacity, 3.32 m wide 15 m long double-single type	2 No. bridge supplied to BCGMC, Sylhet in 1988 Oila Gas Mineral Corp.
4.	30 ton capacity, 3.32 m wide 30 feet long double-single type	1 No. bridge supplied to BCGMC.(Sylhet)
5.	30 ton capacity, 3.32 m wide 20' feet long double-single type	2 No. bridge supplied to BCGMC, Sylhet
6.	5 ton capacity, 2 m wide 30 m long	1 No. bridge supplied to Lohagara Upozila, Chittagong
7.	15 ton capacity, 3.32 m wide 15 m long single-single type	1 No. bridge under construction at CDD for Nasirnagar Upazila Parishad B'baria
8.	5 ton capacity, 2 m wide 15 m long bridge	1 No. bridge under construction at CDD for Nasirnagar Upazila Parishad B'baria
9.	15 ton capacity, 3.2 m wide 15 m long single-single type	1 No. bridge supplied to at CDDL for Chuadanga (Damwehuda) Upozila
10.	30 ton capacity, 3.2 m wide 15 m long double-single type	1 No. bridge supplied to for Bangladesh Navy

Source: BSEC

(3) Questionnaire Survey

Questionnaire survey was conducted to recognize problems and future business potential concerning CDD. The following are items from the questionnaire, distributed to all shipping companies:

1) Questionnaire items

1. Present fleet position and principal particulars of vessels Number/Type/DWT/AGE/
2. Future plan of fleet expansion
3. Comments on IWT containerization
4. Fleet scheduling/shipping route
5. Ship repair facilities
6. Lifting results
   Cargo by kind of goods/passenger
7. Regulations or management policies for ship repair
8. Docking records for ship repair
   location, name of shipyard, name of ship, year, kind of work, period, price paid
9. Comments on CDD's ship-repairing business
   - Price
   - Performance
   - Period
   - Technology/Skill
   - Utilization of CDD's facilities
10. Job order system to shipyard
    Shipbuilding/Ship repairing
11. Possibility of sales promotion for CDD
    - Requirements for sales promotion
    - Kind of services
    - New ship building

2) Results

The results are summarized as in Table 3-4-11 and the following facts are realized.

- There are at present 22 vessels in BSC and 25 vessels in the private sector under the Bangladesh Flag. Most of these vessels are old and require frequent docking facilities, and
- For execution of docking facilities, if immediate action is not taken, the shipowners will sustain heavy losses as the fixed operating cost of a ship is very high.
- The procedure of work, as prevalent at Chittagong Dry Dock can hardly be termed as efficient as needed by shipowners because of excess time taken for repair and exorbitant charges. Insufficient stock and an absence of proper planning at the Dry Dock results in an uncertain period for completion of the job.

It is necessary to take possible action to eliminate difficulties pointed out in the near future, in order that all Bangladesh Flag vessels can be repaired at CDD which in turn will increase the utility of the Dry Dock.

Table 3-4-11 Results of Questionnaire Survey (1/2)

Name of Company	Regulations or Policy for Ship Repair	Docking Results	Comments on CDD's Performance	
Bengal Shipping Line Ltd.	- Own team for repair - CDD for normal work - Singapore for complicated work	- CDD 8 days 623,336 Taka 12 days 1,169,576 Taka - Singapore 9 days US$70,000 6 days US$ 700,000	- Price: cut down 30% - Performance: Slow, 4 times longer than Singapore - Skill: Average - Facilities: Canteen/Superintendent House/Guest House/Telecommunication/Fresh Water/Fire Fighting/spare part	- Kind of service: Above water items, mechanic/electronic - Reducing work period as much as possible by 24 hours work - Fixed operating cost of ship is US$5,000 per day - New ship building: Better start from coastal ship such 1,000 DWT size ship. If cheap and good quality realized by Japanese management, ready to buy.
Atlas Shipping Line Ltd.	- Own workshop - CDD for under water work - Foreign Yard for complicated work	- CDD 6 days 783,615 11 days 1,042,458	- Performance: high potential but no incentives - Period: Average 10 days 2.5 times than Singapore Holding - Facilities: Improve to Singapore's standard	- Efficient work system - More priority on private ship - Shorter work period - New shipbuilding 3.5-4 m draft vessel
Aqua Lines Ltd.	- By tender basis - Mostly done by the own workshop except dry docking and other specialized repair	7 - 8 days 1. Keppal 2. Malaysian shipyard 3. CDD	- Price: Fair - Performance: Good - Period: Too long - Technology/Skill: Satisfactory - Utilization of facility: Not fully	

Table 3-4-11 Results of Questionnaire Survey (2/2)

Name of Company	Regulations or Policy for Ship Repair	Docking Results	Comments on CDD's Performance
BSC	- Own workshop - CDD for docking only	- Almost CDD	- Price: High - Performance: Lack of expert and supervision. - Period: Longer time than Singapore - Facility: Works facilities are satisfactory. - Link up with renouned builders and machinery makers to obtain expert service facilities.
Bangladesh Shipping Owners Asso-ciation	Small work is done by local work-shops. Some work is done at the Chittagong Dry Dock. Specialized jobs/big jobs are done outside the country when vessels call on those ports for bunker/store.		- Price: Not cheap compared to Ports at Far East. - Performance: Not good. - Period: Takes longer time. - Technology/skill: Unsatisfactory. - Utilization of CDD's facilities: Not fully utilized. - Job-order System: Repair list is prepared by Ship Owner's Technical Department in consultation with Master/Chief Engineer of the Ship and the same is forwarded to the Management Dept. of Ship Owner who then obtains quotation from various workshops including Dry Dock and feed backs the Technical Dept. for decision.

(4) Financial Performance

The financial performance is shown in Table 3-4-12. From this table, sales revenues for the past three years (1985/86-87/88) have increased very rapidly from 49 Million taka to 69 Million taka. However, the amount of gross operating income and net operating income significantly decreased since cost of production and variable cost and administration & selling expense increased more than the sales revenue. It is noted that the amount of depreciation and interest repayment had increased very rapidly, and these items are classified by fixed cost and variable cost and thus, CDD keeps repayment not less than this amount towards the future. Repayment burden of interest and principal poses serious problems for operating financial management. Amount of cost can be represented as a percentage in terms of sales amount as follows:

(%)

	1985/86	1986/87	1987/88
Sales Revenue	100	100	100
Cost of Production	100	96	101
Gross Operating Income	0	4	-1
Administration & Selling Expense	36	32	56
Other Revenue	6	4	7
Net Operating Income	-30	-24	-50

All expenses can be classified into variable cost and fixed cost shown in Table 3-4-13. Such cost which increase in relation with the production volume is termed as variable cost.

Fixed cost is such cost which remains constant in volume and has no relation with the production volume.

Amount of variable cost and fixed cost represented in terms of sales amount, are as follows:

Table 3-4-12 Financial Performance

(1,000 taka)

	1985/86	1986/87	1987/88
Sales Revenue			
Sales from Production	48,918	58,946	69,045
Sales of Steel	0	109	238
Total	48,918	59,054	69,282
Cost of Production			
Raw Material	13,630	22,767	23,960
Indirect Material	708	997	704
Work by Outsider	1,532	586	1,394
Contractors Workers	2,882	3,512	2,450
Wages	1,709	1,697	2,467
Overtime for Job	937	0	0
Overtime for General	526	557	0
Salary for Staff	2,694	2,817	3,188
Salary of Officer	2,943	3,242	3,540
Other Pay	4,587	4,818	5,859
Repair & Maintenance	2,606	2,737	4,315
Rent	535	0	0
Power	3,326	2,955	4,260
Other Direct Expenses	391	99	194
Contribution to Head Office	470	513	527
Insurance	0	0	1,533
Depreciation	9,363	9,352	15,895
Total	48,841	56,650	70,286
Gross Operating Income	77	2,405	-1,003
Administration & Selling Expenses			
Salary of Officer	736	811	885
Salary of Staff	673	704	797
Other Pay	283	895	1,261
Overtime	0	139	20
Rent	0	111	86
Depreciation	1,040	1,039	1,766
Insurance	1,339	1,418	170
Interest	9,614	9,614	28,449
Power	370	328	473
Other Administration Cost	2,611	2,967	3,533
Contribution to Head Office	118	101	104
Tax	731	836	989
Total	17,515	18,963	38,535
Other Revenue	3,166	2,497	5,149
Net Operating Income	-14,271	-14,061	-34,389

Source: CDD Profit & Loss Statement

(%)

	1985/86	1986/87	1987/88
Sales Revenue	100	100	100
Variable Cost	44	50	45
Fixed Cost	92	78	112

The variable cost share was almost the same ratio in the past three years, although fixed cost increased significantly.

Break even sales revenue (production volume) can be estimated as twice on the assumption that variable cost shares 45% of sales revenue and fixed cost will incur the same amount in 1987/88. Thus, first of all, CDD should try to increase their revenue/production by two at the earliest to meet all necessary expenses.

Secondly, the share of variable cost should be reduced in line with production volume by acquiring the capability to conduct higher value-added works.

Expenses by items are shown in Table 3-4-14. Production cost show a decreasing tendency from 74% in 1985/86 to 65% in 1987/88, although administration and selling expenses increase. Expenses can be classified largely into as follows:

(%)

	1985/86	1986/87	1987/88
Raw Material	21.6	31.4	22.6
Subcontracting	6.6	5.4	3.6
Wages	4.0	2.2	2.3
Salary	11.4	10.9	7.7
Other Pay	7.3	7.6	6.6
Maintenance	3.9	3.6	4.0
Depreciation	15.7	13.8	16.2
Interest	14.5	12.7	26.1
Other	15.0	12.4	10.9
Total	100.0	100.0	100.0

Raw materials shares about 20% to 30% and wages/salary including other pay is 17% to 23% of the total expenses.

Table 3-4-13 Variable Cost & Fixed Cost

(1,000 taka)

	1985/86	1986/87	1987/88
Variable Cost	21,399	29,559	30,975
Raw Material	13,630	22,767	23,960
Indirect Material	708	997	704
Work by Outsider	1,532	586	1,394
Contractors workers	2,882	3,512	2,450
Wages	1,709	1,697	2,467
Overtime for job	937	0	0
Fixed Cost at Factory	27,442	27,091	39,311
Overtime for General	526	557	0
Salary for Staff	2,694	2,817	3,188
Salary of Officer	2,943	3,242	3,540
Other Pay	4,587	4,818	5,859
Repair & Maintenance	2,606	2,737	4,315
Rent	535	0	0
Power	3,326	2,955	4,260
Other Direct Expenses	391	99	194
Contribution to Head Office	470	513	527
Insurance	0	0	1,533
Depreciation	9,363	9,352	15,895
Fixed Cost at Company	17,515	18,963	38,535
Salary of Officer	736	811	885
Salary of Staff	673	704	797
Other Pay	283	895	1,261
Overtime	0	139	20
Rent	0	111	86
Depreciation	1,040	1,039	1,766
Insurance	1,339	1,418	170
Interest	9,614	9,614	28,449
Power	370	328	473
Other Administration Cost	2,611	2,967	3,533
Contribution to Head Office	118	101	104
Tax	731	836	989
Total	66,356	75,613	108,820
Contribution to Margin	27,519	29,495	38,307
Break-even Sales	1.6	1.6	2.0

Source: CDD Profit & Loss Statement

Table 3-4-14 Share by Expense Item

(%)

	1985/86	1986/87	1987/88
Cost of Production			
Raw Material	20.5	30.1	22.0
Indirect Material	1.1	1.3	0.6
Work by Outsider	2.3	0.8	1.3
Contractors Workers	4.3	4.6	2.3
Wages	2.6	2.2	2.3
Overtime for Job	1.4	0.0	0.0
Overtime for General	0.8	0.7	0.0
Salary for Staff	4.1	3.7	2.9
Salary of Officer	4.4	4.3	3.3
Other Pay	6.9	6.4	5.4
Repair & Maintenance	3.9	3.6	4.0
Rent	0.8	0.0	0.0
Power	5.0	3.9	3.9
Other Direct Expenses	0.6	0.1	0.2
Contribution to Head Office	0.7	0.7	0.5
Insurance	0.0	0.0	1.4
Depreciation	14.1	12.4	14.6
Total	73.6	74.9	64.6
Administration & Selling Expenses			
Salary of Officer	1.1	1.1	0.8
Salary of Staff	1.0	0.9	0.7
Other Pay	0.4	1.2	1.2
Overtime	0.0	0.2	0.0
Rent	0.0	0.1	0.1
Depreciation	1.6	1.4	1.6
Insurance	2.0	1.9	0.2
Interest	14.5	12.7	26.1
Power	0.6	0.4	0.4
Other Administration Cost	3.9	3.9	3.2
Contribution to Head Office	0.2	0.1	0.1
Tax	1.1	1.1	0.9
Total	26.4	25.1	35.4
Total	100.0	100.0	100.0

Source: CDD Profit & Loss Statement

3-4-5 Present Difficulties

The current difficulties with management that CDD was confronted with is pointed out as follows:

(1) Small sales amount compared with the scale of the facility :
Investment cost of the construction of CDD amounts 16,781 lac. taka, while the total sales of CDD was 815 lac. taka in 1988/89. Though the sales is increasing year by year, it is still smaller compared with the past investment amount.

(2) Large amount of depreciation and interest :
The amount for depreciation and interest counted 722 lac. taka in 1988/89. Out of this, large share of interest expense places CDD in difficult circumstances.

(3) Longer docking period than foreign dockyards in Singapore, Malaysia, etc. :
It takes about 15 days to repair a seagoing vessel in the dry dock. This period is much longer than that of foreign dockyards. According to the results of the questionnaire, all shipowners expect CDD to reduce repair time.

(4) Difficulty in proper procurement of materials :
It takes a maximum of 2 weeks to procure locally available materials, and a minimum of 3 months for imported materials. This condition occasionally causes CDD a delay in delivering and waiting losses etc.

(5) Insufficiency of technic and skill :
It makes it difficult for CDD to develop new kinds of products, due to the insufficiency of the design capability. The total management technic from job planning to actual data processing, the mechanical and electrical work skill etc. are insufficient to satisfy the demands of customers.

(6) Lack of general service in commercial base management :
For example, advertisement of CDD by brochure, something good for souvenir to client, conveniences to crew during their stay in the yard, etc. are the lack.

(7) Many competitors, except seagoing ship repair :
There are many domestic private and governmental companies as well as overseas contractors, with whom CDD have to compete to get jobs.

(8) Inefficient utilization of machinery due to the shortage of spare parts and adequate attachment :
Though CDD has various kinds of facilities, some of them, such as mobile stages, are not utilized efficiently due to the shortage of spare parts and adequate attachment.

4 MARKET STUDY AND DEMAND FORECAST

4 MARKET STUDY AND DEMAND FORECAST

4-1 FUTURE CARGO HANDLING VOLUME

4-1-1 Basic Concept

The volume of cargo handled at a port is closely connected with the social and economic activities in the port's hinterland.

Thus, the port's future cargo handling volume is generally forecast based on the past correlation between cargo handling volume, major socioeconomic indices and future forecasts of these indices.

Basic cargo data and socioeconomic indices are utilized from statistical Yearbook 1987 and 1989, Bureau of Statistics.

The Third Five Year Plan (TFYP) starting from 1985/86 states various target values for the year 1989/90.

The four years of 1989/90, 1994/95, 1999/00, and 2004/05 are chosen since these are the final years of each five-year plan period.

The study team forecasts national cargo volume by commodity based on past economic indices and the past cargo volume of imports and exports.

4-1-2 Micro Forecast by Commodity

(1) Food Grains

Bangladesh is an agricultural country, and rice is the staple grain. Various types of rice which require different amounts of rainfall are produced in different seasons.

However, the domestic production of rice is not sufficient to supply the domestic consumption, and thus Bangladesh is forced to import rice.

The production of rice has also been increasing as shown in Table 4-1-1, but the domestic production is not sufficient to supply the domestic demand. Thus, Bangladesh regularly imports grain as noted. By applying the annual per capita consumption, total consumption is calculated as in Table 4-1-1.

Table 4-1-1 Production and Consumption of Food Grain

(1,000 ton)

	Net Production				Internal Procurement			Off-take			Net Availability *4	Imports Total	Consumption per Capita (kg)	Population (Million) *5	Total consumption *6	Surplus *7
	Rice *1	Wheat *2	Cereal *3	Total	Rice	Wheat	Total	Rice	Wheat	Total						
1974/75	10,839	112	63	11,014	127	0	127	180	1,577	1,757	12,644	2,558	165	78.0	12,847	2,355
1975/76	12,453	212	62	12,727	349	7	356	517	1,178	1,695	14,066	1,468	176	79.9	14,066	1,468
1976/77	11,714	102	58	11,874	311	13	324	785	688	1,473	13,023	808	159	81.8	13,024	807
1977/78	12,654	335	58	13,047	569	12	581	607	1,422	2,029	14,495	1,635	173	83.7	14,496	1,634
1978/79	12,537	479	52	13,068	305	56	361	570	1,245	1,815	14,522	1,181	170	85.6	14,522	1,181
1979/80	12,427	799	51	13,277	143	126	269	702	1,738	2,440	15,448	2,871	176	87.7	15,447	2,872
1980/81	13,543	1,060	52	14,655	864	180	1,044	515	1,035	1,550	15,161	1,078	169	89.9	15,161	1,078
1981/82	13,299	938	51	14,288	289	13	302	771	1,297	2,068	16,054	1,245	175	91.6	16,055	1,244
1982/83	13,870	1,063	45	14,978	168	24	192	496	1,441	1,937	16,723	1,870	179	93.6	16,724	1,869
1983/84	14,156	1,175	39	15,370	149	127	276	504	1,538	2,042	17,136	2,134	179	95.7	17,134	2,136
1984/85	14,266	1,420	33	15,719	134	215	349	406	2,172	2,578	17,948	2,575	181	99.2	17,949	2,574
1985/86	14,674	1,011	28	15,713	230	130	360	373	1,167	1,540	16,893	1,032	166	101.7	16,893	1,032
1986/87	15,032	1,058	21	16,111	137	51	188	495	1,623	2,118	18,041	1,032	166	104.1	17,281	1,792
1987/88	18,039	1,016	84	19,139	245	87	332	468	2,032	2,500	21,307	2,920	172	106.6	18,335	5,892

Source: BBS, Yearbook 1989

Notes: *1: Deduction for seed, wastage etc. has been taken as 2.43% of total production of rice and 3.01% of total production of wheat.
*2: Deduction for seeds has been taken as 2.5% of total production.
*3: Minor cereal includes barley, jowar, bajra, ragi and other cereal.
*4: Net availability of food grain = (net production-Internal procurement) + off take from ration distribution.
*5: Estimated population is at mid-year i.e. 1 January.
*6: Total consumption = Consumption per capita x Population
*7: Surplus = Net availability + Imports - Total consumption

The "surplus" food grain is stocked as storage in case of a poor harvest. It is calculated by drawing the total consumption from the sum of the net availability and imports.

In order to estimate the future cargo handling volume of grain cargo, the future net production, consumption and imports should be forecast. First, the future net production is forecast based on the past correlation between net production volume and various factors of production. The study team assumes that the per capita annual consumption of food grain will continue to decrease from 172 kg (roughly the existing level) in 1987 to 170 kg in 1994/95, 165 kg in 1999/00 and 2004/05. Food consumption decreases according to the increase of national income.

The forecast figures are presented in Table 4-1-2.

Various factors considered to exert influences on net production are analyzed by the following three major variables. They are input of fertilizer, total land availability, GDP per capita. Net production function, in which these three variables are used as explanatory variables, can be specified as follows:

$$F = f(I, L, Y)$$

where
- F : Net production volume of food grain
- I : Input volume of fertilizer
- L : Total land availability (rice and wheat)
- Y : GDP per capita

By using the data of 14 years between 1974 and 1987, the following regression result was obtained.

$$\text{Ln } F = -9.436 + 0.062 \times \text{LnI} + 0.597 \times \text{LnL} + 1.357 \times \text{LnY}$$

$$R^2 = 0.95$$

where,
- Ln: National logarithm
- R^2: Multiple correlation coefficient

Future availability of land is estimated by the past increase of cultivated area shown in Table 4-1-3.
Net availability is obtained by multiplying 111% of the net production which is derived from the past average value, calculated in Table 4-1-1.

Future land area for rice and wheat is assumed to increase 1% per year derived from the past trend shown in Table 4-1-4. The constant value of -9.431 in the above formula shall be reduce to -9.416 in and after 1994/95 since the study team assumed that the policy objective of achieving self-sufficiency can be fulfilled by the year 2000.

Table 4-1-2 Future Net Production of Food Grain, Consumption and Imports

(1,000 ton)

	Net Production	Net Availability	Consumption per capita	Consumption	Balance	Imports
1989/90	16,395	18,199	171	19,289	1,090	1,090
1994/95	18,863	20,938	170	21,590	652	652
1999/00	21,272	23,612	165	23,447	-166	0
2004/05	23,900	26,529	165	26,270	-259	0

Source: Study Team

Thereafter, imports of future food grain is obtained by drawing consumption from net availability.

(2) Fertilizer

The major farm products in Bangladesh are rice, wheat, jute and tea, and the cultivated area by crop in the past is shown in Table 4-1-3.

Table 4-1-3 Cultivated Area by Crop

(1000 acres)

	Rice	Wheat	Jute	Tea	Total
1974/75	24,196	311	1,417	107	26,031
1975/76	25,525	371	1,277	106	27,279
1976/77	24,420	395	1,603	103	26,521
1977/78	24,779	467	1,805	106	27,157
1978/79	24,992	654	2,052	107	27,805
1979/80	25,105	1,071	1,874	107	28,157
1980/81	25,474	1,461	1,569	109	28,613
1981/82	25,847	1,320	1,412	112	28,691
1982/83	26,158	1,283	1,425	110	28,976
1983/84	26,064	1,300	1,435	110	28,909
1984/85	25,263	1,192	1,671	110	28,236
1985/86	25,696	1,671	2,614	110	30,091
1986/87	26,216	1,445	1,908	113	29,682
1987/88	25,507	1,476	1,266	115	28,364

Source: BBS, Yearbook 1989

Judging from Table 4-1-3, the total cultivated area has remained almost constant over the last few years, at about 30,000 thousand acres (equal to about 117,000 km²).

As 117,000 km² is equal to approximately 80% of the 144,000 km² area of Bangladesh, the study team presumes that the cultivated area will not increase significantly hereafter and follow past increasing tendencies.

There are four fertilizer factories in Bangladesh at present, and the supply and demand of fertilizer during the past ten years is shown in Table 4-1-4.

The target production, consumption and imports of fertilizer in 1985 and in 1990 are set in the TFYP.

The study team assumes that the future cultivated area will remain the same as the existing cultivated area, and that fertilizer production will increase to 2,150 thousand tons in 1989/90 as projected in the TFYP.

Future fertilizer production is planned to grow by more than twice from 989 thousand tons in 1986/87 to 2,150 thousand tons in 1989/90, as four new fertilizer factories are scheduled to begin operations during this period. According to the TFYP, fertilizer consumption per acre is estimated to increase to 64.0 kg/acre in 1989/90.

The study team assumes that future fertilizer consumption per acre will be 80.0 kg/acre in 1994/95, 100.0 kg/acre in 1999/00 and 120.0 kg/acre in 2004/05.

Judging from Table 4-1-4, imported fertilizer includes reserves as there have been shortages of fertilizer in some years. The national fertilizer storage (Godown) capacity is 443 thousand tons at present (BBS, Yearbook 1987).

The study team assumes that the stock capacity for fertilizer is 1,000 thousand tons/year based on a stock turnover of three times per year.

Table 4-1-4 Supply & Demand of Fertilizer

(1,000 ton)

	Total Area (1000 acres)	Production	Imports	Consumption	Kg/ acre	Surplus/ Reserve
1974/75	26,031	106	144	389	14.9	-139
1975/76	27,279	320	327	282	10.3	365
1976/77	26,521	313	41	505	19.0	-151
1977/78	27,157	363	564	784	27.8	143
1978/79	27,805	333	516	695	25.0	154
1979/80	28,157	363	564	784	27.8	143
1980/81	28,613	425	350	823	28.8	-48
1981/82	28,691	424	464	771	26.9	117
1982/83	28,976	770	299	872	30.1	197
1983/84	28,909	715	357	1,033	35.7	39
1984/85	28,236	766	668	1,247	44.2	187
1985/86	30,091	874	640	1,958	65.1	-444
1986/87	29,569	989	152	1,157	39.1	-16
1989/90	28,914	2,150	1,044	1,850	64.0	1,344
1994/95	30,338	2,700	827	2,427	80.0	1,100
1999/00	31,837	3,300	884	3,184	100.0	1,000
2004/05	33,412	4,050	959	4,009	120.0	1,000

Source: BBS, Yearbook 1989 and Study Team

(3) Cement

At present there are two cement factories in Chittagong and Chatak (Sylhet) in Bangladesh. Three new cement factories are proposed to be built in Bogra, Rangpur and Sylhet in the future. The supply and demand of cement in Bangladesh is shown in Table 4-1-5.

Future cement consumption in Bangladesh is forecast based on the past correlation between GDP of the construction sector and cement consumption as shown in Table 4-1-5.

Table 4-1-5 Supply & Demand of Cement

(1,000 ton)

Year	Production	Imports	Consumption
1972/73	29	374	403
1973/74	53	129	182
1974/75	143	417	560
1975/76	159	234	413
1976/77	307	207	657
1977/78	338	407	745
1978/79	322	456	756
1979/80	336	616	930
1980/81	345	515	933
1981/82	326	593	981
1982/83	307	777	1,254
1983/84	273	935	1,347
1984/85	240	1,202	1,536
1985/86	292	1,305	1,623
1986/87	310	1,616	1,977
1987/88	310	1,446	1,872
1989/90	410	1,812	2,222
1994/95	1,000	2,564	3,564
1999/00	2,000	3,536	5,536
2004/05	3,000	5,021	8,021

Source: BBS, Yearbook 1989 and Study Team

A regression model was estimated by the Ordinary Least Squares Method by using the past 16 years time series data. The estimated model is as follows:

$$Cc = -637.95 + 0.091 \times Yc \qquad R^2 = 0.82$$

where
Cc: Cement consumption
Yc: Construction sector of GDP

Future cement imports are forecast based on the difference between forecast consumption and production.

Future cement production is estimated as 1,000 thousand tons in 1994/95, the target value of the tentative FFYP, and the study team assumes that cement production in 1999/00 will reach 2,000 thousand tons considering the planned new cement factories.

(4) Iron and Steel

There is presently only one Bangladesh's steel plant. The plant is located in Chittagong and uses imported scrap and pig iron to make rods and sheets.

The past supply and demand of iron & steel in Bangladesh is shown in Table 4-1-6.

Future iron and steel consumption in Bangladesh is forecast based on the past correlation between the construction sector of GDP and iron & steel consumption.

A regression model was estimated as follows by using the past 16 years time series data.

$$LnSc = -4.53 + 0.933 \times LnYCI \qquad R^2 = 0.64$$

where,
Sc : Iron & steel consumption
YCI: Construction & industry sector of GDP

Table 4-1-6 Supply & Demand of Iron & Steel

(1,000 ton)

Year	Production	Imports	Consumption
1972/73	68	98	166
1973/74	74	61	135
1974/75	76	44	120
1975/76	90	70	160
1976/77	102	69	171
1977/78	110	100	210
1978/79	121	157	278
1979/80	133	230	363
1980/81	136	221	357
1981/82	108	136	244
1982/83	47	129	176
1983/84	78	138	216
1984/85	101	326	427
1985/86	96	354	450
1986/87	82	243	325
1987/88	70	284	354
1989/90	120	277	397
1994/95	180	389	569
1999/00	250	564	814
2004/05	350	796	1,146

Source: BBS, Yearbook 1989 and Study Team

Future iron and steel import is calculated as the differences between production and consumption.

The TFYP sets iron & steel production in 1989/90 as 120 thousand tons. The study team assumes that iron and steel production in 2004/5 will reach 350 thousand tons, about three times the 1990 value because the development of the construction sector is emphasized in the national economic policy.

(5) Petroleum Products

Crude oil is not produced in Bangladesh at present. Therefore, all crude oil and some petroleum products are imported from other countries.

Imported crude oil is refined at Bangladesh's sole refinery. The refinery is located in Chittagong and the petroleum products produced at Chittagong are distributed to various storage facilities.

Imported crude oil and petroleum products, the Chittagong refinery production, and the consumption of petroleum products in Bangladesh are shown in Table 4-1-8.

The projected energy consumption pattern by kind of energy from 1979/80 to 1989/90 is presented in Table 4-1-7.

Table 4-1-7 Energy Consumption during 1979/80 - 1989/90

(Million ton)

	1979/80		1984/85		1989/90	
		(%)		(%)		(%)
Natural Gas	1.042	36.5	2.310	56.3	3.879	65.3
Petroleum	1.520	53.2	1.500	36.6	1.717	28.9
Coal	0.139	4.9	0.080	2.0	0.077	1.3
Hydro Power	0.155	5.4	0.211	5.1	0.267	4.5
Total	2.856	100.0	4.101	100.0	5.940	100.0
Per Capita (kg)	32.750		41.350		54.000	

Source: BBS, Yearbook 1989 and Planning Commission

The 2.7% annual growth rate of petroleum consumption from 1984/85 to 1989/90, derived from Table 4-1-7 will apply for future consumption to the year 2004/05.

The projected import volume in the TFYP are 1,000 thousand tons of crude oil.

The existing refinery capacity is 1,500 thousand tons per year and the operating ratio is generally about 70%. Assuming that the operating ratio of the refinery will remain 70% in the future, the import of crude oil in the future will in fact total 1,000 thousand tons in 1989/90.

The future import and consumption of petroleum products in Bangladesh are thus forecast as shown in Table 4-1-8.

Table 4-1-8 Supply & Demand of Petroleum Products

(1,000 ton)

Year	Imports			Refinery Production	Petroleum Products Consumption
	Crude Oil	Petroleum Products	Total		
1972/73	547	580	1,127	475	1,055
1973/74	557	497	1,054	502	999
1974/75	774	559	1,333	731	1,290
1975/76	1,194	357	1,551	1,086	1,443
1976/77	1,052	260	1,312	1,048	1,308
1977/78	1,012	351	1,363	974	1,325
1978/79	1,023	381	1,404	1,038	1,419
1979/80					
1980/81	1,305	524	1,829	1,264	1,788
1981/82	1,178	583	1,761	1,025	1,608
1982/83	1,443	219	1,662	939	1,158
1983/84	1,003	464	1,467	1,048	1,512
1984/85	985	570	1,555	954	1,524
1985/86	983	805	1,788	950	1,755
1986/87	1,000	732	1,732	983	1,715
1987/88	1,200	900	2,100	900	1,800
1989/90	1,000	828	1,828	1,000	1,828
1994/95	1,000	1,092	2,092	1,000	2,092
1999/00	1,000	1,394	2,394	1,000	2,394
2004/05	1,000	1,740	2,740	1,000	2,740

Source: BBS, Yearbook 1989 and Study Team

(6) Jute and Jute Goods

Jute is the major Bangladesh's export, accounting for 70 - 80% of the total national export. The national production and export of jute in the past are shown in Table 4-1-9. According to the FFYP, the annual production of jute is planned to 1,080 thousand tons and export of jute is planned to be 306 thousand tons.

However, the study team presumes that contrary to the tentative FFYP target, the production of jute will actually remain more or less constant at the current level, and that exports of jute will also remain constant at about 306 thousand tons per year.

As shown in Table 4-1-9, the growth rate of production and export of jute goods were 1.1% per year and 0.3% per year respectively during 1972/73 - 1986/87.

However, according to the tentative FFYP, the export of jute goods will increase from 435 thousand tons to 590 thousand tons.

The study team assumes that the future export of jute goods will remain constant at about 590 thousand tons per year.

Table 4-1-9 Production and Export of Jute and Jute Goods

(1,000 ton)

Year	Jute		Jute Goods	
	Production	Exports	Production	Exports
1972/73	1,173	488	446	418
1973/74	1,080	472	500	436
1974/75	626	265	444	368
1975/76	709	405	478	455
1976/77	858	413	490	462
1977/78	957	293	555	530
1978/79	1,150	358	509	462
1979/80	1,065	362	531	455
1980/81	883	352	590	502
1981/82	829	352	587	533
1982/83	872	457	570	522
1983/84	931	387	544	483
1984/85	913	266	516	445
1985/86	1,546	387	458	472
1986/87	1,206	492	540	556
1987/88		250	527	435
1989/90	816	285	600	507
1994/95	1,080	306	774	590
1999/00	1,080	306	774	590
2004/05	1,080	306	774	590

Source: BBS, Yearbook 1989 and Study Team

(7) Non-Bulk

Incoming non-bulk commodities are milk products, animal and vegetable oil, oil seeds, garments (raw material), chemicals, machinery and so on.

The future import of non-bulk items in Bangladesh is forecast based on the past correlation between GDP in Bangladesh and the import of non-bulk items as shown in Table 4-1-10.

The main commodities of outgoing non-bulk items are tea, leather, frozen foods and garments. The future export of non-bulk items is forecast based on the past correlation between GDP of the industrial sector except for jute and jute goods and the volume of non-bulk exports as shown in Table 4-1-10.

A regression model applied for forecasting was presented as follows:

$$NBI = -1252.46 + 0.00627 \times Y \qquad R^2 = 0.82$$
$$LnNBE = -11.543 + 1.269 \times LnY \qquad R^2 = 0.64$$

where
NBI: Import of non-bulk
NBE: Export of non-bulk
Y : Total GDP

Table 4-1-10 Import & Export of Non-Bulk

(1,000 ton)

Year	Imports	Exports
1975/76	706	77
1976/77	493	102
1977/78	787	103
1978/79	917	104
1979/80	917	95
1980/81	1,216	96
1981/82	1,180	122
1982/83	985	128
1983/84	1,162	117
1984/85	1,389	143
1989/90	1,787	160
1994/95	2,711	224
1999/00	3,900	313
2004/05	5,459	438

Source: JICA, Dhaka and Narayanganji Ports Project 1987 and Study Team

(8) Container Traffic in Bangladesh

Container cargo in Bangladesh is a lower volume among South Asian Countries at present. The container cargo volume in the past is shown in Table 4-1-11.

Containerized cargo comprises non-bulk cargo, and the containerized ratio shows the share of actual container cargo in total non-bulk cargo.

The containerized ratio by import and export in 2005 is calculated for each of the commodities in Table 4-1-11 based on the Rail Container Transport Study, 1987.

Table 4-1-11 Future Container Cargo

(1,000 ton)

Year	Imports			Exports		
	Con-tainer	Non-bulk	Container-ized Ratio	Con-tainer	Non-bulk	Container-ized Ratio
1980/81	14	1,216	1.2%	12	971	1.2%
1981/82	24	1,180	2.0%	24	1,029	2.3%
1982/83	50	985	5.1%	75	1,072	7.0%
1983/84	82	1,162	7.1%	118	964	12.2%
1984/85	166	1,389	12.0%	118	864	13.7%
1985/86	235	1,532	15.0%	172	1,067	16.0%
1986/87	311	1,639	19.0%	230	1,072	21.0%
1989/90	581	1,787	32.5%	355	952	37.3%
1994/95	1,434	2,711	52.9%	719	1,120	64.2%
1999/00	2,465	3,900	63.2%	881	1,209	72.9%
2004/05	3,549	5,459	65.0%	1,000	1,334	75.0%

Source: Railway Container Transport Study, 1987 and Study Team

4-1-3 Summary of Future Cargo Volume

A summary of the cargo forecast is presented in Table 4-1-12.

The average annual growth rate of the total cargo handling volume is 4.3% during 1989/90 - 1994/95, 4.7% during 1995-2000, and 5.8% during 1999/00 - 2004/05. The overall average annual growth rate during the entire period is 4.9% per year.

The average growth rate of international cargo handled at the ports of Chittagong and Mongla were 2% for export and 5.3% for import during 1975/76 and 1987/88. In the same period, GDP at constant 1984/85 price increased at 4.7% per year. Therefore, GDP elasticity coefficient of the cargo volume growth rate can be calculated as 0.43 for export and 1.13 for import. Based on this elasticity coefficient, the growth rate of cargo volume is forecast at 2.4% in 1989/90 - 1994/95 and 2.3% in 1994/95 - 2004/05 for export and 6.1%, 6.2% in the same period for import.

The results of the micro forecast is slightly lower than that of the GDP elasticity forecast. The study team adopts the results of the micro forecast by commodity.

		1989/90 - 1994/95	1994/95 - 1999/00	1999/00 - 2004/05
Micro forecast Method	Export	3.3 (%)	1.5 (%)	2.0 (%)
	Import	4.4	4.9	6.1
GDP elasticity Method	Export	2.4	2.3	2.3
	Import	6.1	6.2	6.2

Table 4-1-12 Summary of Future Cargo Handling Volume

(1,000 ton)

	1984/85	1989/90	1994/95	1999/00	2004/05
Imports	6,172	9,624	11,945	15,179	20,436
(Bulk)	4,783	7,837	9,234	11,278	14,976
Food Grain	1,032	1,090	652	0	0
Fertilizer	668	1,044	827	884	959
Cement	1,202	1,812	2,564	3,536	5,021
Iron & Steel	326	277	389	564	796
Petroleum	1,555	1,828	2,092	2,394	2,740
(Non-bulk)	1,389	1,787	2,711	3,900	5,459
Others					
Exports	854	952	1,120	1,209	1,334
(Bulk)	711	792	896	896	896
Jute	266	285	306	306	306
Jute Goods	445	507	590	590	590
(Non-bulk)	143	160	224	313	438
Others					
Total	7,026	10,576	13,065	16,388	21,769

Source: Study Team

4-2 REQUIRED NUMBER OF VESSELS

4-2-1 Basic Concept

In this section, the required number of vessels in Bangladesh until the year 2004/05 has been estimated in view of the latest economic situation, cargo volume and the present fleet expansion plan up to the year 1990. (End of Third Five Year Plan) which was prepared by BSC.

As a basic concept for the estimation adopted in this procedure, the following is considered.

(1) Forecasting Period

Four years of 1989/90, 1994/95, 1999/00, and 2004/05 are chosen since these years are the last years of each Five Year Plan period.

(2) Forecasting Ships

The following types of ship are considered from the past performance.

Seagoing ship --- BSC own ship
-- BSC chartered ship
-- Private ship
-- Foreign flag ship

Fishing Trawler

The number of other ships are almost the same as that of the fishing trawlers from the past performance, and shall be continued throughout the planned period.

4-2-2 Seagoing Vessels

(1) Method

Forecasting procedure is shown in Fig. 4-2-1.

For seagoing ship, first the future GDP growth rate and its sectoral share are estimated by examing the past achievement, then, future cargo volume is obtained by the micro forecast method as described in the previous section.

Second, the required volume of DWT to carry cargo volume will be calculated by applying the future lifting share by the type of different ownership, the present lifting share by shipping routes (direction) and annual carrying capacity of vessels. Annual carrying capacity can be divided into the number of sailings per year and transport efficiency, which largely depends on type of cargo and work efficiency.

Finally, required number of vessels are estimated by dividing required volume of DWT with the average DWT per vessel.

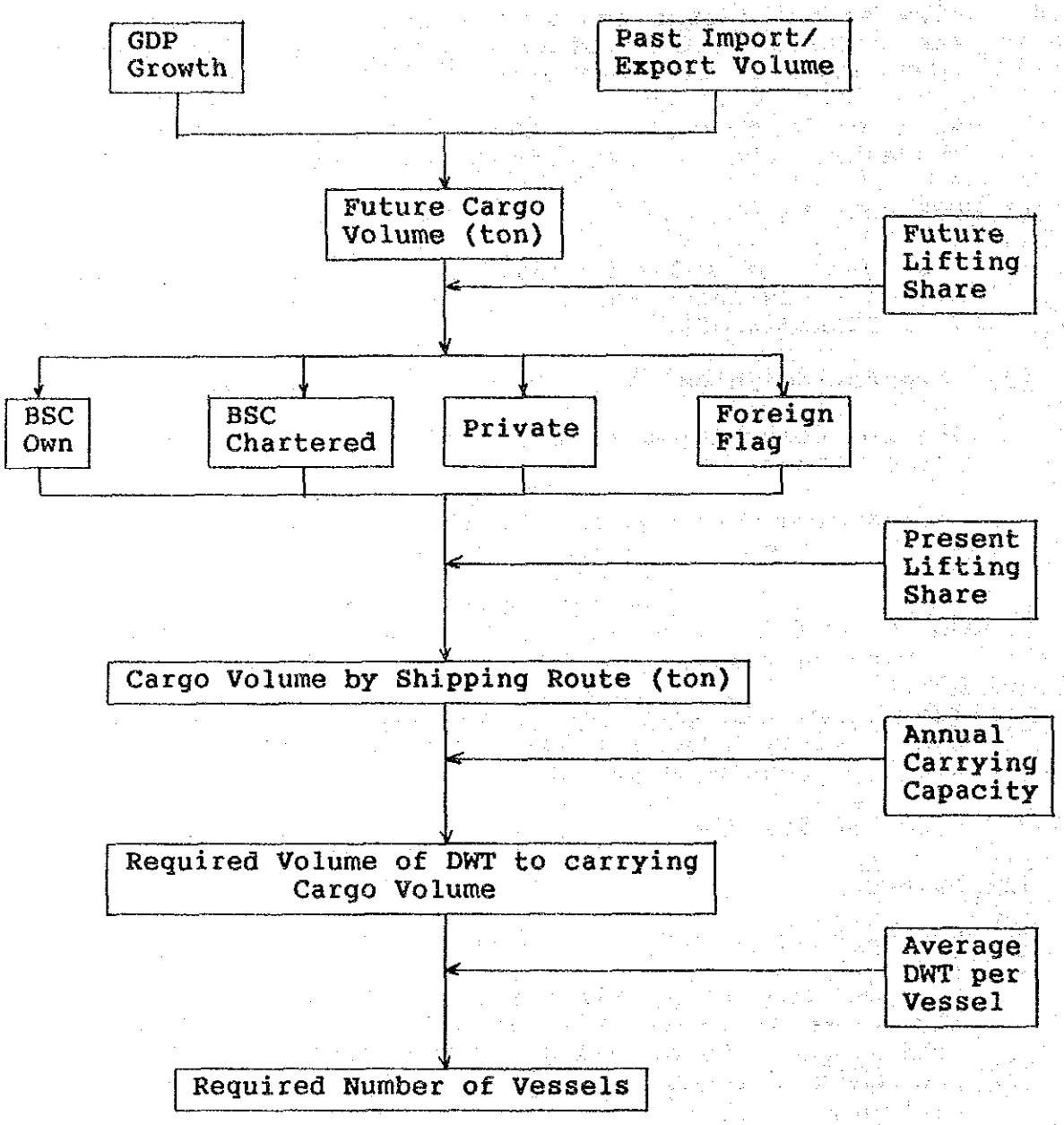


Fig. 4-2-1 Estimation Procedure for Required Number of Vessels (Seagoing Ship)

(2) Lifting Share

The principal shipping lines providing services from the various regions of the world to Bangladesh are three major conferences, IPBC (known as the UK-Continental Conference in Bangladesh), BENJAP and ECUSA, which operate on routes between Bangladesh and Western Europe, South East Asia and the Far East, and the USA, respectively. However, a notable feature of the recent development of liner services to and from Bangladesh and worldwide, has been the infiltration of "outsiders" into the major conference routes.

One important agreement governing seaborne trade to and from Bangladesh is the Flag Protection Ordinance, or "40:40:20" rule. The objective of this legislation is to give Bangladesh shipping a 40% share of trade with any other country by allowing only 20% to be carried by a third country's vessel.

In practice, this can not readily be realized because it is tacitly acknowledged that the national shipping line, BSC, does not have the capacity to carry 40% of Bangladesh trade. Furthermore, on many routes it cannot compete with the freight rates being offered by major world lines.

The Bangladesh Government, thereby, has a future target over a long term period to increase their cargo lifting share of the nation's flag ship from 20.7% in 1987/88 to 40%.

This study assumes the following two cases. One is that lifting shares can be increased to 30% by the end of the Sixth Five Year Plan (2004/05) and the other is that shares of 40% can be fulfilled in 2004/05 by expecting more rapid increasing tendencies of private ships.

Table 4-2-1 Future Lifting Share (30%)

(%)

	1989/90	1994/95	1999/00	2004/05
BSC Own Ships	4	6	8	10
BSC Chartered Ships	15	13	12	10
Private Ships	5	7	9	10
Foreign Flag Ships	76	74	71	70
Total	100	100	100	100

Source: Study Team

Table 4-2-2 Future Lifting Share (40%)

(%)

	1989/90	1994/95	1999/00	2004/05
BSC Own Ships	4	7	10	12
BSC Chartered Ships	15	14	13	13
Private Ships	5	8	10	15
Foreign Flag Ships	76	71	67	60
Total	100	100	100	100

Source: Study Team

Present lifting shares by shipping route will continue to be the same rate throughout the planned period on the assumption that present importing and exporting locations will not be much changed.

(3) Annual Carrying Capacity

The annual carrying capacity by the sea-route can be estimated by dividing the total carried cargo handling volume (ton) with the total utilized ship tonnage (DWT) utilized in the specific sea routes.

$$\text{Annual carrying capacity in the specific sea route} = \frac{\text{Total cargo carried (ton) in the specific sea route}}{\text{Total ship tonnage (DWT) utilized in the sea route}}$$

This value indicates the ship's productivity, which means "How many tons in the specific sea routes can be carried per dead weight tonnage in a year?"

Further, annual carrying capacity per vessel can be divided into the following two factors.

$$\text{Annual carrying capacity per vessel} = \text{No. of Sailings per year} \times \text{Transport Efficiency (ton/DWT)}$$

Therefore, future values of annual carrying capacity will be estimated by considering the above factors.

The past performance obtained from BSC own ship are as follows:

(Ton/DWT)

Sea Routes	Maximum Number of Sailings per Vessel	Annual Carrying Capacity		Transport Efficiency	
		1984/85	1985/86	1984/85	1985/86
UK	6	2.15	1.58	0.47	0.43
USA	4	1.10	0.44	0.33	0.18
Far East	8	1.25	1.28	0.33	0.34
Asia Gulf	5	0.68	1.30	0.36	0.45

Source: FGSS and BSC Annual Report

Annual carrying capacity of private ships are estimated as follows:

(Ton/DWT)

	1984/85	1985/86	1986/87	1987/88
Private ship (average)	3.40	4.65	3.35	3.33
Atlas	3.36	4.88	4.06	3.78
Aqua Lines	3.45	4.40	5.44	4.14

Source: FGSS No. 5, 6 & 7

It is noted that the annual carrying capacity for private ships is larger than that for BSC own ships since they transport different types of cargo, different sea routes and as a result, have different transport efficiency.

Future values for BSC ships and private ships were estimated as shown in Table 4-2-3 and 4. Factors for affecting this values are first possible number of sailings per vessels and second increase of transport efficiencies by changing cargo contents. In practice, the transport of jute requires about 30% more space per unit tonnage than general cargo. Third, increase of transport efficiency through better shipping operation can be achieved by mechanizing ship's equipment and acquiring technical skills. Fourth, more rapid containerization may increase this value. In general, there had been experienced values of about five for general dry cargo vessels and seven for container cargo vessels.

Annual carrying capacity for both chartered ships and foreign flag ships are assumed to be the same as that of the BSC own ships in 2004/05 throughout the planned period for all shipping direction.

Table 4-2-3 Annual Carrying Capacity of BSC Owned Ships

(Ton/DWT)

Shipping Direction	Annual Carrying Capacity			
	1989/90	1994/95	1999/00	2004/05
Europe	2.25	2.69	3.12	4.68
America	1.02	1.64	2.25	3.38
Far East	2.01	3.41	4.80	7.20
Asia	2.01	3.41	4.80	7.20
South Asia	2.03	3.51	5.00	7.50
Feeder	1.60	2.80	4.00	6.00
Other	1.82	2.91	4.00	5.99

Source: Study Team

Table 4-2-4 Annual Carrying Capacity of Private Ships

(Ton/DWT)

Shipping Direction	Annual Carrying Capacity			
	1989/90	1994/95	1999/00	2004/05
Europe	4.00	4.23	4.45	4.68
America	3.20	3.25	3.32	3.38
Far East	3.20	4.53	5.87	7.20
Asia	4.00	5.07	6.13	7.20
South Asia	4.00	5.17	6.33	7.50
Feeder	2.00	4.00	6.00	9.00
Other	3.40	4.26	5.13	5.99

Source: Study Team

(4) Ship Enlargement

The average size of vessel will not be enlarged in the future. The enlarging tendency of vessel size is limited due to port conditions and operating efficiencies. This study assumes that all types of vessels shall maintain the same average size as at present, as shown in Table 4-2-5.

Table 4-2-5 Average Ship Size

Shipping Direction	BSC Own & chartered	Private Ship	Foreign Flag
	Average DWT	Average DWT	Average DWT
Europe	15,615	8,596	8,596
America	16,764	9,218	9,218
Far East	10,443	9,791	5,591
Asia	10,443	9,791	9,921
South Asia	14,279	8,000	6,591
Feeder	10,000	5,427	5,427
Other	13,000	8,000	6,752
Average	12,935	8,403	7,442

Source: FGSS No. 7

(5) Required Number of Vessel

The total required number of vessels is estimated from Table 4-2-6 to 13.

The total number of BSC ships planned in 1989/90 is to be 25 vessels. The number of vessels is calculated by dividing the total number of DWT with the average ship size (DWT).

$$\text{No. of Vessels} = \frac{\text{Total DWT}}{\text{Average ship size (DWT)}}$$

The remaining vessels are made available for lighterage or tramp service, which follow the same distribution pattern as at present.

Both numbers of BSC chartered ships and foreign flag ships are totalled in one year, so that actual number of arriving or leaving vessels in a year should be obtained by multiplying the average number of sailings in a year with the number of ships in the tables.

Table 4-2-6 Required Number of Vessels (BSC Own Ships), 30% Lifting Share

Shipping Direction	Total DWT (1000)				Total Required Number of Vessels			
	1989/90	1994/95	1999/00	2004/05	1989/90	1994/95	1999/00	2004/05
Europe	72	112	160	175	5	8	11	12
America	23	26	31	34	2	2	2	3
Far East	54	59	70	78	6	6	7	8
Asia	52	57	68	76	5	6	7	8
South Asia	4	5	5	6	1	1	1	1
Feeder	10	11	13	14	2	2	2	2
Other	0	1	1	1	1	1	1	1
Total	215	269	348	384	22	26	31	35

Source: Study Team

Table 4-2-7 Required Number of Vessels (BSC Own Ships), 40% Lifting Share

Shipping Direction	Total DWT (1000)				Total Required Number of Vessels			
	1989/90	1994/95	1999/00	2004/05	1989/90	1994/95	1999/00	2004/05
Europe	72	131	199	210	5	9	13	14
America	23	31	39	41	2	2	3	3
Far East	54	69	88	94	6	7	9	10
Asia	52	66	85	91	5	7	9	9
South Asia	4	5	7	7	1	1	1	1
Feeder	10	13	16	17	2	2	2	2
Other	0	1	1	1	1	1	1	1
Total	215	314	434	460	22	29	38	40

Source: Study Team

Table 4-2-8 Required Number of Vessels (Private Ships), 30% Lifting Share

Shipping Direction	Total DWT (1000)				Total Required Number of Vessels			
	1989/90	1994/95	1999/00	2004/05	1989/90	1994/95	1999/00	2004/05
Europe	1	2	4	5	1	1	1	1
America	6	10	16	23	1	2	2	3
Far East	16	19	24	29	2	2	3	3
Asia	51	70	95	121	6	8	10	13
South Asia	27	36	47	58	4	5	6	8
Feeder	47	40	42	40	9	8	8	8
Other	14	20	27	34	2	3	4	5
Total	162	197	253	310	25	29	34	41

Source: Study Team

Table 4-2-9 Required Number of Vessels (Private Ships), 40% Lifting Share

Shipping Direction	Total DWT (1000)				Total Required Number of Vessels			
	1989/90	1994/95	1999/00	2004/05	1989/90	1994/95	1999/00	2004/05
Europe	1	3	4	7	1	1	1	1
America	6	11	17	35	1	2	2	4
Far East	16	22	27	44	2	3	3	5
Asia	51	80	105	181	6	9	11	19
South Asia	27	41	52	86	4	6	7	11
Feeder	47	46	47	60	9	9	9	12
Other	14	22	30	51	2	3	4	7
Total	162	225	282	464	25	33	37	59

Source: Study Team

Table 4-2-10 Required Number of Vessels (BSC Chartered Ships), 30% Lifting Share

Shipping Direction	Total DWT (1000)				Total Required Number of Vessels			
	1989/90	1994/95	1999/00	2004/05	1989/90	1994/95	1999/00	2004/05
Europe	37	39	46	52	3	3	3	4
America	89	96	112	125	6	6	7	8
Far East	2	2	2	2	1	1	1	1
Asia	78	83	96	105	8	8	10	11
South Asia	55	60	70	78	4	5	5	6
Feeder	20	22	25	27	3	3	3	3
Other	0	0	0	0	0	0	0	0
Total	282	302	350	388	25	26	29	33

Source: Study Team

Table 4-2-11 Required Number of Vessels (BSC Chartered Ships), 40% Lifting Share

Shipping Direction	Total DWT (1000)				Total Required Number of Vessels			
	1989/90	1994/95	1999/00	2004/05	1989/90	1994/95	1999/00	2004/05
Europe	37	43	50	67	3	3	4	5
America	89	103	121	162	6	7	8	10
Far East	2	2	2	2	1	1	1	1
Asia	78	90	104	136	8	9	10	14
South Asia	55	64	76	102	4	5	6	8
Feeder	20	23	27	35	3	3	3	4
Other	0	0	0	0	0	0	0	0
Total	282	325	379	504	25	28	32	42

Source: Study Team

Table 4-2-12 Required Number of Vessels (Foreign Flag Ships), 30% Lifting Share

Shipping Direction	Total DWT (1000)				Total Required Number of Vessels			
	1989/90	1994/95	1999/00	2004/05	1989/90	1994/95	1999/00	2004/05
Europe	526	632	761	996	62	74	89	116
America	531	639	769	1,007	58	70	84	110
Far East	45	54	65	85	8	10	12	16
Asia	212	255	307	402	22	26	31	41
South Asia	28	34	40	53	5	6	7	9
Feeder	104	126	151	198	20	24	28	37
Other	131	158	190	249	20	24	29	37
Total	1,577	1,897	2,283	2,990	195	234	280	366

Source: Study Team

Table 4-2-13 Required Number of Vessels (Foreign Flag Ships), 40% Lifting Share

Shipping Direction	Total DWT (1000)				Total Required Number of Vessels			
	1989/90	1994/95	1999/00	2004/05	1989/90	1994/95	1999/00	2004/05
Europe	526	607	718	854	62	71	84	100
America	531	613	725	863	58	67	79	94
Far East	45	52	61	73	8	10	11	13
Asia	212	245	290	345	22	25	30	35
South Asia	28	32	38	45	5	5	6	7
Feeder	104	121	143	170	20	23	27	32
Other	131	152	180	214	20	23	27	32
Total	1,577	1,820	2,155	2,563	195	224	264	313

Source: Study Team

4-2-3 Fishing Trawler

(1) Method

First, the total quantity of marine fresh fish caught by trawler is estimated by applying the same growth rate of GDP agricultural sector and the share of the trawler in total fresh fish.

Second, productivity of the trawler per year will be utilized for estimation of the required number of trawlers, that is, by multiplying the total quantity by trawler with trawler productivity.

Third, the number of steel trawlers in 1999/00 or 2004/05 should be subtracted from the estimated total number by applying the same ratio obtained in 1994/95.

(2) Total Fresh Fish Quantity

The quantity of fresh fish caught increased 5.6% per year from 1971/72 to 1987/88 and targeted 4% during the Fourth Five Year Plan (1989/90-1994/95). Therefore, the Study assumes that the same growth of 4% can be achieved during 1994/95 and 1999/00 and 3.5% during 1999/00 and 2004/05 following the same rate of agricultural GDP growth.

(3) Share of Trawler in Fresh Fish Caught

The shares of marine fish trawler's caught in 1984/85 and 1985/86 were 6.6% and 5.7% of the total marine fish respectively. The shares of trawler's remains constant because aqua culture will be developed in the future. This Study assumes the shares to continue throughout the planned period since development of fisheries can be fulfilled by stocking open water.

(4) Productivity of Trawler

Productivity is calculated by dividing the quantity of fish caught with the number of trawlers and indicates efficiency of trawler operation. This value was 186 tons per vessel in 1984/85 and increased to 252 tons in 1986/87. This increasing tendency will continue as in this table since the operating efficiency can be expected to be more than the present condition.

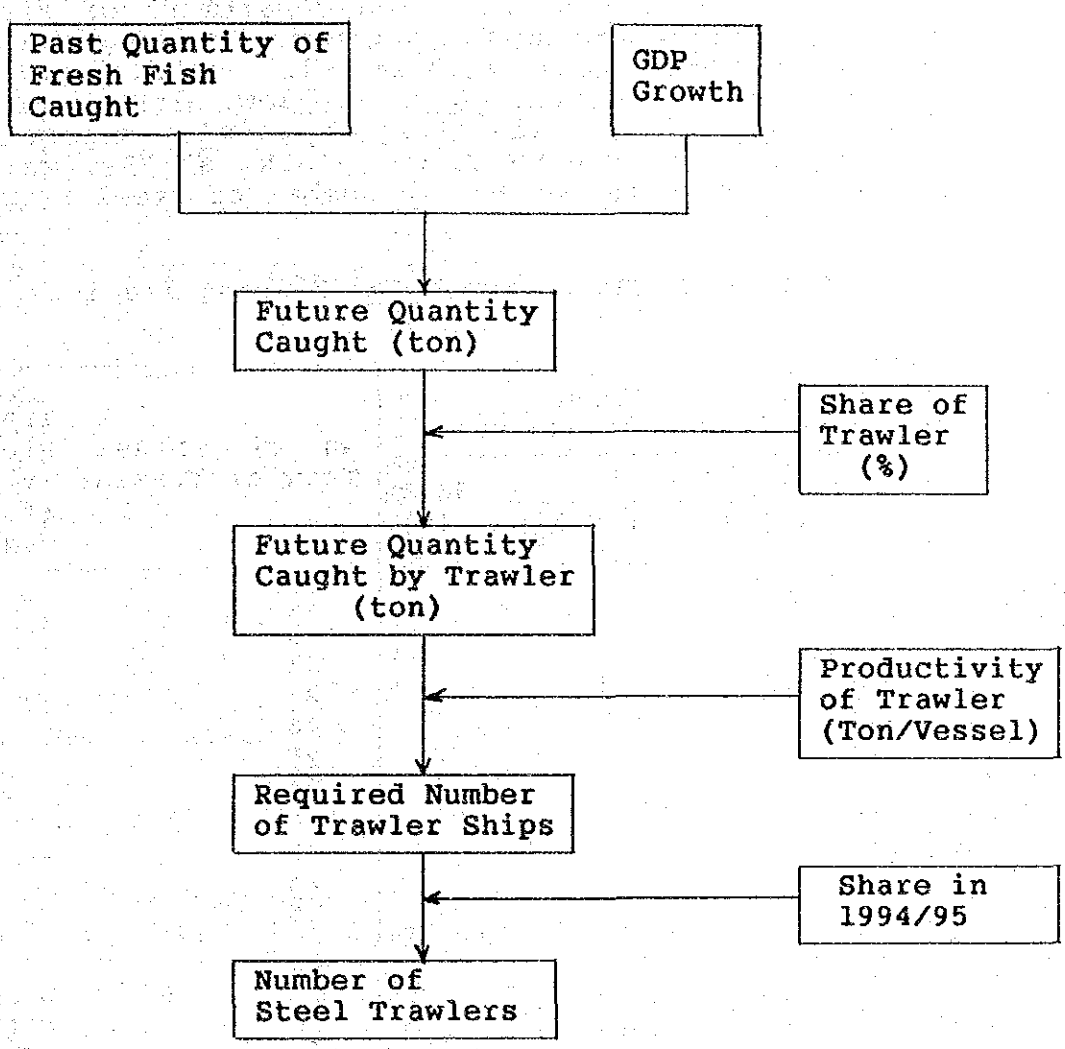


Fig. 4-2-2 Estimation Procedure for Required Number of Vessels (Fishing Trawlers)

(5) Number of Trawler

The number of trawlers in 1987/88 is 53 entering service for fish caught in 1988/89, and among this number, there are 35 steel trawlers which can be considered as ship repairing clients for CDD. The department of fisheries outlined a fleet expansion programme by the year 1994/95 that four more steel vessels will enter service in 1989/90 and are scheduled to follow eight more steel vessels immediately. The share of steel trawlers to the total number in 1994/95 is calculated as 73%, which was applied to estimate the future number of steel trawlers.

Table 4-2-14 Required Number of Fishing Trawlers

Year	Quantity of Fresh Fish Caught (1,000 ton)					No. of Trawler	Steel Trawler	Trawler Productivity (ton/vessel)
	Total	By Trawler			Share (%)			
		Total	Shrimp	Fish				
1971/71	95					10		
1972/73	87					10		
1973/74	88					21		
1974/75	89					21		
1975/76	95					26		
1976/77	100					26		
1977/78	110					26		
1978/79	118					26		
1979/80	122					26		
1980/81	125					24		
1981/82	130					35		
1982/83	141					53		
1983/84	165					73		
1984/85	188	12.4	3.1	9.3	6.6	67		186
1985/86	207	11.9	4.0	7.9	5.7	45		264
1986/87	218	12.4	4.5	7.9	5.7	49		252
1987/88	227	10.4	3.5	6.9	4.6	53	35	196
1988/89		10.5	5.0	5.5		52	35	202
1989/90	235	12.3	5.0	7.3	5.7	56	39	219
1994/95	285	16.1	5.0	11.1	5.7	64	47	250
1999/00	339	19.2	5.0	14.2	5.7	74	54	260
2004/05	402	22.8	5.0	17.8	5.7	81	60	280

Source: BBS, Yearbook 1989, Department of Fisheries and Study Team

4-2-4 Summary of Future Number of Vessels

A summary of the future number of vessels is presented in Table 4-2-15 for the case of 30% lifting shares and Table 4-2-16 for 40% lifting shares.

Table 4-2-15 Summary of Required Vessels (30%)

	BSC Owned	BSC Chartered	Private	Foreign	Trawler
1989/90	22	25	25	195	39
1990/91	22	25	25	202	40
1991/92	23	25	26	212	42
1992/93	25	26	28	217	44
1993/94	25	26	29	225	45
1994/95	26	26	29	234	47
1995/96	27	26	29	243	48
1996/97	27	27	30	252	50
1997/98	30	28	33	261	51
1998/99	30	29	34	271	53
1999/00	31	29	34	280	54
2000/01	31	29	35	299	55
2001/02	31	30	36	321	56
2002/03	35	33	39	343	58
2003/04	35	34	40	367	59
2004/05	35	33	41	366	60

Source: Study Team

Table 4-2-16 Summary of Required Vessels (40%)

	BSC Owned	BSC Chartered	Private	Foreign	Trawler
1989/90	22	25	25	195	39
1990/91	23	25	26	202	40
1991/92	24	25	27	205	42
1992/93	26	28	31	212	44
1993/94	28	28	32	217	45
1994/95	29	28	33	224	47
1995/96	30	28	33	231	48
1996/97	32	28	34	240	50
1997/98	34	32	36	248	51
1998/99	37	32	37	255	53
1999/00	38	32	37	264	54
2000/01	38	33	40	275	55
2001/02	38	35	45	290	56
2002/03	40	38	49	303	58
2003/04	40	41	53	319	59
2004/05	40	42	59	313	60

Source: Study Team

4-3 STEEL STRUCTURE

4-3-1 Electricity Transmission Tower

The Bangladesh Power Development Board (BPDB) is the only state corporation requiring an electricity transmission tower for power distribution.

In the past, almost all poles for large power projects were supplied by the following major manufactures.

Tower: Japan Steel Tower Co., Ltd.
Nasu Denki Tekko Co., Ltd.
Hyundai Heavy Industries Co., Ltd.
Kolon Electric Machinery Co., Ltd.

Poles: Sumitomo Poles
Nippon Steel Corporation
Petitjean, (France)
Chittagong Steel Works, Dhaka
Karim Pipe Mills Ltd., Chittagong

BPDB has ordered steel towers ranging from 13.6 tons to 44 tons per Km in the past five projects shown in Table 4-3-1. BPDB plans to construct 1,468 Km of new transmission lines during the Fourth Five Year Plan (1990-95).

The total procurement volume of steel towers can be estimated by multiplying the total length of the transmission (1,468 km) with the average tonnage per km (about 30 ton/km), that is 44,040 tons for the Fourth Five Year Plan Period (1990-95).

Table 4-3-1 Supplied by Different Manufacturers to BPDB

Name of Transmission Project	Steel Tower Supplier	Approx. Weight in Metric Ton	Year of Supply Contract
Dohazari-Cox's Bazar 132 kV, 88 km	Hyundai Heavy Industries Co., Ltd. Korea	1,200	1986
Kaptai-Boro Pulia 132 kV, 50 km	Japan steel Tower Co., Ltd., Japan	1,950	1984
Ghorasal-Tongi 230 kV, 26 km	Nasu-Denki-Tekko Co., Ltd., Japan	950	1986
Bheramara-Faridpur-Barisal 132 kV, 230 km	Japan Steel tower Co., Ltd., Japan	6,200	1981
Ashuganj-Ghorasal 230 kV, 44 km	Kolon Electric Machinery Co., Ltd., Korea	1,950	1985

4-3-2 Chemical Plants

All chemical plants are constructed by the Bangladesh Chemical Industries Corporation (BCIC), which is the only state corporation in Bangladesh. Since agriculture is the dominant sector and fertilizer is increasingly used to further productivity, there is a high potential for consuming steel by BCIC for constructing new plants.

Top officials of BCIC expect that chemical plants will consume an estimate of about 1,200 tons of steel per year and require less time in procurement, lower price, and better quality.

At present, almost all steel used is produced by foreign manufacturers.

4-3-3 Bridge

Roads in Bangladesh are classified into national highways, regional highways, district roads, feeder road type A, B and rural roads. National, regional highway and district roads are administrated by the Roads & Highway Department, Ministry of Communication.

In addition, feeder roads type B and rural roads extending to 125,000 km are responsible to the Ministry of Local Government, Rural development & Cooperatives. The Local Government Engineering Bureau (LGEB) functions to support technical assistance to construct feeder type B and rural roads.

The government has decided to urgently install steel bridges in every Upazila (sub-district) due to the bad experience of flood disaster. The government prefers concrete or steel bridges feeder roads depending on specific site conditions and accessibility and prefer steel bridges for rural roads.

There is a possibility of utilizing 2,000 m of bridges under foreign aided projects, 3,000 m under local resources and 6,000 m under local government sources every year.

Competition for the supply of steel bridges in Bangladesh is not expected at present. The government will, most probably, appoint CDD as the only manufacturer. Problems of government budget/disbursement and prices of bridges still make it difficult to enter this market. It will however be more attractive to users of steel bridges to lower prices to make it more competitive with concrete bridges.