3.4 Urban Structure

3.4.1 Urbanization Process

Since 1947, when Dhaka became the capital of East Pakistan, the construction of government offices and housing developments has proceeded remarkably. New Dhaka areas like Dhanmondi, Mohammadupur, Motijheel, Ramna and Tejgaon were included in the Dhaka Urban Area in the 1950s. Narayanganj was developed as the port city for Dhaka in order to cope with increasing shipping demand and restrictive physical conditions at Dhaka Port.

Urbanization has advanced during the past decade, absorbing Gulshan, Mirpur, Tongi and part of Savar to the north, Jinjira on the other side of the Buriganga river, areas along the Dhaka-Narayanganj Road, and both sides of Narayanganj Port (the Lakhya river) to the south.

The urbanized area in 1950 and 1985 is shown in Fig. 3.4.1.

3.4.2 Land Use and Transportation Network

An updated land use map of the entire DNMA is not available. Fig. 3.4.2 shows the general land use layout and the main transportation network. For this study land use maps along the port areas are prepared as shown in Figures 3.4.3 and 3.4.4. The outline of the land use is as follows:

a. Adjoining Dhaka Port, there is a commercial - residential quarter called Old Dhaka.

b. The present urban activity center called New Dhaka is located to the north and includes government offices, business activities, universities, cultural facilities and housing estates for public sector employees.

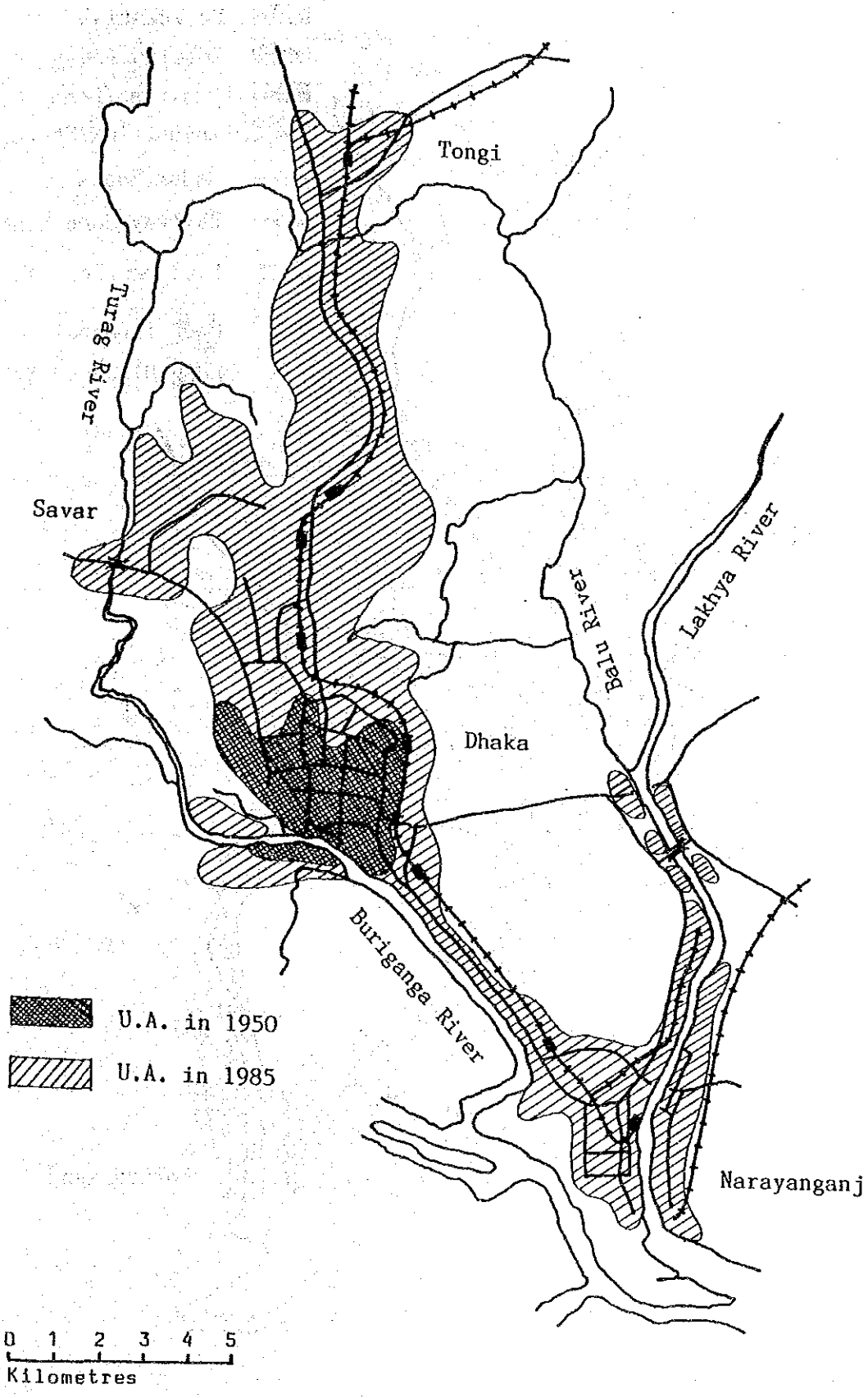


Fig. 3.4.1 Approximate Urban Area of DNMA, 1950 and 1985

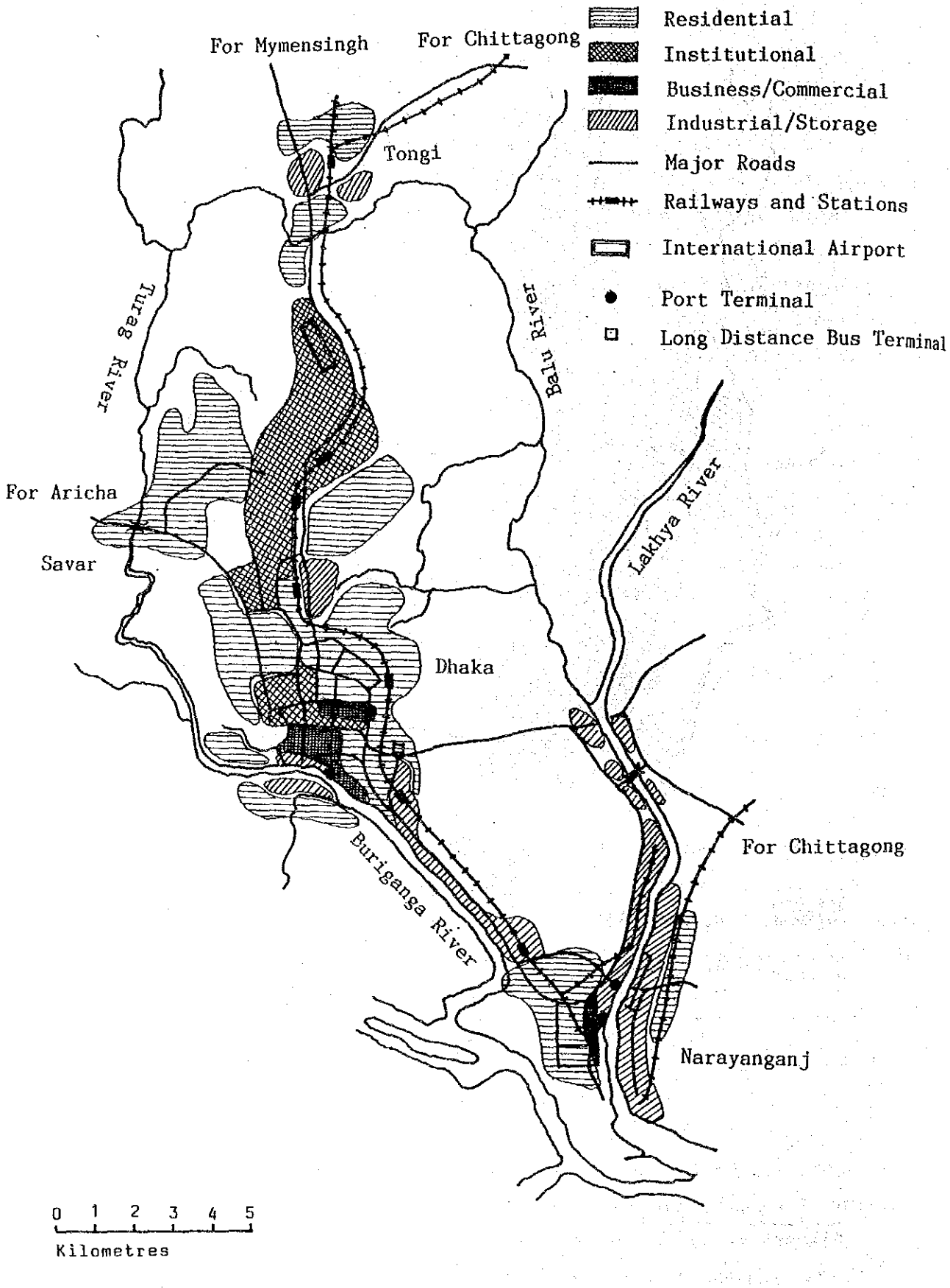


Fig. 3.4.2 Urban Land Use and Transportation Network of DNMA

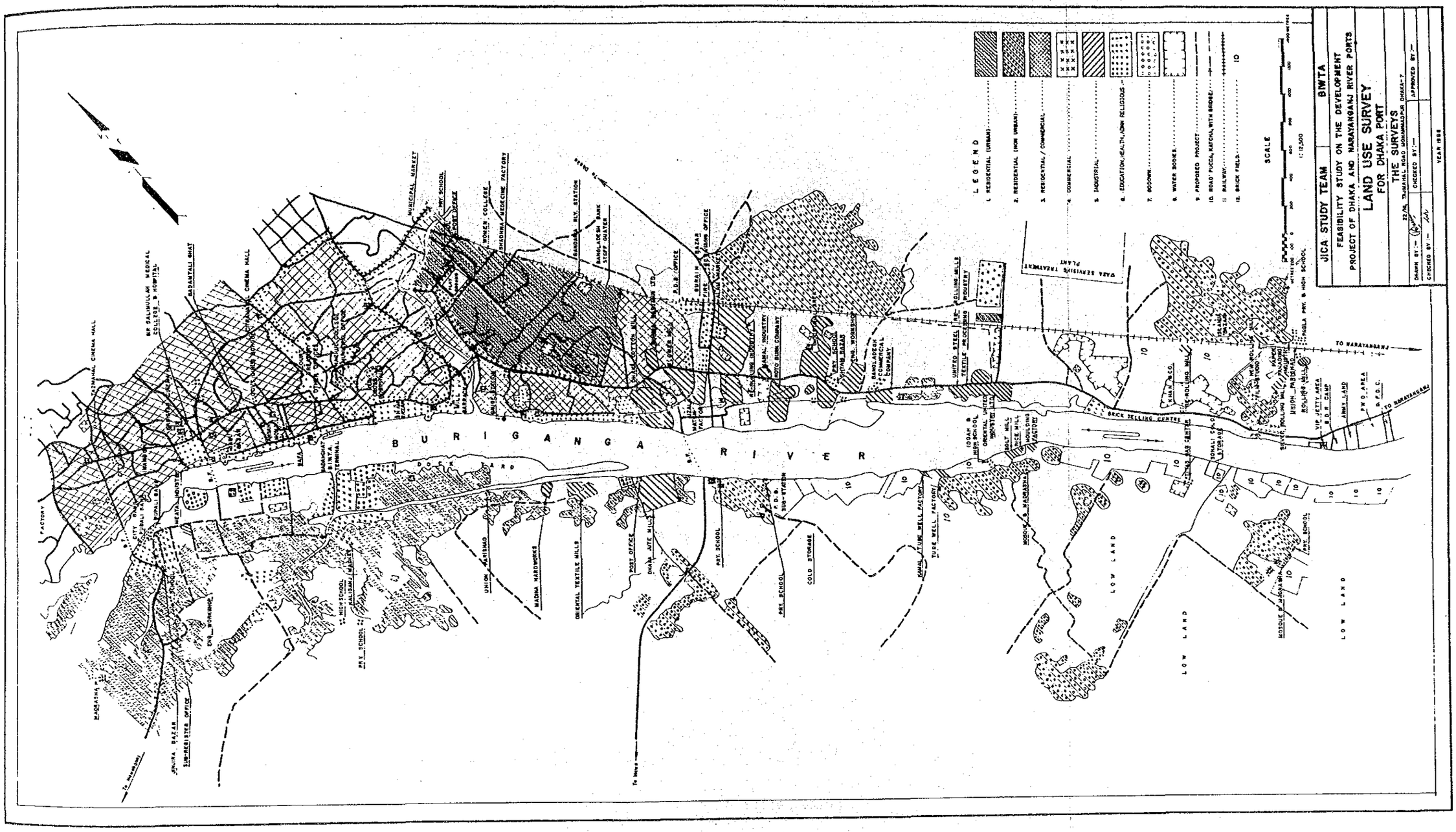


Fig. 3.4.3 Land Use around Dhaka Port

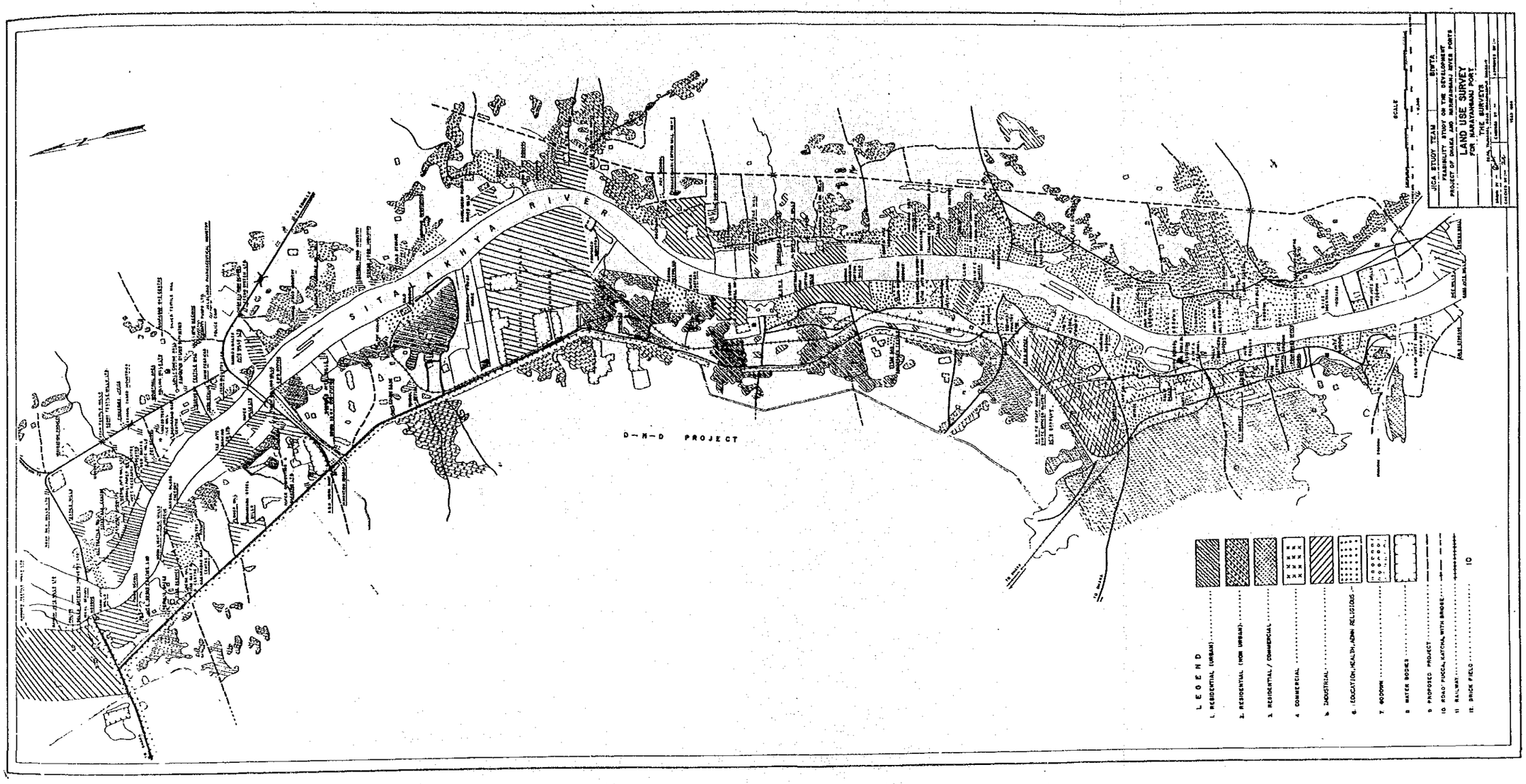


Fig. 3.4.4 Land Use around Narayanganj Port

c. Many factories and godowns are located along the river ports of Dhaka and Narayanganj.

d. Other industrial zones are located at Tejgaon and Tongi.

e. High-quality residential areas extend northwards from the city.

f. Extensive land for military use is located in the north.

g. The Dhaka-Narayanganj-Demra triangle area is under urbanization pressure from housing, factories and brick fields.

The outline of the transportation network in DNMA is as follows:

a. Main roads connecting this area to other parts of the country are the Dhaka Mymensingh Road in the north, the Dhaka Aricha Road in the west, and the Dhaka Chittagon Road in the east.

b. Main urban roads are the New Airport Road, the Mirpur Road, the Circular Road, the North-South Road, the Dhaka-Narayanganj Road, the Demra Road and the Narayanganj - Demra Road.

c. The railway runs through Dhaka from Narayanganj to Tongi and then separates to Mymensingh to the north and to Chittagong to the east. There are nine railroad stations in DNMA: Narayanganj, Gandaria, Kamalapur, Tejgaon, Banani, Dhaka Cantonment, Kurmitola, Tongi and Joydebpur.

d. The bases of inland water transport are Dhaka port on the Buriganga River and Narayanganj port on the Lakhya River. Passenger terminals are located at Sadarghat (Dhaka) and at Narayanganj.

e. The international and domestic air transport uses the Kurmitola Airport opened in 1980. The old Tejgaon Airport is used for military purposes today.

3.4.3 Zone Division

Considering that this study is for the development of Dhaka and Narayanganj ports, and regarding the urbanization process, land use and the transportation network, DNMA is divided into three main zones for analysis, forecasting and planning as outlined in Table 3.4.1 (see Fig. 3.4.5).

Table 3.4.1 Zone Division of DNMA

Zone	Sub-zone
I. Port Related Zone	I-1 DND Triangle I-2 Keraniganj I-3 Narayanganj I-4 Bandar
II. Central Zone	II-1 Central Dhaka
III. North Zone	III-1 North Dhaka III-2 Tongi Joydebpur III-3 Savar

3.4.4 Population Distribution

The population of DNMA in 1985 is estimated as 5.2 million persons. 2.5 million persons, about half of the total population, are living in the Central Zone, while about a quarter of

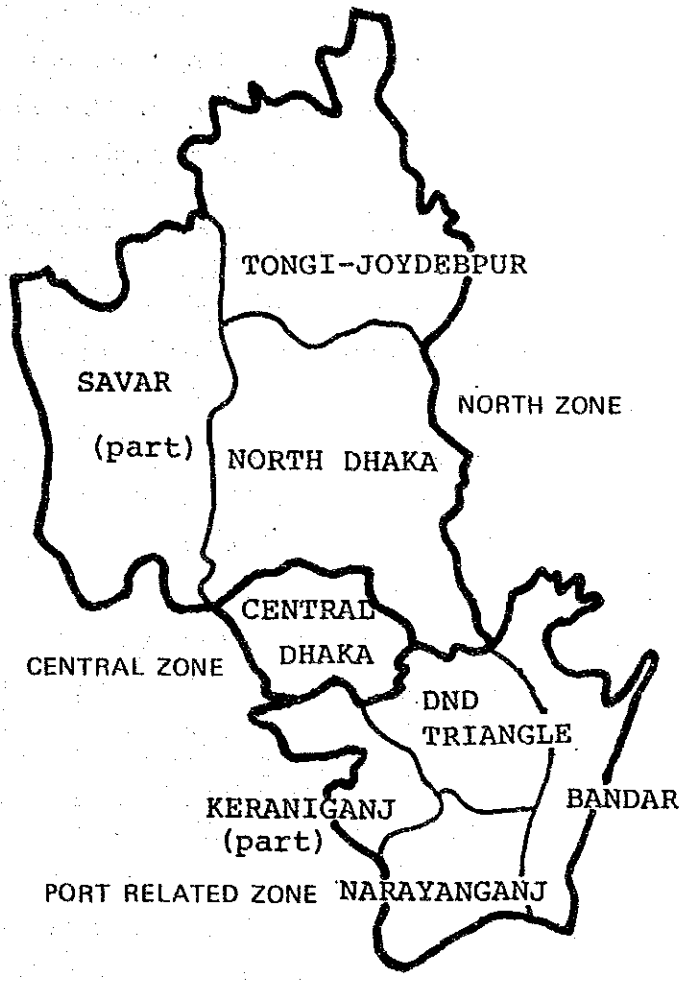


Fig. 3.4.5 Zone Division of DNMA

the population live in the Port Related Zone. The population distribution by zone is presented in Table 3.4.2.

Table 3.4.2 Population Distribution by Zone, 1985

(thousand)

Zone	Population	Percent
Port Related Zone	1,260	24.3
DND Triangle	300	5.8
Keraniganj	260	5.0
Narayanganj	380	7.3
Bandar	320	6.2
Central Zone	2,470	47.7
North Zone	1,450	28.0
North Dhaka	900	17.4
Tongi Joydebpur	310	6.0
Savar	240	4.6
Total	5,180	100.0

In the Central Zone, Old Dhaka which is composed of Kotwali, Lalbagh and Sutrapur Thanas located just behind Dhaka port has a population density as high as 1000 persons per hectare.

In the North Zone, North Dhaka, including middle/high class residential areas like Gulshan, Mirpur and Cantonment, has a population of 900 thousand. Tongi Joydebpur, where industrialization is proceeding, and Savar are at the edge of the urban area and have populations of 310 thousand and 240 thousand, respectively.

About one-third of the 1,260 thousand population of the Port Related Zone are living in Narayanganj. Narayanganj Municipality extends across the Lakhya river to the Bandar side, but the Narayanganj side is the center of the

Municipality and has a high population density of about 600 persons per hectare. The population of the DND Triangle is 300 thousand, of which nearly half (140 thousand) are living in the area between Demra and Shampur. 120 thousand live in Siddhirganj and the rest live in the area near Pagla. Keraniganj on the opposite side of Dhaka across the Buriganga river has a population of 260 thousand, almost all of which is concentrated in Jinjira and its vicinity. Bandar on the opposite side of Narayanganj across the Lakhya river has 320 thousand residents, some of whom live within Narayanganj Municipality.

3.4.5 Employment Distribution

Based on the crude activity rate and on the sectoral distribution of employed persons in DNMA, the total employment by sector in 1985 is estimated as shown in Table 3.4.3.

Table 3.4.3 Employment by Sector, 1985

(thousand persons)

Sector	Employment
Agriculture	130
Manufacturing	280
Others	1,350
Total	1,760

There is no official up-to-date data about the physical distribution of economic establishments and employment within DNMA. However, by combining information from several sources it is possible to roughly estimate the employment distribution by sector.

For this analysis, economic activities are divided into two categories: basic industry and population-related

industry. Basic industry serves a wider market than the zone in which it is situated. Such industry is generally located in the best areas for obtaining the factors of production and in areas with good accessibility to markets. Population-related industry consists of economic activities which serve local residents, and is distributed throughout DNMA. In the Dhaka Metropolitan Area-Integrated Urban Development Project (hereinafter referred to as IUDP), employment by sector is divided into basic employment and population-related employment as shown in Table 3.4.4.

Table 3.4.4 Basic and Population-Related Employment by Sector in Dhaka Conurbation, 1980

(percent)

Sector	Total Employment	Basic Employment	Population-Related Employment
Agriculture	100	100	-
Manufacturing	100	78	22
Services	100	41	59
Total	100	52	48

Source: Dacca Metropolitan Area-Integrated Urban Development Project, Final Report Vol. 2, pp. 97 (UNDP, 1981)

DNMA is wider than the Dhaka conurbation, and the population has grown since 1980, so the present share of the population-related employment in DNMA might be larger than that of the Dhaka conurbation in 1980. Accordingly, the basic and population-related employment in DNMA are estimated as shown in Table 3.4.5.

Table 3.4.5 Basic and Population-Related Employment by Sector in DNMA, 1985

(thousand persons)

Sector	Total Employment		Basic Employment		Population-Related Employment	
	No.	%	No.	%	No.	%
Agriculture	130	100	130	100	-	-
Manufacturing	280	100	210	75	70	25
Services	1,350	100	540	40	810	60
Total	1,760	100	880	50	880	50

a. Agriculture

Considering that the agricultural workers work in the same zone where they live, the employment distribution of agriculture is estimated as shown below based on the resident workforce in agriculture by zone in the 1981 population census.

Table 3.4.6 Estimated Distribution of Employment in Agriculture, 1985

(thousand persons)

Zone	Employment
Port-Related Zone	35
Central Zone	10
North Zone	85
Total	130

b. Manufacturing

The distribution of basic employment in manufacturing industries is estimated based on the results of the Mirpur Industrial Survey (United Nations Center for

Human Settlement, Housing Development Project - BGD/81/004, Mirpur Industrial Survey Final Report, pp. 9, Associated Services, 1985). The population-related employment is distributed to zones pro rata to the zonal population.

Table 3.4.7 Estimated Distribution of Employment in Manufacturing 1985

Zone	Total Employment	Basic Employment	Population-Related Employment
Port-Related Zone	110	90	20
Central Zone	100	70	30
North Zone	70	50	20
Total	280	210	70

c. Services

The basic employment in services is distributed to zones based on the estimation of employment location in IUDP, while the population-related employment is distributed pro rata to the zonal population.

Table 3.4.8 Estimated Distribution of Employment in Services, 1985

Zone	Total Employment	Basic Employment	Population-Related Employment
Port-Related zone	360	170	190
Central Zone	730	340	390
North Zone	260	30	230
Total	1,350	540	810

CHAPTER 4
NATURAL CONDITIONS OF DHAKA AND NARAYANGANJ PORTS

CHAPTER 4 NATURAL CONDITIONS OF DHAKA AND NARAYANGANJ PORTS

4.1 Topographical Features

The plateau known as the central Madhupur clay plain lies at the center of Bangladesh. Its ground elevation is 15 m in the northern part, and the plain inclines gradually down to 8 m in the southern part. A topographical map covering part of central Bangladesh is shown in Fig. 4.1.1.

Dhaka city is located at the southern end of the plateau at a ground elevation of 5 m to 7 m PWD, which is generally high enough to be free from annual flooding.

The Buriganga river flows southwards down along the west edge of the plateau forming a series of natural levees along the river banks.

The Lakhya river flows southward too, forming another series of natural levees on the banks.

Narayanganj city sits on sandy hills 6 m high formed by the Lakhya river. Most of the city is usually not submerged by the annual flooding.

Plains spread out behind the banks with a ground elevation of 2 m to 3 m, and are covered with water every flood season. The flood plains are mainly cultivated to produce rice, jute, and vegetables.

Several examples of formations along the river banks in the study area are shown in Table 4.1.1 and Fig. 4.1.2.

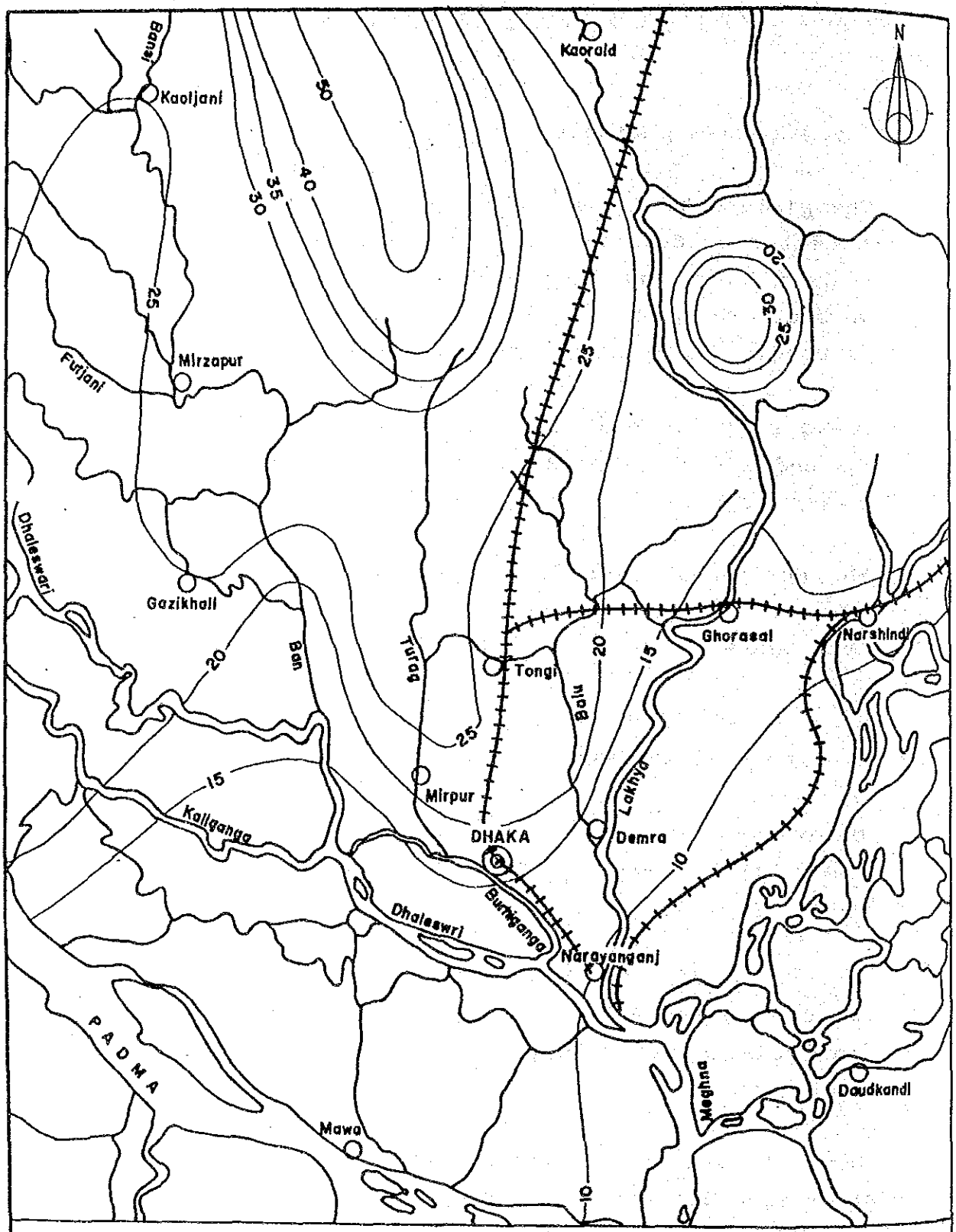


Fig. 4.1.1 Topographical Map of the Dhaka – Narayanganj Area

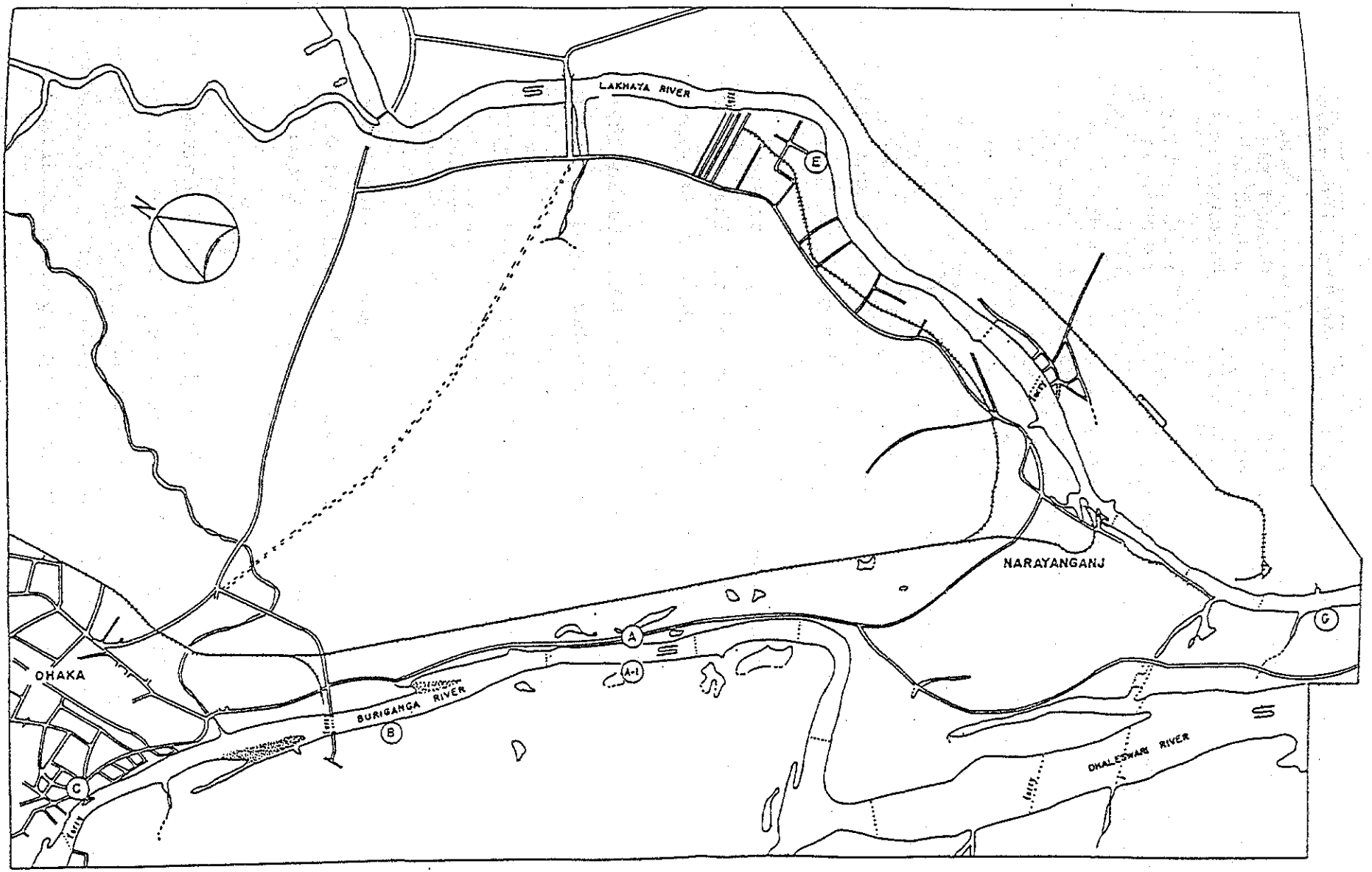


Fig. 4.1.2 River Bank Locations

Table 4.1.1 Sample Formations along the River Banks

Location	Formation	Width of bank (m)	Ground Elevation behind the Embankment (PWD m)
A		90	+1.50 - +1.80
A-1	Natural levee	120	+1.00 - +1.50
B	Natural levee	150	+1.00 - +1.50
E		200	
G			+3.00 - +3.30

4.2 Geological and Soil Features

4.2.1 Geological Features

The central plateau is comprised of Older Alluvial Deposits (Qo) of the Quaternary pleistocene.

Deposits surrounding the plateau are interstream deposits (Qa), and consist of silt and sand deposits. The surface elevation in these areas is slightly lower than in the Qo plan.

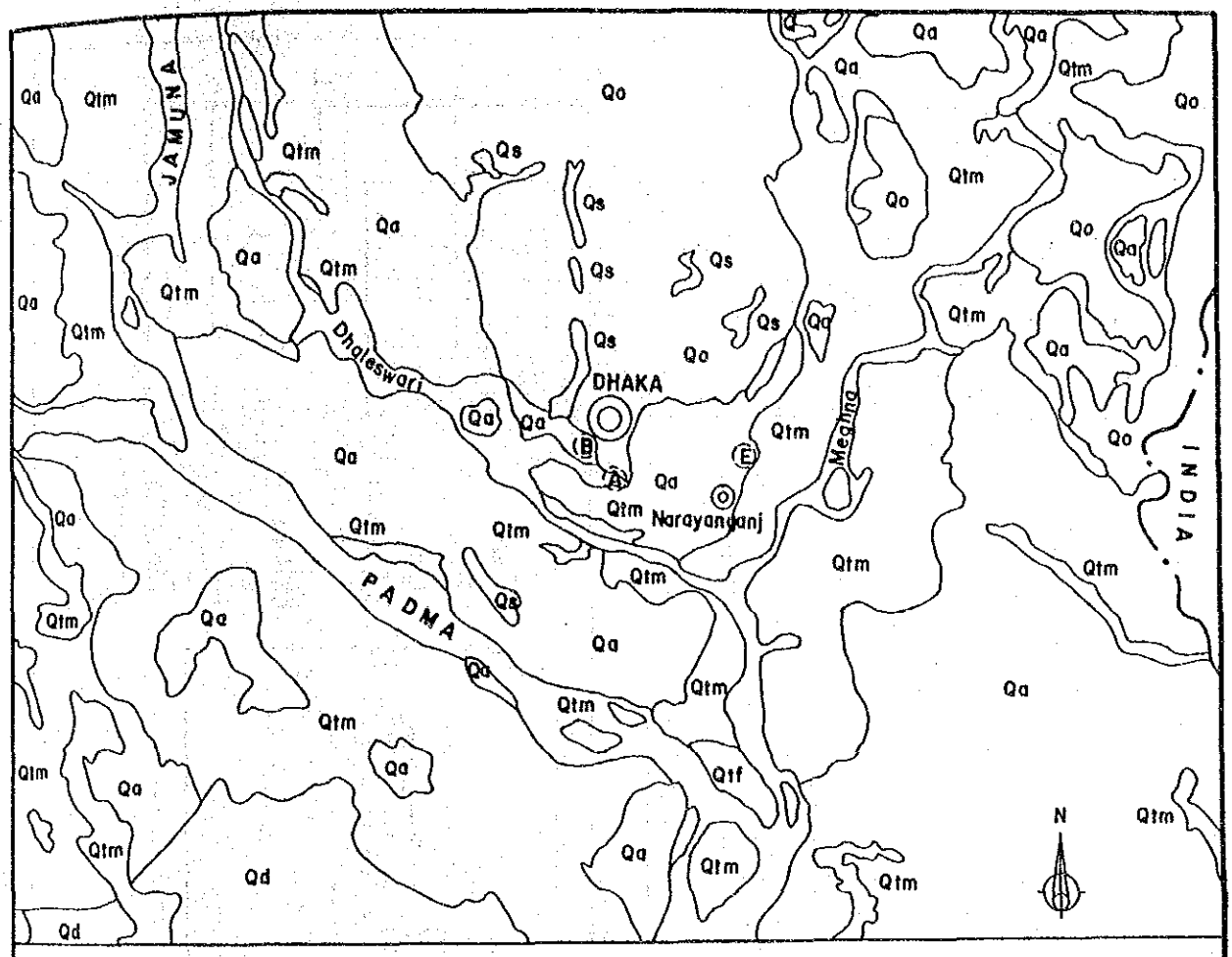
The natural levees and flood plain deposits on the Qo are recent, and consist of Terrace and Meander Deposits (Qt m).

A geological map is presented as Fig. 4.2.1.

4.2.2 Soils

Several sample soil profiles of points along the river banks in the study area are shown in Fig. 4.2.2, 4.2.3, 4.2.4 and 4.2.5. The locations of the points are shown in Fig. 4.1.2.

Fig. 4.2.3 is a typical soil profile of a natural levee (location B). The upper layer including the bank itself is a loose sand deposit. The lower stratum laying lower than 20 m deep is a compacted sand layer. The soil profile of location A indicates the same lower stratum sandy layer as at location B.



Source: Geological Survey of Bangladesh

Scale 1: 1,000,000

LEGEND:

Qtf : Coastal deposits, Beach-sand and sandbar deposits.
Qs : Swamp deposits.
Qd : Deltaic deposits.
Qtm : Terrace and meander deposits including swamp deposits in some areas.
Qa : Interstratified deposits, silt and some gravel deposits at a slightly higher altitude than the adjacent flood plain and low level terrace deposits.
Qo : Older alluvial deposits, Madhupur Clay, mostly red and orange clay deposits at a slightly higher altitude than the interstream deposits (Qa) and having an incised dendritic drainage pattern generally not subject to seasonal flooding.

Fig. 4.2.1 Geological Map of the Dhaka – Narayanganj Area

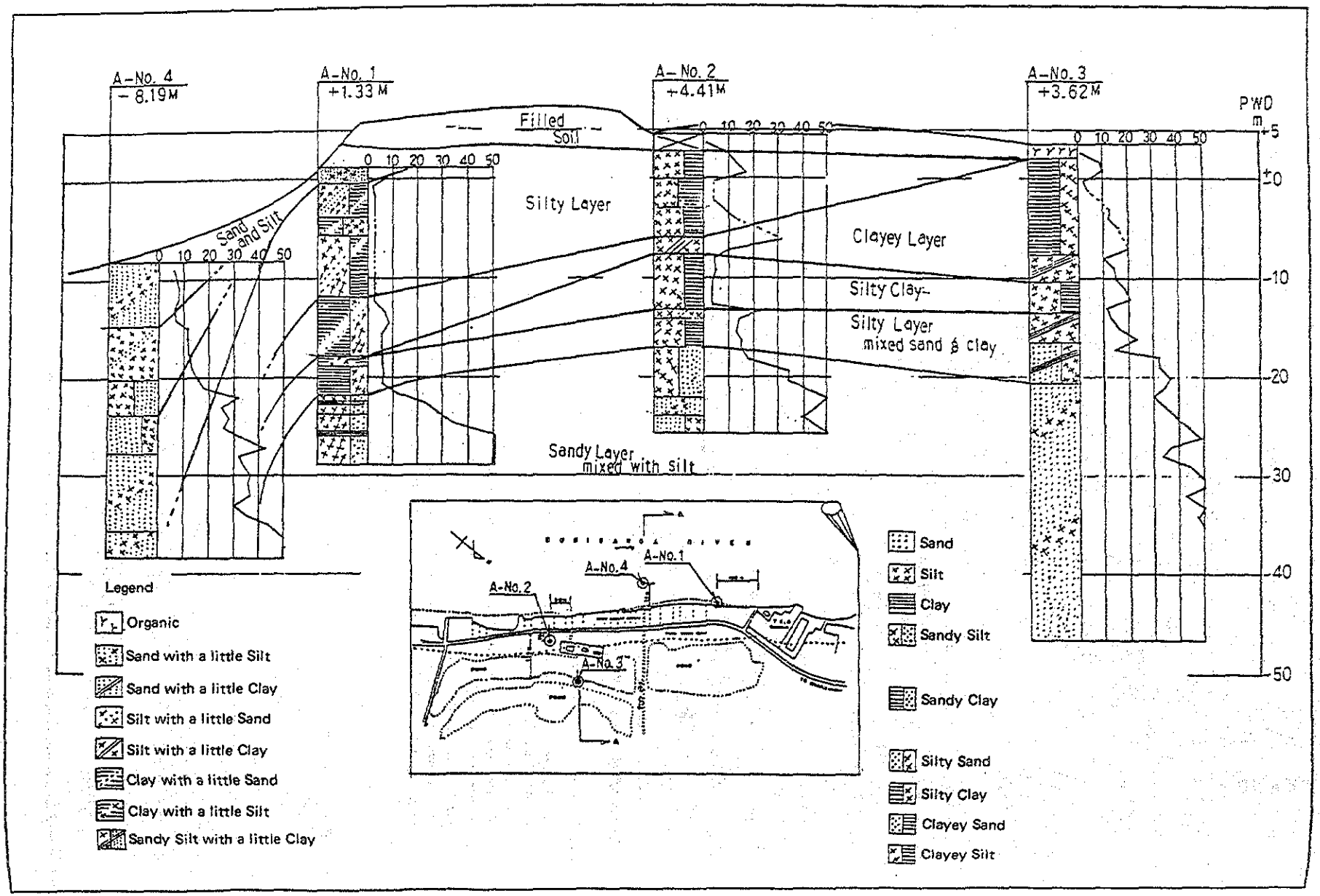


Fig. 4.2.2. Soil Profile of Location A

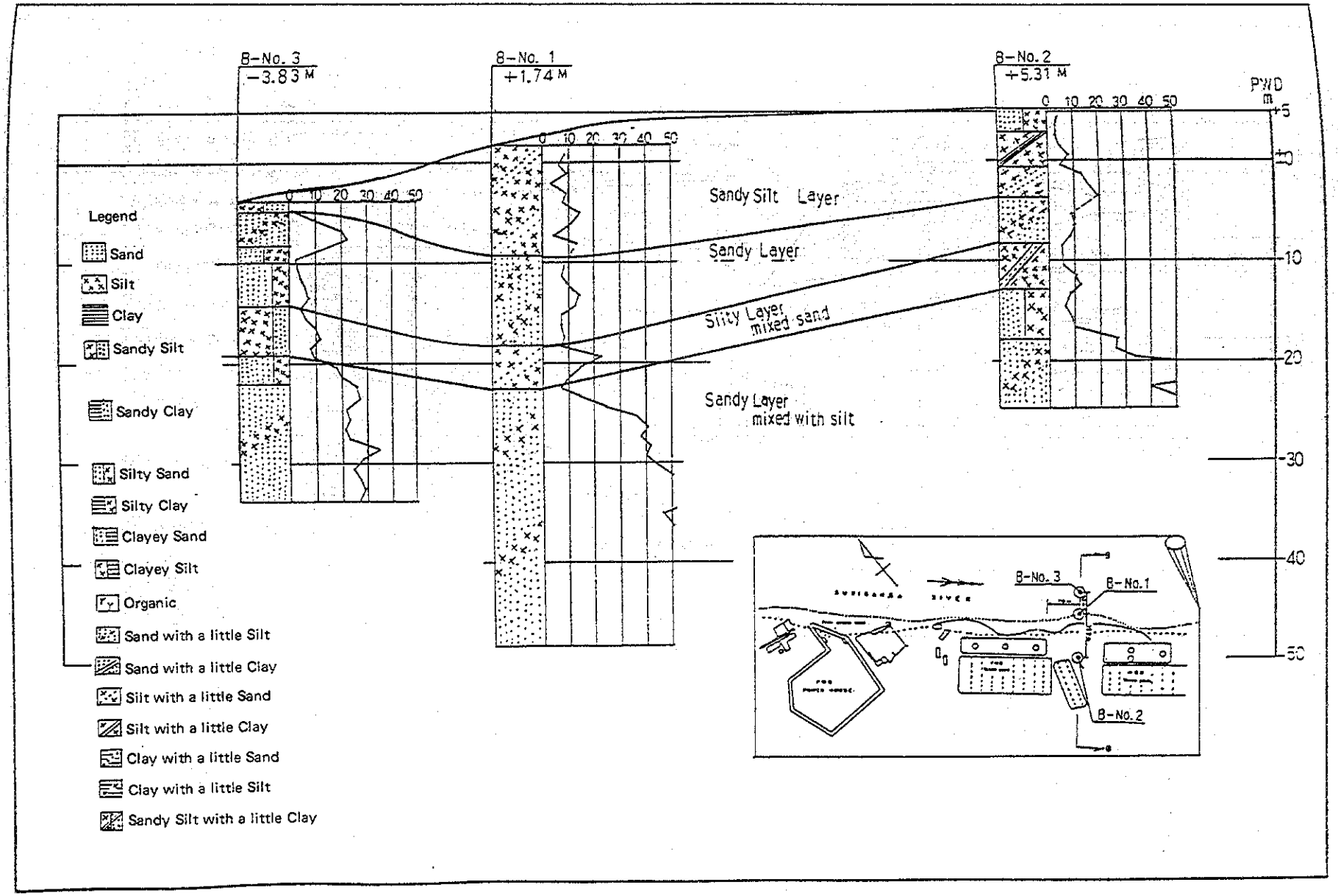


Fig. 4.2.3 Soil Profile of Location B

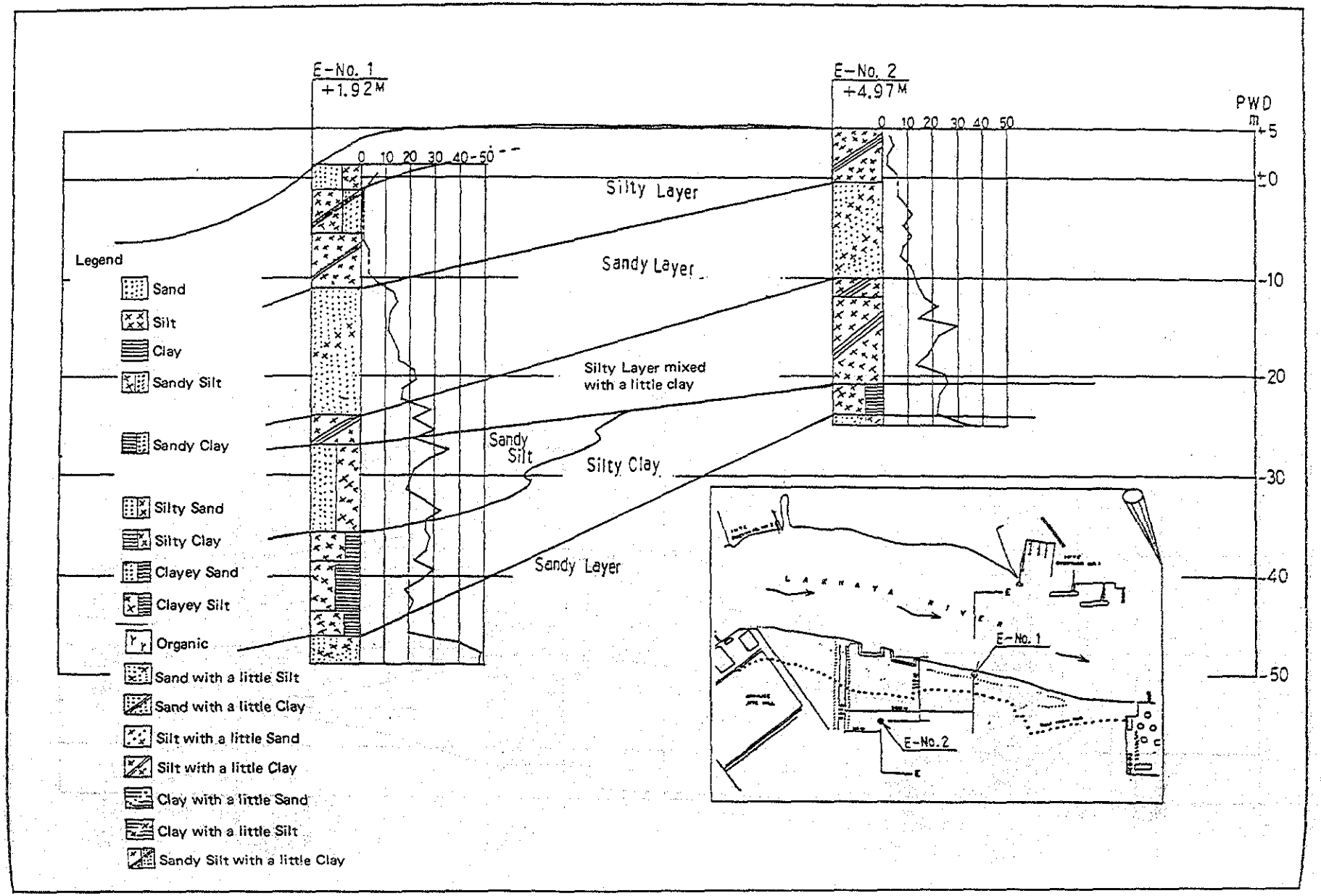


Fig. 4.2.4 Soil Profile of Location E

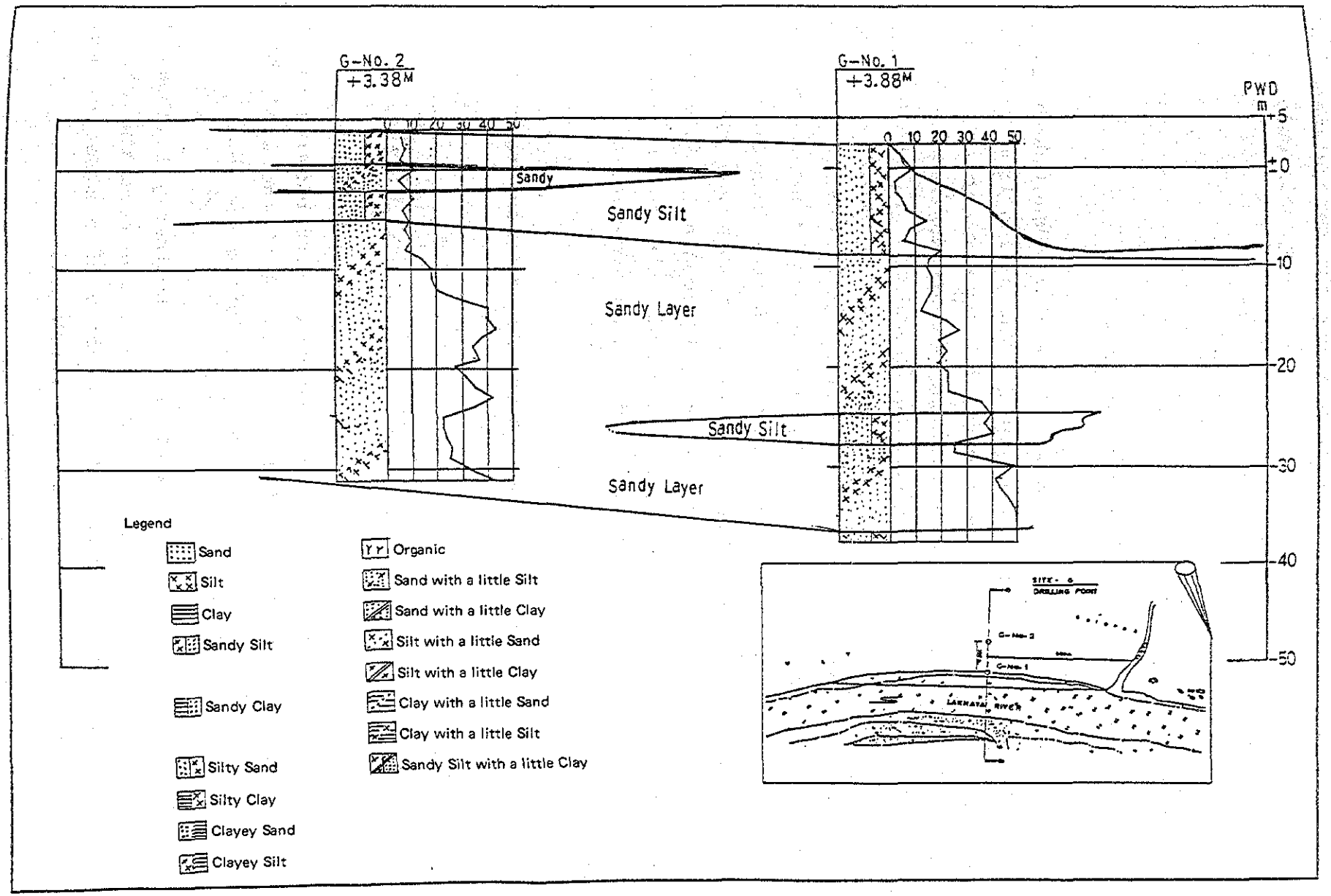


Fig. 4.2.5 **Soil Profile of Location G**

The soil in location G, located close to the confluence of the Daleswari and the Lakhya, consists of sandy soil only.

4.3 Meteorological Features

4.3.1 Temperature, Humidity and Rainfall

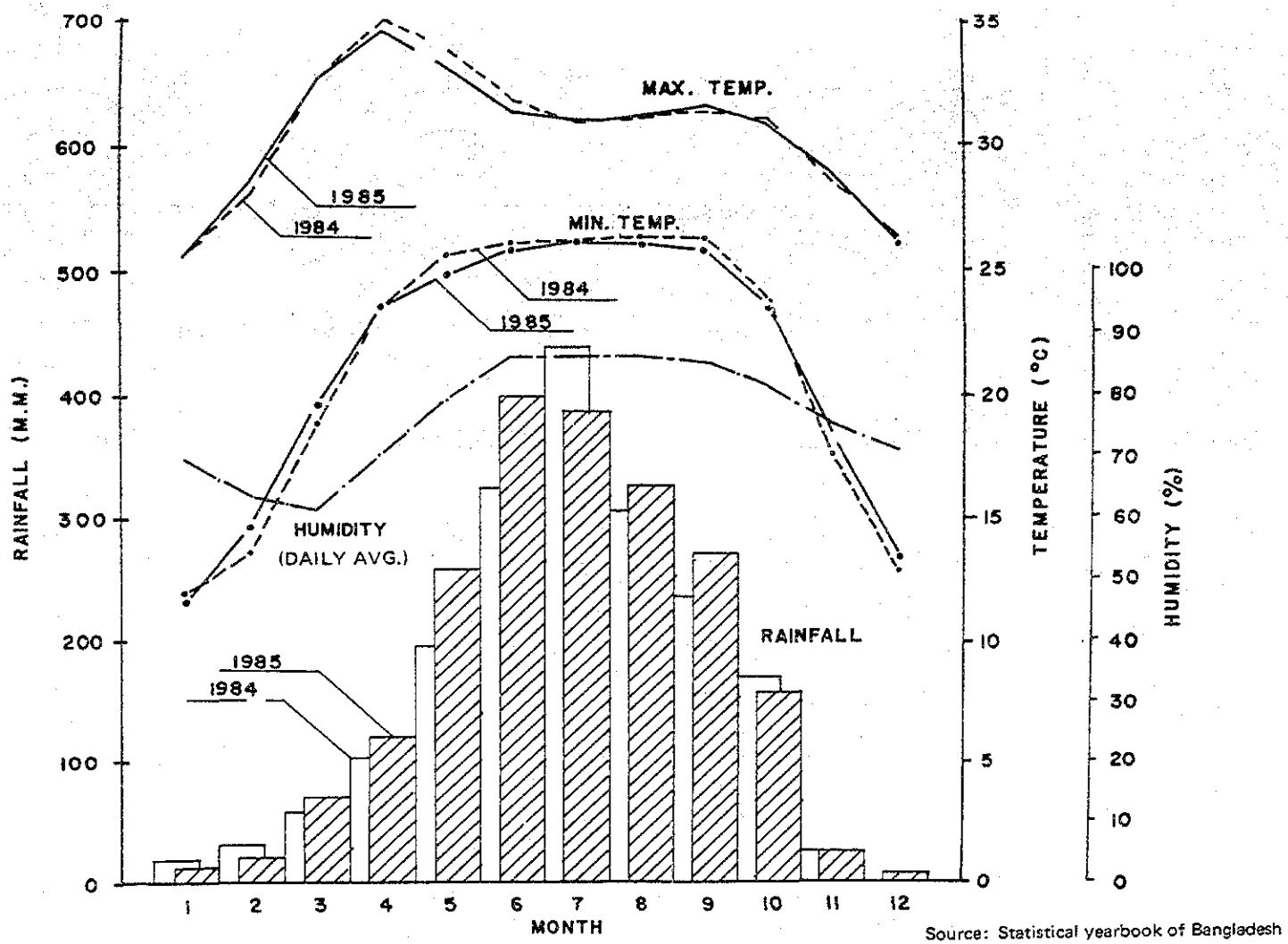
The climate in the central region of Bangladesh is a typical sub-tropical monsoon climate. The period from November to February is a warm dry season with many clear days. The period from March to May is a hot season during which the temperature rises considerably. April and May are the hottest months of the year. The period from June to October is the so-called monsoon season when the temperature drops slightly and the monsoon brings a great amount of rain from the Bay of Bengal. This is the rainy season with its high humidity. During the dry season there is almost no rain and the total rainfall during this four month period amounts to only 3% of the total yearly rainfall. In contrast, the total rainfall during the five months of the rainy season accounts for 75% of the total yearly rainfall.

Fig. 4.3.1 shows the temperature, humidity and rainfall in the Dhaka region.

4.3.2 Winds

As shown in the Fig. 4.3.2 Wind Rose, wind blowing in the Dhaka region is generally mild, and only 1% of the winds blow with a wind velocity of 5 m/sec or more during the year.

The most frequent wind direction is southerly followed by south easterly, and the prevailing winds are from the Bay of Bengal. The strong winds with a velocity of 5 m/sec or more show a prevailing wind direction of southeast.



Source: Statistical yearbook of Bangladesh

Fig. 4.3.1 Temperature, Humidity and Rainfall in Dhaka

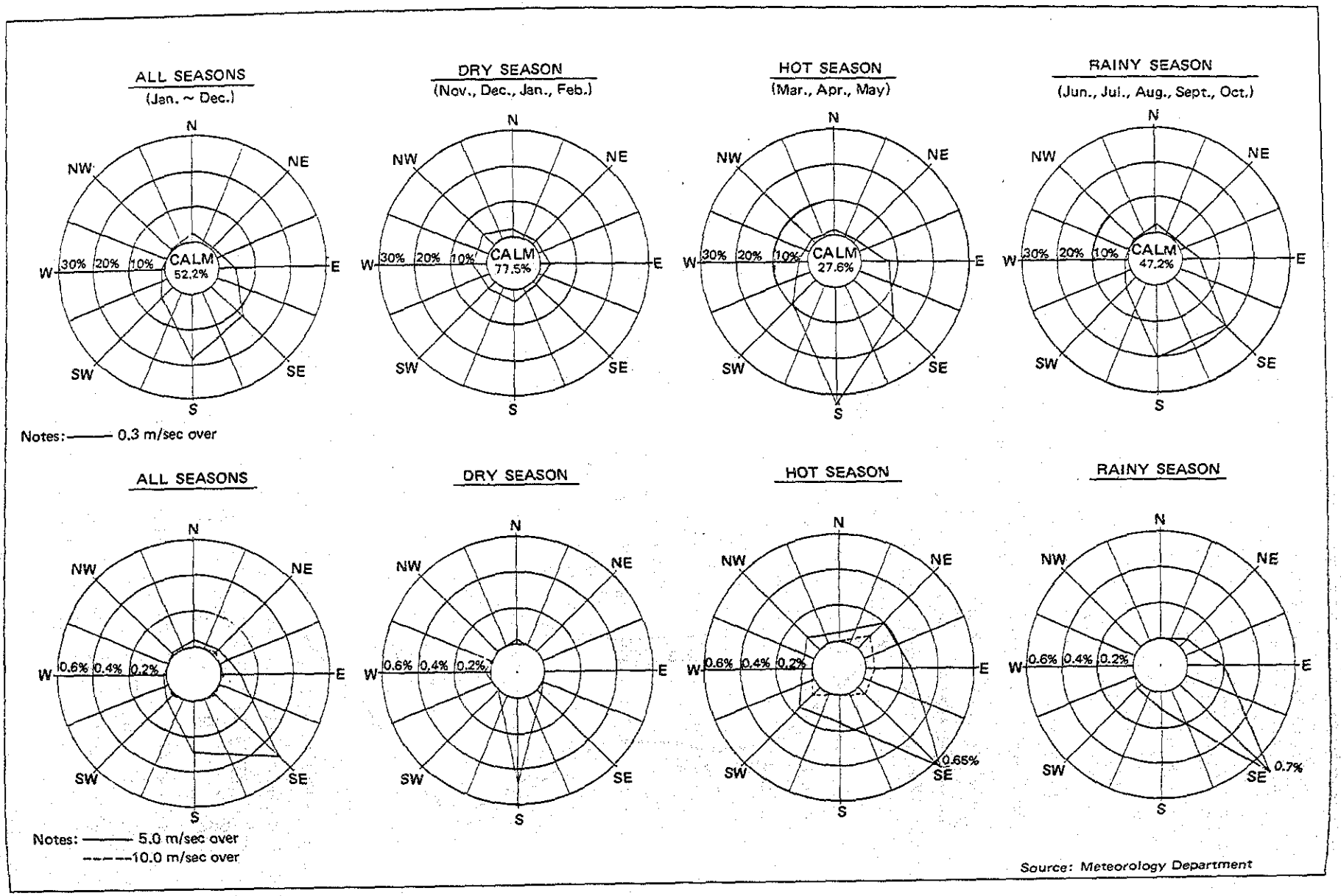


Fig. 4.3.2 Wind Rose

The occurrence rate of calm days varies greatly by season. The rate is 78%, 28% and 47%, in the dry, hot and rainy seasons, respectively. Winds blowing in the hot and rainy seasons are generally south or southeasterly winds.

On the other hand, as indicated in Table 4.3.1, the major cyclones attacking Bangladesh during the past 20 years have mainly influenced Chittagong and coastal areas. The Dhaka area is generally out of the cyclone route. However, an examination of the monthly instantaneous maximum wind velocity observed between 1953 and 1980 shows the occurrence of a wind velocity of almost 50 m/sec during 1980 as shown in Table 4.3.2.

Table 4.3.1 Chronology of Major Cyclonic Storms and Surges In Bangladesh

Year	Month & Date	Wind Speed	Phenomenon Wave	Affected Areas
1965	5/11-12	45m/s	3.7m	Barisal, Faridpur, Khulna, Chittagong
1965	12/14-15	58m/s	3.0m	Cox's Bazaar, Teknaf
1966	10/23		6.7m	Sandwip
1967	10/11			Khulna & Sundarban Coast
1967	10/23-24			Cox's Bazaar
1969	10/11			Khulna Coast
1970	5/7			Chittagong, Cox's Bazaar
1970	10/23			Khulna, Patuakhali, Dhaka, Chittagong
1970	11/12-13	62m/s		Meghna
1971	5/7-8	22m/s		
1971	9/28-29	31m/s		
1971	11/5-6			
1973	11/16-18			
1973	12/6-9			
1974	8/13-15	22m/s		Barisal
1974	11/24-28	45m/s		Cox's Bazaar Chittagong
1975	1/5	27m/s		Chittagong
1975	5/9-12	30m/s		Barisal, Cox's Bazaar
1976	10/19-20			Chittagong Coastal
1977	5/9-12	31m/s		Khulna, Noakhali, Patuakhali, Barisal Chittagong
1978	9/30-10/3	21m/s		Khulna & Sundarban Coastal
1983	10/15	55m/s		Chittagong Coast
1983	11/9	61m/s	1.5m	Chittagong, Cox's Bazaar Coast
1985	5/24-25	69m/s	4.3m	Chittagong, Cox's Bazaar, Noakhali

Source: Statistical Yearbook of Bangladesh

Table 4.3.2 Maximum Instantaneous Wind Speed by Year and Month at Dhaka City

unit: m/sec

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEP.	OCT.	NOV.	DEC.	AVE.
1953	4.6	7.2	12.3	27.2	30.8	18.0	5.7	9.8	12.9	7.7	6.7	4.6	12.3
1954	4.6	6.7	10.3	9.3	30.8	8.2	8.7	7.2	7.7	12.3	2.6	3.6	9.3
1955	5.1	6.2	40.1	36.5	30.8	7.7	8.2	6.7	20.6	8.2	5.1	3.6	14.9
1956	6.2	4.6	30.8	26.7	12.9	13.4	18.0	8.2	11.3	6.2	4.6	4.6	12.3
1957	13.9	7.2	7.2	18.0	22.1	15.4	8.2	7.2	6.2	7.2	3.6	4.6	10.1
1958	5.1	20.6	8.2	15.4	36.5	18.0	9.3	10.3	9.3	6.2	3.6	4.6	12.5
1959	4.6	8.2	18.0	11.3	44.7	9.3	11.3	7.7	6.2	9.8	3.6	4.6	11.6
1960	5.1	8.2	13.4	30.8	20.6	9.3	12.9	9.3	8.2	14.4	4.6	3.6	11.7
1961	3.6	6.7	20.0	26.7	30.8	18.0	9.3	8.2	8.2	7.2	5.1	5.1	12.4
1962	7.2	8.7	24.7	26.7	22.1	9.8	9.8	7.2	18.0	4.6	5.1	6.7	12.5
1963	6.2	8.7	12.9	23.1	20.6	18.5	10.8	10.3	11.3	-	-	-	13.6
1964	4.6	23.1	25.7	22.1	33.4	36.0	9.8	9.8	12.9	12.9	6.7	4.6	16.2
1965	4.6	4.6	20.0	15.9	40.6	12.9	9.8	9.8	6.7	4.6	20.6	6.7	13.1
1966	4.6	4.6	7.2	14.4	15.4	15.4	6.7	5.1	5.1	15.4	2.6	2.6	8.2
1967	4.6	4.6	18.0	7.7	25.7	18.5	6.7	6.7	6.7	4.6	4.6	2.6	9.3
1968	4.6	4.6	26.7	26.7	33.4	15.4	18.0	6.7	6.7	6.7	2.6	2.6	14.2
1969	8.7	4.6	15.4	8.7	4.6	6.7	4.6	6.7	8.7	6.7	2.6	2.6	6.7
1970	7.7	14.4	30.8	33.4	20.6	10.3	14.4	9.3	12.3	46.3	20.6	5.1	18.8
1971	7.2	6.7	-	-	25.7	12.9	12.9	10.3	6.7	10.3	10.3	-	11.4
1972	6.2	11.3	18.0	30.8	23.1	14.9	21.6	13.4	10.3	9.3	7.7	5.1	14.3
1973	4.6	30.8	10.3	30.8	20.6	6.7	5.1	4.6	4.6	4.6	6.7	12.9	11.0
1974	3.1	2.6	18.0	28.3	15.9	4.6	5.1	7.2	9.8	2.6	2.6	2.6	8.5
1975	7.2	13.9	12.9	25.7	22.6	18.0	4.6	4.6	2.6	2.6	-	-	11.5
1976	8.7	2.6	18.0	24.7	8.7	21.6	6.7	9.8	9.8	7.7	2.6	2.6	10.4
1977	10.3	15.4	18.0	25.7	26.7	19.0	6.7	10.3	6.7	2.6	2.6	4.6	12.4
1978	4.6	22.1	20.6	28.3	23.1	5.1	6.2	6.7	9.8	6.7	4.6	4.6	11.9
1979	2.6	4.6	12.9	33.4	20.6	12.9	9.8	12.9	4.6	6.7	6.7	2.6	10.8
1980	2.6	23.1	26.7	38.0	48.8	19.5	19.5	7.7	4.6	7.7	2.6	2.6	17.0

Source: Meteorology Department

4.4 River Features

4.4.1 Fluctuation of River Water Level

(1) Fluctuation in Dhaka Port

Dhaka port is located at the foot of a terrace that stands in the middle of the river delta of the Ganges and Jamuna rivers. Therefore, the river water level in the port is influenced by flooding of the rivers as well as by tidal changes in the Bay of Bengal.

The level of the river water in the port becomes gradually low after the rainy season and reaches a low water level in the middle of November, and tends to drop still further little by little until the beginning of March. It then begins to increase slightly from mid-March onwards. The increasing rate becomes highest at the end of June and it reaches its peak in August or September (see Fig. 4.4.1).

The level changes not only monthly, but also hourly. Daily variations are negligibly small, less than 5 cm, during the flood season of July to September, but are larger, 0.5 m to 1 m, during the dry season. The water fluctuates periodically during the dry season, and its period from peak to peak is almost 2 weeks, the same as the period of tidal variation.

As for the annual maximum water level observed in Dhaka Port since 1951, the highest water level on record is 7.087 m PWD on August 22, 1955 and the lowest annual high is 5.26 m PWD recorded on August 22, 1978. The middle value is 5.93 m. There is some variation for the flood season. However, the fluctuation in the flood season is generally regular.

The number of days when the daily HWL exceeded 4 m, 4.5 m, 5 m, 5.5 m, 6 m and 6.5 m during 18 years of observatin are shown in Table 4.4.1. There are only 12 days when HWL exceeded

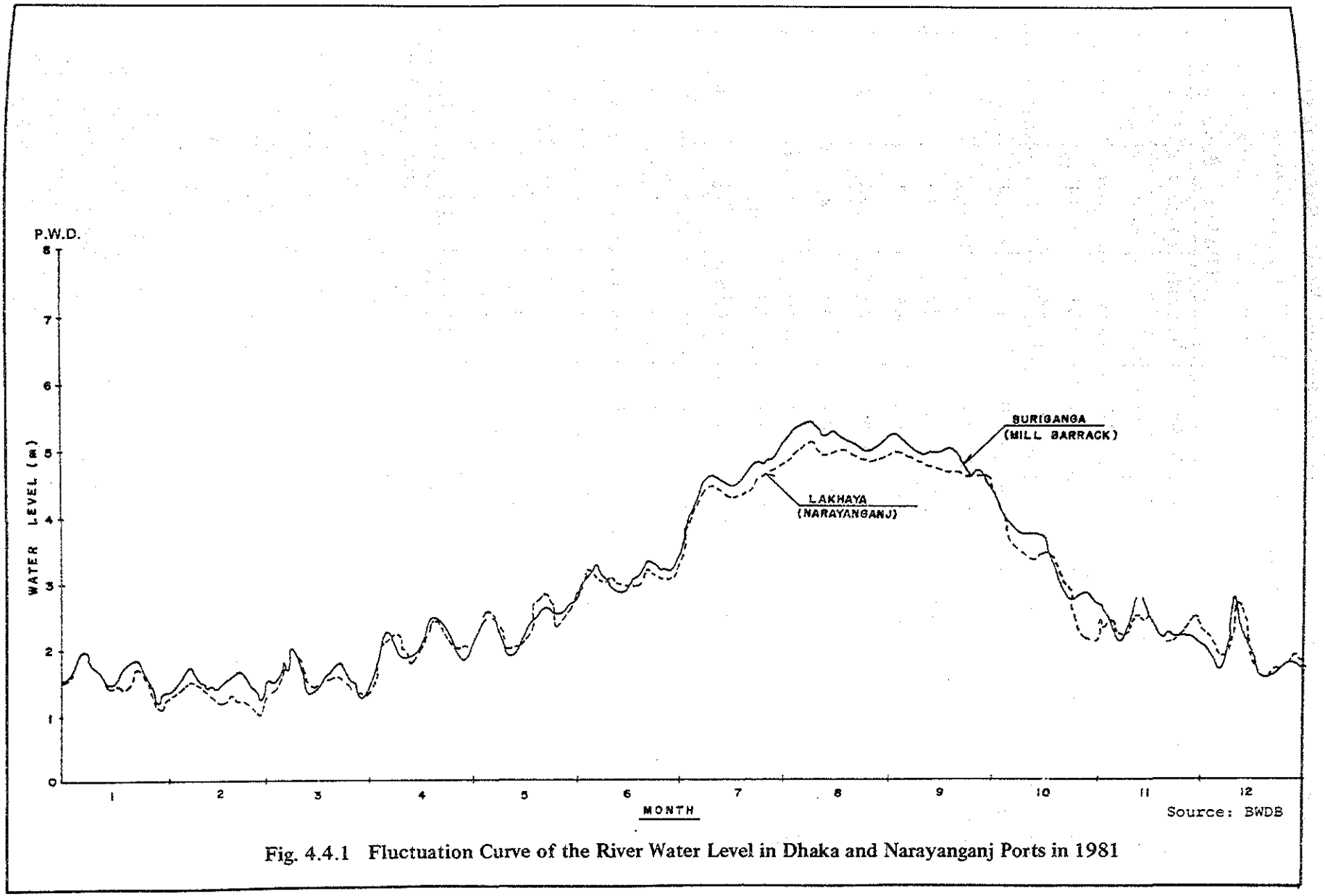


Fig. 4.4.1 Fluctuation Curve of the River Water Level in Dhaka and Narayanganj Ports in 1981

Table 4.4.1 Number of Days Exceeding Fixed Water Levels in Dhaka Port

(Unit: days/year)

Year \ HWL	4.0 m ∿	4.5 m∿	5.0 m∿	5.5 m∿	6.0 m∿	6.5 m ∿
1957	62	34	19	-	-	-
1958	106	65	46	31	14	-
1959	123	99	29	12	-	-
1960	105	89	78	18	4	-
1961	80	59	30	2	-	-
1968	123	113	75	32	13	-
1969	109	98	82	48	3	-
1970	126	108	76	44	26	2
1971	130	103	84	42	21	-
1972	98	48	14	-	-	-
1973	126	109	59	17	-	-
1974	118	104	91	62	24	10
1975	99	76	19	-	-	-
1976	93	77	19	-	-	-
1980	114	79	57	28	11	-
1981	94	84	46	-	-	-
1982	-	-	-	-	-	-
1983	116	97	58	15	-	-
1984	128	102	63	28	2	-
Total	1,950	1,544	945	379	118	12

Source: BWDB

6.5 m PWD during the 19 years, and the occurrence probability of HWL exceeding 6.0 m and 5.5 m is 1.8 % and 5.8 %, respectively.

The annual probability distribution of the water surface elevation in Dhaka port is shown in Fig. 4.4.2. If the port planning disregards situations having an occurrence probability of less than 5%, planning water levels of +5.7 and +0.7 m are appropriate for HWL and LWL in Dhaka port, levels of +1.2 m and +0.7 m are good for the daily highest and daily lowest in the dry season, and levels of +2.0 m to +2.5 m are proper in all seasons.

(2) The Fluctuations in Narayanganj Port

The river Buriganga serving Dhaka port flows southwards on the east side of Dhaka city. The river Lakhya serves Narayanganj port and flows southwards on the west side of the city. They join each other at the confluence located 20 km to the southwest. Narayanganj port is 7 km upstream from this point. The joining rivers join again with the Meghna river after a flow of 5 km, link with the Padma river after another flow of 15 km, and then flow into the Bay of Bengal.

The annual and daily fluctuation in water levels at both ports are similar owing to the connections among the two ports, the three major rivers and the Bay of Bengal.

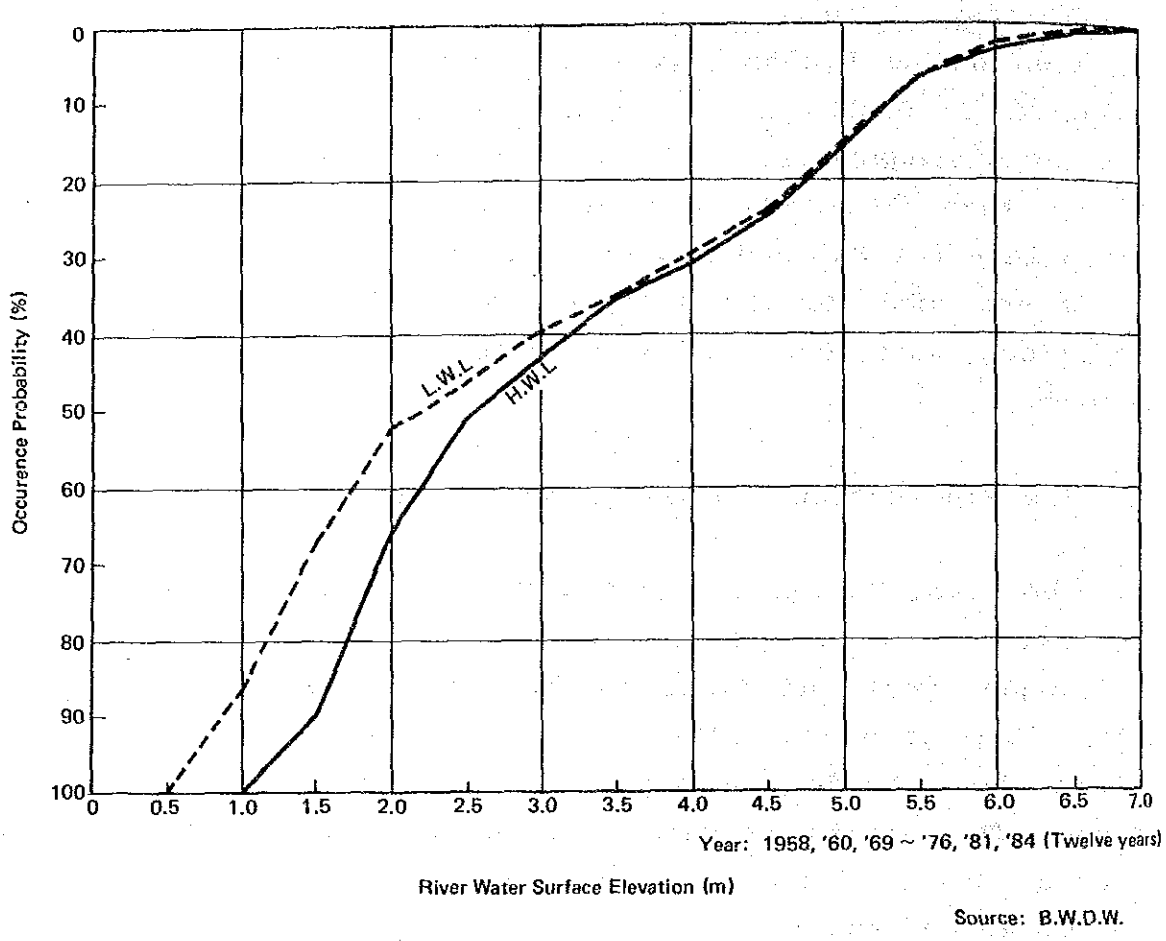


Fig. 4.4.2 Occurence Probability of River Water Surface Elevation in Dhaka Port

4.4.2 River Cross Sections

(1) Dhaka Port

Dhaka port extends along the left bank of the Buriganga river over 10 km, and many vessels of various sizes load and unload cargoes at public and private wharves as well as at the natural bank. The main port facilities are concentrated in the northern part, that is in the areas adjoining Old Dhaka.

The Buriganga river turns its flowing course sharply in the northern part of the port area, flows while meandering very slightly, and then turns course again very sharply at the south end of the port area (refer to Fig. 4.4.3).

River cross-sections of the terminal and the bridge project sites, as well as at each 1 km interval from the fish ghat, are shown in Fig. 4.4.4 where water depth is indicated based on the Standard Low Water. River cross sections in bending parts are generally narrow in width and deep. The section of the fish ghat is 200 m wide and 10 m deep because it is located just at the centre of the first bend. The section at Badamtali wharf is of a triangular shape being 200 m wide and 13 m deep. This wharf is 1 km from the fish ghat, and is located at the end of the bend.

The straight sections are flat and shallow. The river is 300 m wide and 7.3 m deep in front of the passenger terminal. It is 400 m to 600 m wide and 4 m to 7 m deep at straight flow sections 2.5 km to 6 km from the fish ghat. The river becomes narrow and deep downstream again at the section 7 km to 9 km from the fish ghat. The river width, with a navigation channel 12 ft deep, and the maximum depth in the 9 km port area are shown in Table 4.4.2 which ranges from the fish ghat to the land newly reclaimed by PWD adjoining the VIP jetty of BIWTA. The navigation channel is 12 feet deep and 150 m wide in the main port area, excluding several sections such as a section

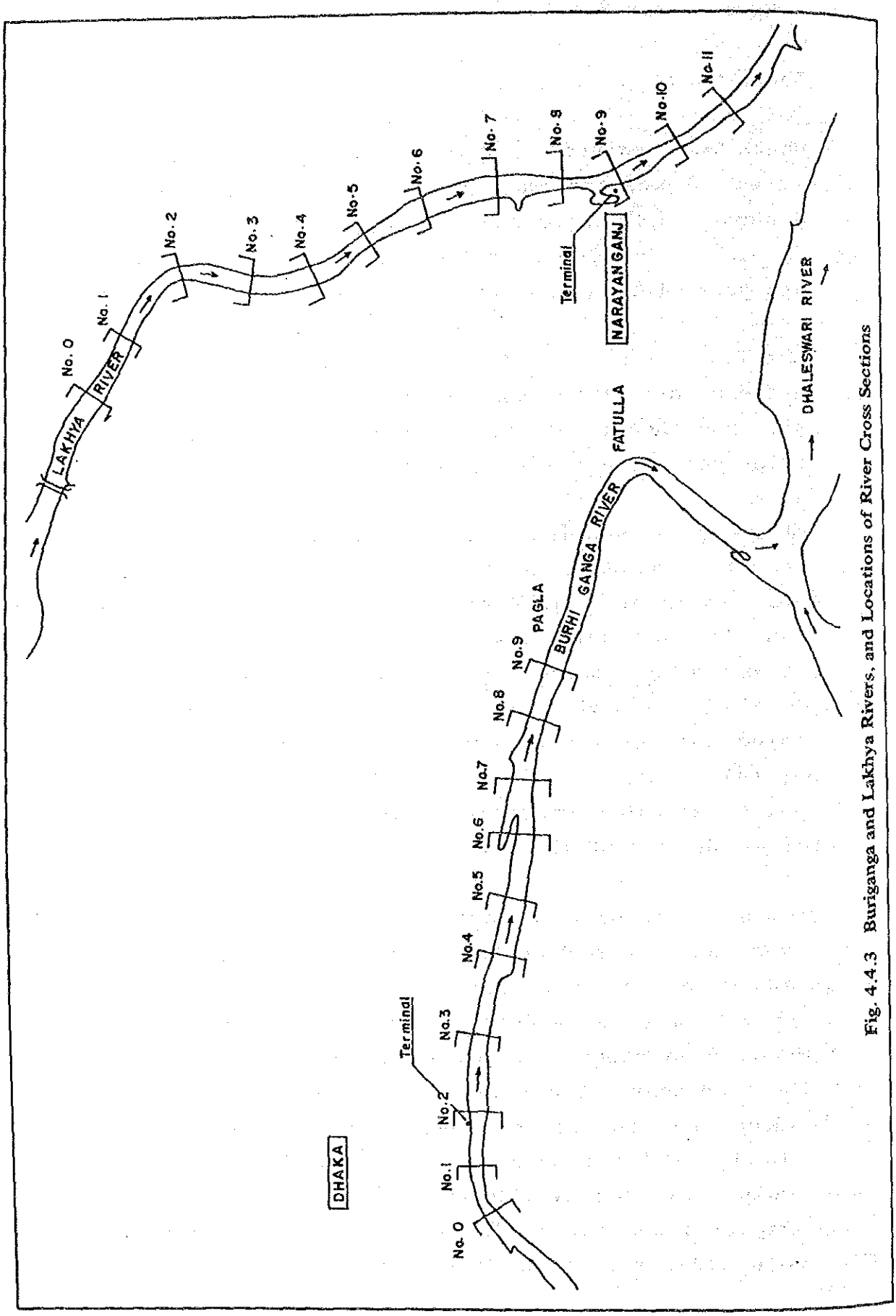


Fig. 4.4.3 Buriganga and Lakhya Rivers, and Locations of River Cross Sections

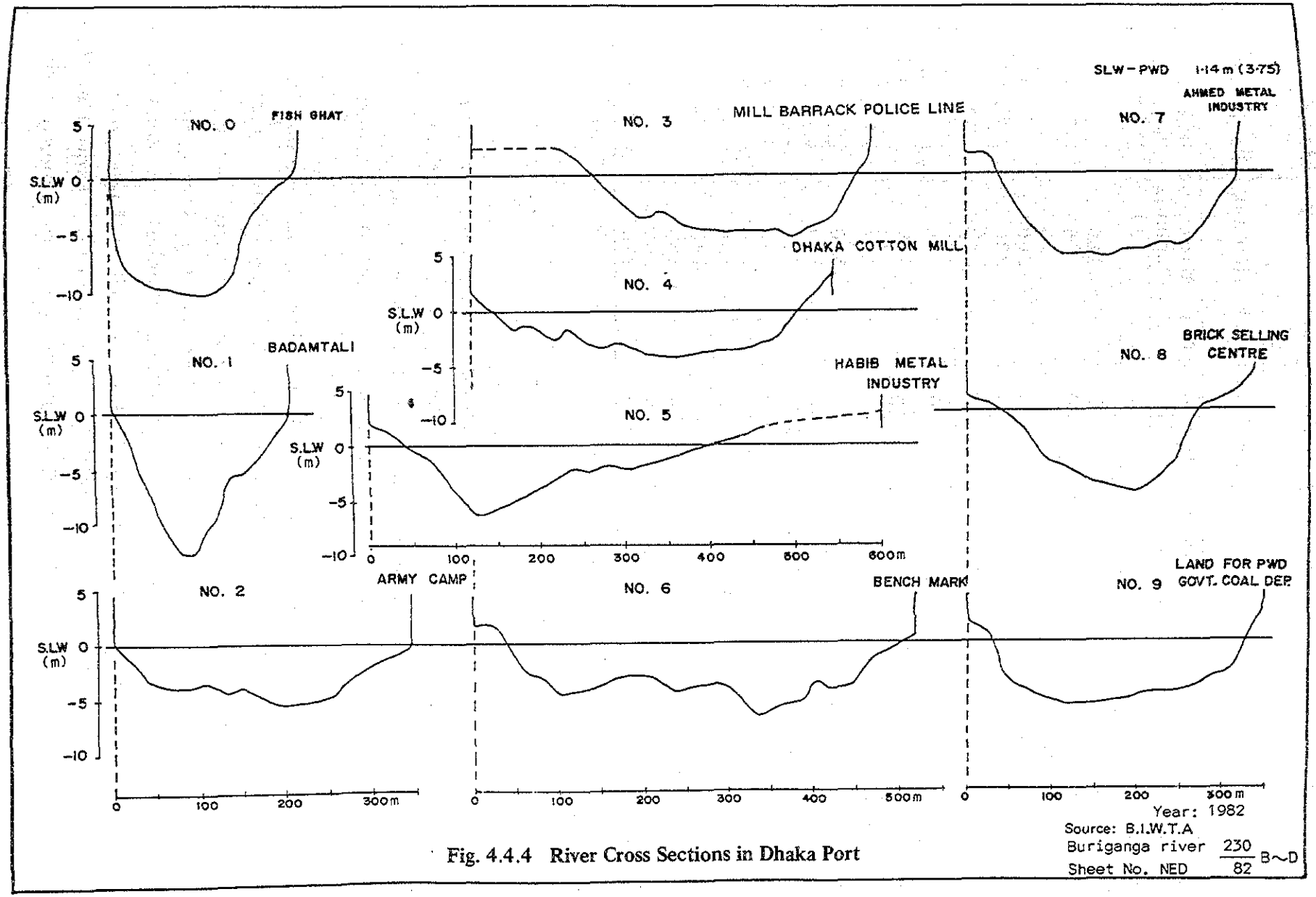


Fig. 4.4.4 River Cross Sections in Dhaka Port

to the WAPPA power house where the river is very wide.

Table 4.4.2 River Cross Sections in Dhaka Port

Location	Distance (km)	Width of River (m)	Width of Channel (m)	Maximum Water Depth from SLW
Fish Ghat	0	215	160	-10.5
	0.5	220	175	-12.0
Badantali	1.0	210	170	-13.0
Wise Ghat	1.5	290	200	- 9.5
Terminal	-	310	230	- 8.0
	2.0	345	220	- 5.5
	2.5	375	230	- 5.2
Mill Barrack	3.0	470	195	- 5.8
	3.5	425	110	- 5.5
	4.0	425	135	- 4.3
Postagola Ferry	4.5	440	160	- 5.8
Power House	5.0	600	110	- 6.4
Site B	5.5	560	250	- 7.0
	6.0	520	245	- 7.0
	6.5	385	250	- 5.8
	7.0	320	205	- 7.6
Site A	7.5	280	190	- 8.8
	8.0	330	185	- 7.6
	8.5	330	185	- 7.6
	9.0	350	230	- 5.8

Year: 1982

(2) Narayanganj Port

Narayanganj port extends along both banks of the Lakhya river over 10 km or more. The main port facilities are concentrated on the west bank in the downstream part, but a grain silo and a power station are constructed upstream on the west bank.

The river flows southwards meandering as shown in Fig. 4.4.3, and its cross section varies greatly. The river cross sections at 1 km intervals are shown in Fig. 4.4.5 and the river width, navigation channel width and maximum depth are shown in Table 4.4.3. The navigation channel in Narayanganj port is deeper by 8.2 m and wider by 120 m than the one in Dhaka port which is 4.3 m deep and 110 m wide. From the point of view of safe navigation, Narayanganj port is superior to

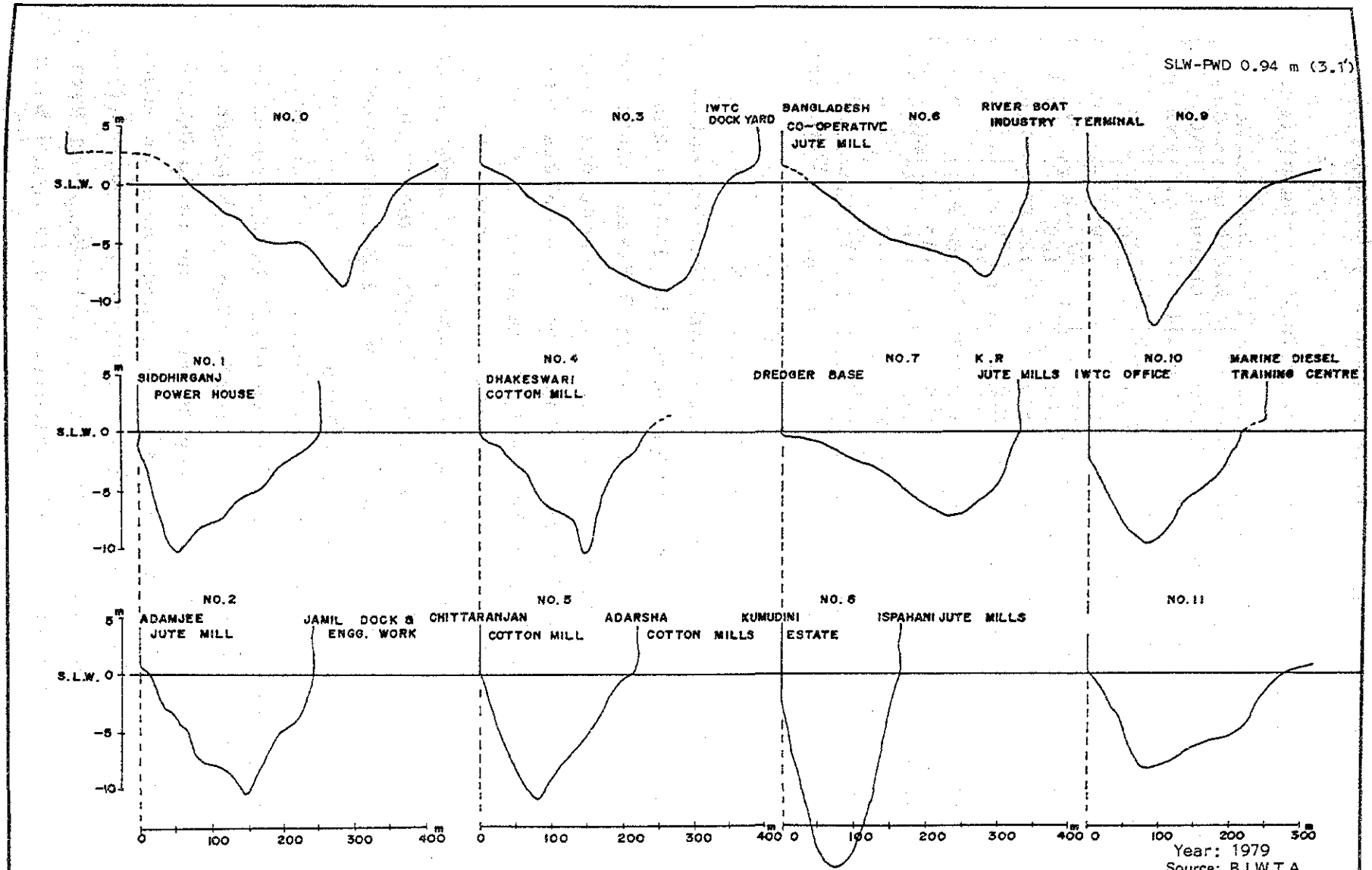


Fig. 4.4.5 River Cross Sections in Narayanganj Port

Dhaka and has served naturally as a good port for many years.

Table 4.4.3 River Cross Sections in Narayanganj Port

Location	Distance (km)	Width of River (m)	Width of Channel	Maximum Water Depth from SLW
Site D	0	(400)	180	- 9.2
Power Station	1	250	170	-10.7
	2	245	275	-11.0
Site E	3	390	180	- 9.5
	4	(300)	120	-10.7
	5	220	150	-11.3
	6	345	205	- 7.9
Dredger Base	7	330	165	- 7.3
	8	170	145	-17.4
Terminal	9	(350)	150	-12.2
	10	255	170	- 9.8
Site G	11	320	185	- 8.2

Year: 1979

4.4.3 Current Velocity

A detailed current observation was carried out at the Buriganga river crossing bridge site in 1984. The river current in the dry season was observed at 3 fixed points for 36 continuous hours on 18 to 19 March. The current distribution in the full river section during the flood season was observed 35 times over the 4 months from July to October.

The maximum value of current velocity in the dry season is 0.57 m/sec at the beginning of the flood tide. The river current changes direction and velocity according to periodic variations in the river water position.

The maximum value of current velocity in the flood season is 1.26 m/sec. This takes place not at the peak of the water level, but slightly after the beginning of the rapid descent in water level. There were two peaks of flood waves on August 3 and September 26 in 1984, 6.8 m and 7.1 m high. The difference in flood level of 0.3 m in height is small compared with the difference in average current velocity of 0.12 m/sec which is

the difference between 0.96 m/sec on September 30 and 0.84 m/sec on August 9. Thus current velocity depends on the descending rate primarily and on the elevation of the river water level secondarily.

Floods in the Buriganga River are caused by backwater owing to flood waves flowing down from the Padma River, as mentioned in Appendix 3 3.3. Current at the flood peak in the Buriganga river is restrained by the blocking effect of the Padma's flowing water. However, the river level begins to drop rapidly and the water flows down at the peak velocity along with the decrease of the blocking effect as the Padma flood wave passes by.

The current velocity in both parts of Dhaka and Narayanganj during the dry season were observed by the team last February. The highest current velocities were 0.48 m/sec and 0.40 m/sec in Dhaka port and Narayanganj port respectively, which are almost equal to the velocity observed at the bridge project site.

4.5 Earthquakes

During the last one hundred years, in Bangladesh widespread earthquake damage only occurred once, caused by the great earthquake of 1897 which had its epicentral tract in the Shillong Plateau. Two other major earthquakes in 1885 and 1918 caused severe damage only in limited areas surrounding their epicentres which were located close to the national border in the northeast. "The Committee of Experts on Earthquakes Hazard Minimization" published its final report in November 1979 indicating the seismic zoning map of Bangladesh as shown in Fig. 4.5.1.

The committee recommends calculation of the shear force at the base of buildings using the following formula.

Shear Force = Z.I.K.C.S.

= 0.05 x 1.0 x 1.0 x 1.0 x 1.2 = 0.06

where, z = basic seismic coefficient (shown in Fig. 4.4.1)

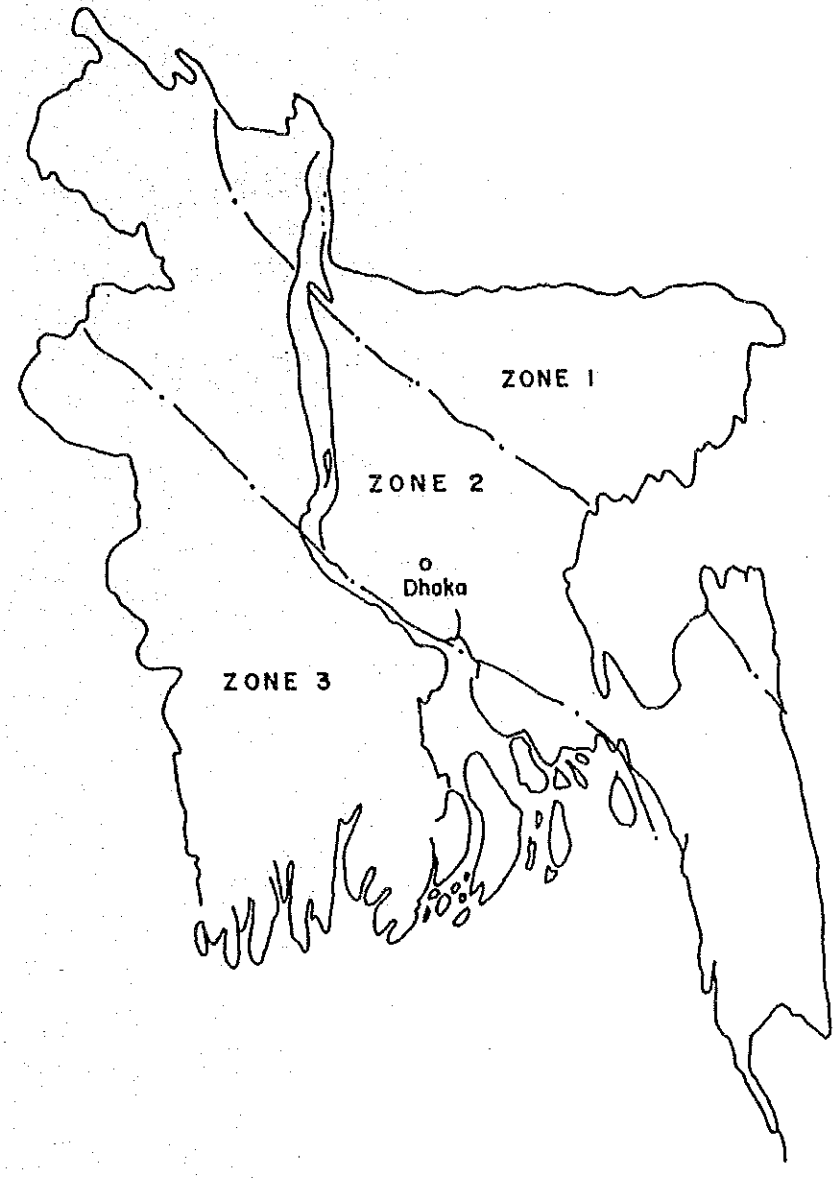
I = importance factor

K = a factor to take into account structural type

C = a factor depending on the flexibility of structures

S = soil foundation factor

The code gives a design shear force of 0.06 to ordinary buildings or mounting pile foundations in the Dhaka Port Area.



Source: Final Report by the Committee of Experts on Earthquake Hazard Minimization 1979

Fig. 4.5.1 The Seismic Zoning Map of Bangladesh

CHAPTER 5

PORT ACTIVITIES AT DHAKA AND NARAYANGANJ PORTS

CHAPTER 5 PORT ACTIVITIES AT DHAKA AND NARAYANGANJ PORTS

5.1 General Outlook

Dhaka Port, contiguous to the City of Dhaka, the capital, and facing the Buriganga River, is one of the leading ports of Bangladesh. Since the port has behind it the Dhaka District, the main political and economic center, and functions as a terminal for land transportation networks to the northwest and northeast regions where inland water transportation is not greatly developed, the cargo handling volume at the port has been gradually increasing year after year.

At Narayanganj Port, which has almost the same hinterland as Dhaka port, a greater cargo volume is handled and more passengers get on and off. Although the importance of Dhaka Port has increased in recent years, Narayanganj is the key port, and supports the Dhaka metropolitan area activities together with Dhaka Port.

5.2 Management and Operations

5.2.1 Functions of BIWTA

Under Ordinance No. LXXV of 1958 the Bangladesh Inland Water Transport Authority was set up in November 1958 for development, maintenance and control of inland water transport and of certain inland navigable waterways in Bangladesh. The BIWTA has the following statutory functions:

(1) Carry out river conservancy works including river training works for navigational purposes and for provision of aids to navigation, including marks, buoys, lights and semaphore signals.

(2) Disseminate navigational and meteorological information including publishing river charts.

(3) Maintain pilotage and hydrographic survey services.

(4) Draw up programmes of dredging requirements and priorities for efficient maintenance of existing navigable waterways and for the revival of dead or dying rivers, channels, and canals, including development of new channels and canals for navigation.

(5) Develop, maintain and operate inland river ports, landing ghats and terminal facilities at such ports and ghats.

(6) Carry out removal of wrecks and obstructions in inland navigable waterways.

(7) Conduct traffic surveys to establish passenger and cargo requirements on the main rivers, feeders and creek routes.

(8) Develop the most economical facilities for passenger traffic to ensure comfort, safety and speed on mechanised craft.

(9) Fix maximum and minimum fares and freight rates for inland water transport on behalf of the Government.

(10) Approve time-tables for passenger services.

(11) Develop rural water transport by promoting schemes for modernising and mechanising country craft.

(12) Ensure the smooth interface between inland water transport and other forms of transport including major sea ports, and ensure cooperation with trade and agricultural interests for the optimum utilization of the available transport capacity.

(13) Conduct research in matters relating to inland water transport including development of -

(a) Craft design
(b) Technique of towage
(c) Landing and terminal facilities
(d) Port installations

(14) Arrange programmes of technical training within and outside Bangladesh for inland water transport personnel.

(15) Maintain liaison with the shipyard and ship repair industry to meet the requirements of the inland water transport fleet including repairs and new construction.

(16) Maintain liaison with the Government and facilite import of repair materials for the inland water transport industry.

(17) Prepare plans or schemes for carrying out the above-mentioned functions.

(18) Any other function or functions which the Government may prescribe from time to time.

BIWTA also performs a number of other functions in addition to those stated above.

BIWTA is a semi-governmental body directly under the control of the Ministry of Ports, Shipping and IWT.

5.2.2 Organization of BIWTA

There are 12 departments and one marine workshop in BIWTA. The organization is shown in Fig. 5.2.1. The number of staff

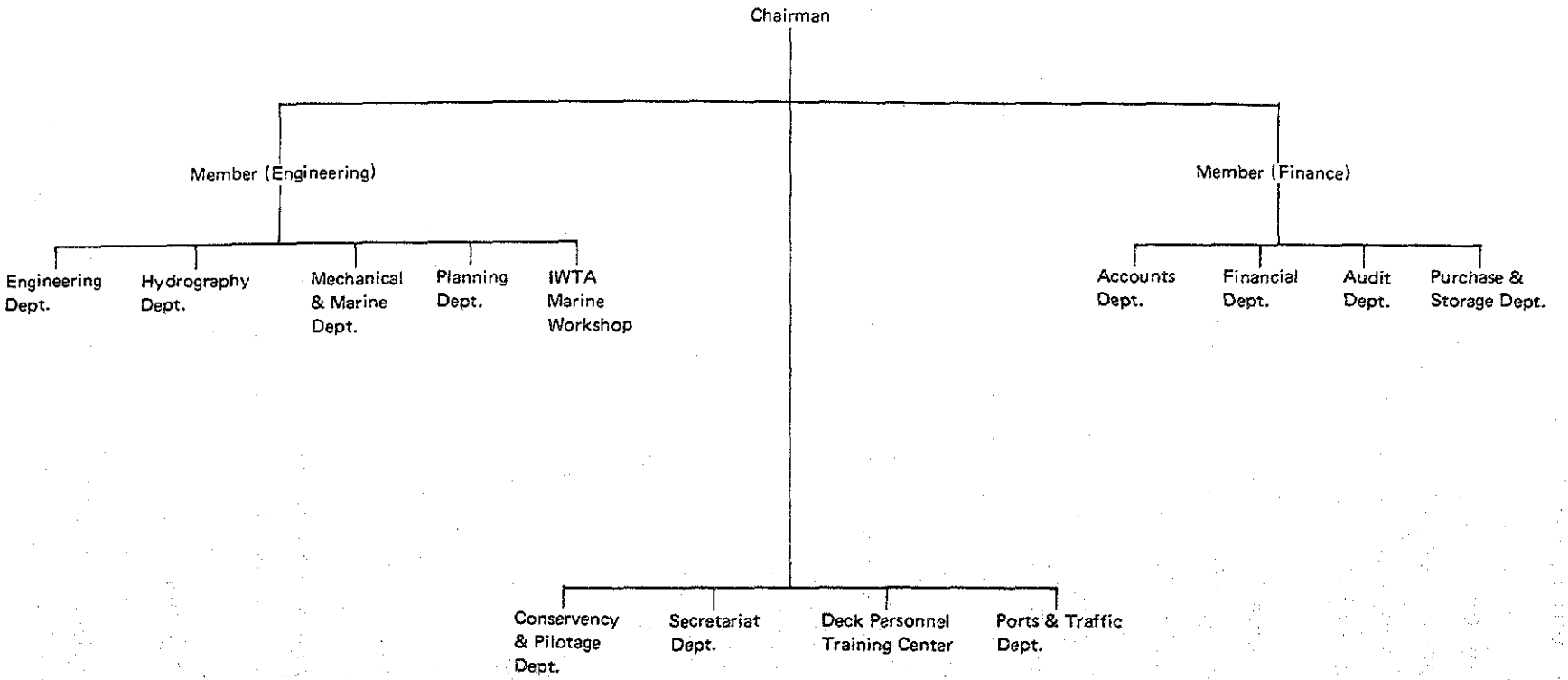


Fig. 5.2.1 Organization of BIWTA.

is approximately 4,000 persons, and 70% of them are engaged in field work such as dredging, pilotage and hydrographic surveys.

Some department such as Engineering, Port & Traffic and Conservancy & Pilotage have their own local offices at Dhaka and Narayanganj Ports.

5.3 Vessels Engaged in Inland Water Transport

5.3.1 General Outlook

There are two categories of vessels engaged in inland water transport in Bangladesh. One group comprises "bay-crossing" type vessels which operate between sea ports and inland ports. The other group comprises "inland" type vessels engaged exclusively in inland water transport. The number of vessels by type is shown in Table 5.3.1.

Table 5.3.1 Registered Vessels by Type
(cargo carrying vessels)

	Public Sector		Private Sector		Total	
	1978	1983	1978	1983	1978	1983
Bay Crossing						
Coaster	23	25	18	75	41	100
Tug	6	6	-	-	6	6
Flat	8	8	-	-	8	8
Barge	54	52	-	-	54	52
Tanker	16	14	7	16	23	30
Inland						
Cargo Vessel	9	6	350	556	359	562
Tug	50	58	83	123	133	181
Flat	51	38	52	52	103	90
Barge	249	186	392	510	641	696
Tanker	-	-	-	8	-	8

Source: BIWTA Annual Ports and Traffic Report

A general description of each vessel type is presented in "Transport of Containers in Bangladesh" as follows:

- Coaster

  conventional type; machinery and superstructure aft, central hold or holds and raised forecastle. The majority of these vessels range in size from 500 to 1,000 DWT. The more modern vessels are fitted with steel hatch covers while the older ones follow the tradition of hatch beams, wood lifters and canvas covers.

- Cargo vessel

  for Bangladesh, a relatively new type of inland waterway vessel, being a smaller version of the coaster usually with two holds but having no raised forecastle. Sizes range from 250 to 400 DWT with those of 300 tons being the most numerous.

- Flat, Bay Crossing

  a non-propelled ship-shaped barge with up to five holds and equipped with winches and cargo handling derricks; of 60 metre length with a cargo capacity of 550 tons.

- Barge, Bay Crossing

  a non-propelled craft which was originally a much smaller vessel than a flat, with an average capacity of about 300 tons in the older units but now up to 750 tons in the newer ones (built in 1972 with a length of 60 meters).

- Flat, Inland

a large non-propelled ship-shaped craft of 67 metres in length and with a large number of holds port and starboard (as many as 10). Flats have up to 900 tons of cargo capacity and the holds are covered by a shedlike structure to permit traditional manual cargo handling to continue uninterrupted in the wet season.

- Barge, Inland

  almost always in the 250 to 350 ton cargo capacity range, usually with a number of separate holds.

- Towing Vessels

  the fleet of towing vessels is intended to assist bay-crossing and inland flats and barges, and now consists of sea-going tugs of up to 1,000 BHP, pusher tugs of similar horsepower and smaller inland tugs of 500 BHP.

There are actually even a wider variation of vessels. About 200,000 country boats that are not registered are found in all sizes up to the bay-crossing type. The passenger carrying types have a capacity ranging from 5-20 passengers, and the cargo carrying country boats are divided into three groups:

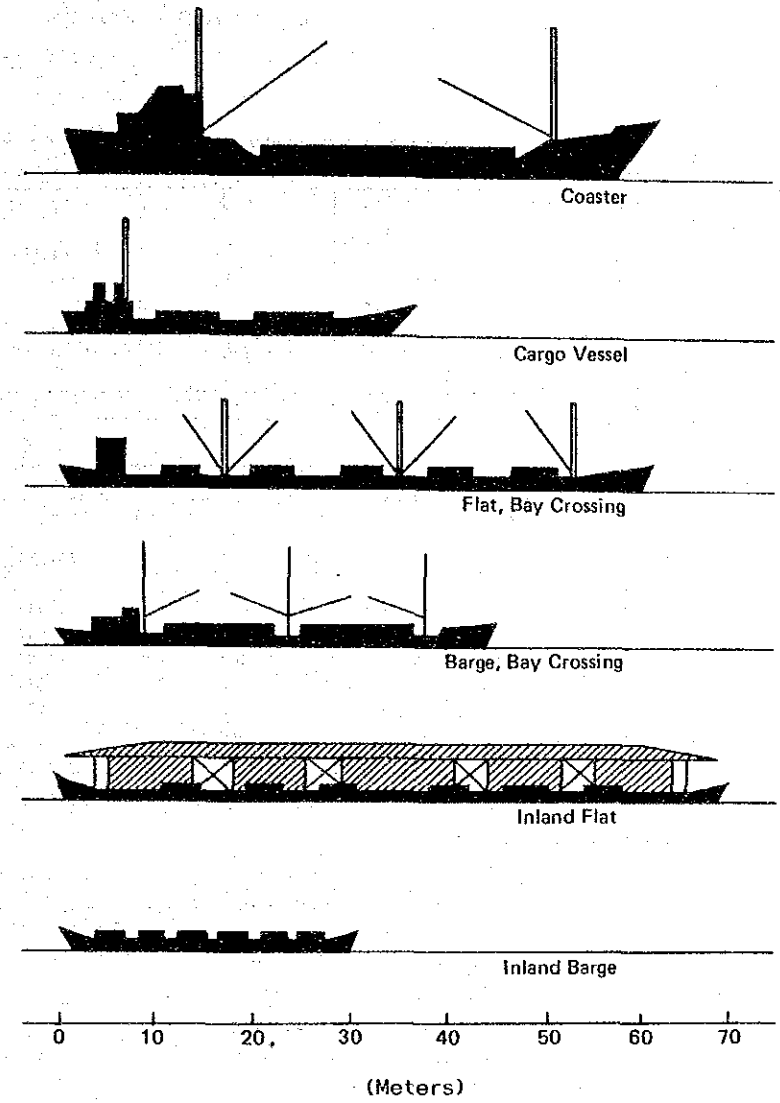
Small	up to 50 maunds
Medium	50 - 200 maunds
Large	Over 200 maunds

(1 maund = 37.195 kg)

5.3.2 Cargo Vessels

The types of vessels engaged in carrying cargo at Dhaka Port are shown in Table 5.3.2. Commodities carried by coaster are restricted compared with other vessel types. This is

because coasters are operated only between Chittagong and Dhaka/Narayanganj Ports, and transport imported cargo exclusively. Country boats call at Dhaka Port and take care of the capital's everyday consumption of fresh vegetables, fish and goods for industry.



Source: Transport of Containers in Bangladesh

Fig. 5.3.1 Types of Cargo Carrying Vessels

Table 5.3.2 Vessel Types Engaged in Carrying Cargo at Dhaka and Narayanganj Ports

(Unit: tons)

(Dhaka)

Vessel Type / Commodity	Coaster	Cargo Launch	Passenger Launch	Flat Barge	Mechanized Country Boat	Manual Country Boat	Others	Total
Cement	19,092	20,723	5	9,005	15	218	-	49,058
Fertilizer	2,156	3,590	-	1,225	-	-	-	6,971
Sugar	5,605	675	27	-	-	41	-	6,348
Rice/Wheat	2,475	300	491	-	28	454	-	3,748
Newsprint	345	1,768	175	638	-	-	-	2,926
Iron & Steel	890	-	179	-	-	27	-	1,096
Sundries	-	1	888	-	108	30	-	1,027
Others	650	297	894	113	11	6	-	1,971
Total	31,213	27,354	2,659	10,981	162	776	-	73,145

(Narayangang)

Vessel Type / Commodity	Coaster	Cargo Launch	Passenger Launch	Flat Barge	Mechanized Country Boat	Maual Country Boat	Others	Total
Fertilizer	2,623	28,033	-	12,140	31	457	-	43,284
Raw Jute	333	10,939	-	9,891	378	33,293	-	54,834
Rice/Wheat	29,421	1,383	32	-	25	18,139	-	49,000
Jute goods	-	17,942	-	1,700	-	1,059	-	20,701
Salt	528	320	-	1	38	1,055	-	1,942
Fish	-	138	16	-	480	54	-	686
Sugar	125	361	5	-	3	596	-	1,090
Sundries	-	185	41	-	2	1,089	25	1,342
Others	-	243	146	6	40	1,460	34	1,929
Total	33,030	59,544	240	23,738	997	57,202	59	174,810

* Average cargo handled by vessel type

	Dhaka	Narayanganj
Coaster	650 tons	768 tons
Cargo launch	276 tons	278 tons
Pass, launch	5.45 tons	1.07 tons
Flat/Barge	268 tons	349 tons
Mechanical country boat	10 tons	21 tons
Manual country boat	11 tons	22 tons
Others	-	15 tons

Source: Study team survey 18.2. 1986 - 19.3. 1986

5.4 Port Cargoes and Passengers

5.4.1 Seaport Statistics

There are two seaports in Bangladesh: Chittagong and Chalna. Cargo is carried by road, river and rail between the two seaports and the hinterland.

The cargo volume handled in the last five years at the two sea ports is shown in Table 5.4.1. These same figures are presented graphically in Fig 5.4.1.

Table 5.4.1 Cargo Handling Volume at the Two Seaports

Unit: '000 tons

	1979/80			1980/81			1981/82			1982/83			1983/84		
	Chitta-gong	Chalna	Total	Chitta-gong	Chalna	Total	Chitta-gong	Chalna	Total	Chitta-gong	Chalna	Total	Chitta-gong	Chalna	Total
Import	5,999.3	1,470.0	7,469.3 (88.1%)	5,014.9	885.6	5,900.5 (82.1%)	5,147.5	920.1	6,067.6 (83.4%)	4,963.1	1,098.5	6,061.6 (82.9%)	5,681.1	1,104.2	6,785.3 (86.2%)
Export	334.4	675.7	1,010.1 (11.9%)	547.6	741.4	1,289.0 (17.9%)	503.4	708.0	1,211.4 (16.6%)	454.4	802.5	1,256.9 (17.2%)	393.1	689.4	1,082.5 (13.8%)
Total	6,333.7	2,145.7	8,479.4 (100%)	5,562.5	1,627.0	7,189.5 (100%)	5,650.9	1,628.1	7,279.0 (100%)	5,417.5	1,901.0	7,318.5 (100%)	6,074.2	1,793.6	7,867.8 (100%)

Source: Year Book Chittagong and Chalna Port

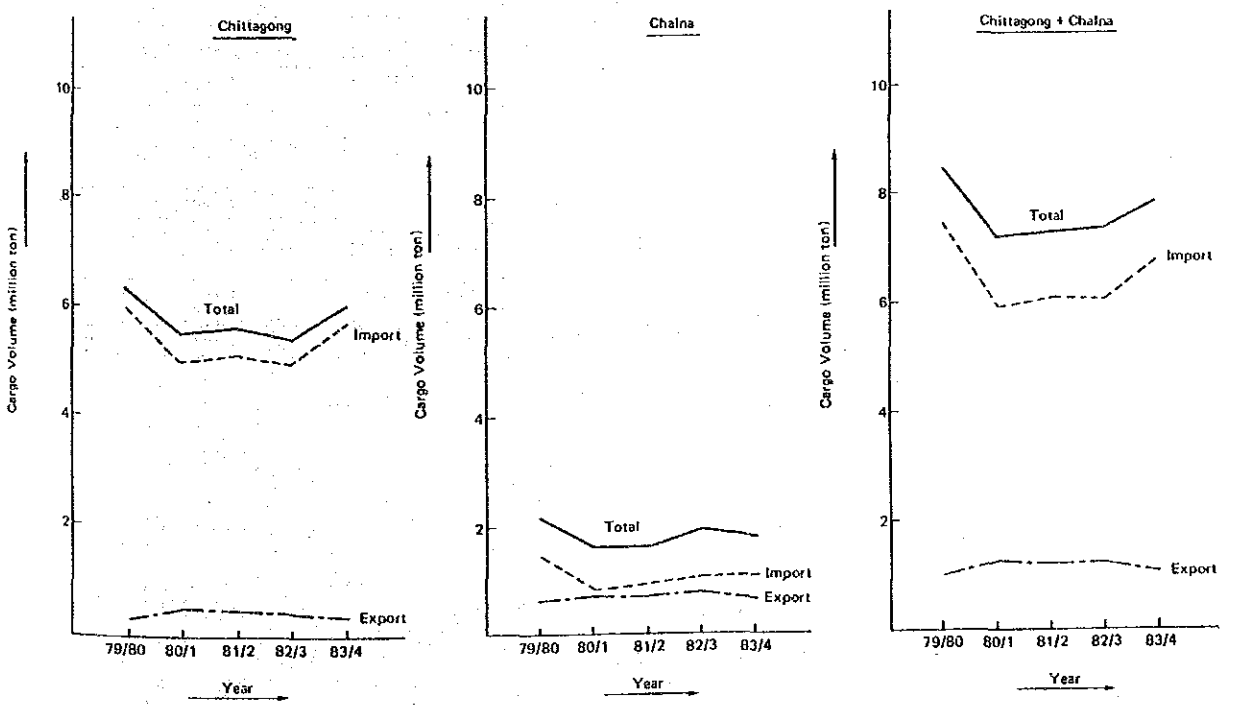


Fig. 5.4.1 Cargo Handling Volume at the Two Seaports

Source: Year Book Chittagong & Chalna Port

About 80% of the total cargo handling volume at the two ports is import cargo; the remaining 20% is export cargo. Cargo handling volume by commodity at Chittagong and Chalna Ports is shown in Table 5.4.2 and Table 5.4.3.

Table 5.4.2 Import Tonnage Handled at Chittagong and Chalna Ports by Commodity

(In tons)

Commodity	1979 - 80			1980 -81			1981 - 82			1982 - 83			1983 - 84		
	Chitta-gong	Chalna	Total	Chitta-gong	Chalna	Total	Chitta-gong	Chalna	Total	Chitta-gong	Chalna	Total	Chitta-gong	Chalna	Total
Food grains	2,076,851	847,822	2,924,673	1,037,041	404,468	1,441,509	998,438	409,190	1,407,628	1,254,318	693,419	1,947,737	1,572,306	615,281	2,187,587
Sugar	65,228	-	65,228	25,778	-	25,778	43,090	-	43,090	5,077	-	5,077	555	-	555
Salt	-	-	-	-	-	-	83,055	15,842	98,897	286,280	-	286,280	520,292	10,172	530,464
Oil in drums	71,306	-	71,306	100,768	-	100,768	65,756	-	65,756	180,508	-	180,508	48,936	-	48,936
Palm oil	-	-	-	-	-	-	-	4,739	4,739	-	-	-	-	-	-
Rape seed oil	-	-	-	-	748	748	-	2,820	2,820	-	-	-	-	-	-
Oil seeds	22,106	3,874	25,980	14,946	319	15,265	17,373	-	17,373	15,424	-	15,424	33,776	-	33,776
Cement	316,483	299,719	616,202	251,023	264,228	515,251	330,698	262,104	592,802	550,664	226,641	777,305	614,132	280,973	895,105
Cement clinker	248,668	-	248,668	184,842	-	184,842	218,088	-	218,088	149,848	-	149,848	168,667	-	168,667
Fertilizer	446,099	237,116	683,215	239,750	164,362	404,112	309,033	157,353	466,386	208,069	120,735	328,804	232,099	133,812	365,911
Cotton	46,786	-	46,786	54,393	-	54,393	45,017	-	45,017	36,329	-	36,329	64,149	921	65,070
Cotton piece goods	7,098	-	7,098	17,439	-	17,439	20,103	-	20,103	16,088	-	16,088	10,902	-	10,902
Iron & Steel	117,904	-	117,904	57,766	-	57,766	24,596	-	24,596	59,164	-	59,164	119,407	-	119,407
C.I. Sheets	23,445	4,409	27,854	41,528	3,821	45,349	33,384	6,127	39,511	5,490	-	5,490	13,952	5,006	18,958
Chemicals	53,810	-	53,810	109,480	-	109,480	63,108	-	63,108	17,884	-	17,884	4,613	-	4,613
Tobacco	-	-	-	977	-	977	-	-	-	-	-	-	-	-	-
Betel nuts	99	-	99	-	-	-	-	-	-	-	-	-	-	-	-
Timber	51	-	51	-	-	-	-	-	-	-	-	-	4,447	-	4,447
Paper	2,292	-	2,292	1,734	-	1,734	1,093	-	1,093	-	-	-	259	-	259
Wood pulp	-	3,477	3,477	-	4,104	4,104	-	1,048	1,048	-	1,567	1,567	-	9,337	9,337
Sundries	483,790	-	483,790	662,905	-	662,905	796,095	-	796,095	612,579	-	612,579	798,227	-	798,227
Coal	128,991	18,479	147,470	183,201	-	183,201	196,938	24,126	221,064	93,374	20,178	113,552	32,768	-	32,768
Pol (in bulk)	1,755,263	-	1,755,263	1,735,272	-	1,735,272	1,757,680	-	1,757,680	1,535,176	-	1,535,176	1,352,000		1,352,000
Machinery	-	3,185	3,185	-	2,489	2,489	-	1,433	1,433	-	3,141	3,141	-	1,237	1,237
Steel pipes	-	-	-	-	970	970	-	970	970	-	-	-	-	-	-
Bitumen	-	22,371	22,371	-	12,666	12,666	-	-	-	-	-	-	-	-	-
G. Cargo	-	28,553	28,553	-	26,970	26,970	-	34,326	34,326	-	33,154	33,154	-	46,302	46,302
Pig iron	86,655	710	87,365	121,307	-	121,307	81,302	-	81,302	10,477	-	10,477	48,437	1,118	49,555
Milk powder	-	285	285	-	451	451	-	-	-	-	-	-	-	-	-
Iron materials	46,365	-	46,365	114,761	-	114,761	62,628	-	62,628	4,383	-	4,383	1,443	-	1,443
Total	5,999,290	1,470,000	7,469,290	4,954,911	885,596	5,840,507	5,147,475	920,078	6,067,553	5,041,132	1,098,835	6,139,867	5,641,367	1,104,159	6,745,526

Table 5.4.3 Export Tonnage Handled at Chittagong and Chalna Ports by Commodity

(In tons)

Commodity	1979 - 80			1980 - 81			1981 - 82			1982 - 83				1983 - 84	
	Chitta-gong	Chalna	Total	Chitta-gong	Chalna	Total	Chitta-gong	Chalna	Total	Chitta-gong	Chalna	Total	Chitta gong	Chalna	Total
Jute	17,140	344,720	361,860	13,247	338,569	351,816	25,308	323,338	348,646	18,361	389,340	407,701	11,910	318,364	330,274
Jute goods	156,270	300,192	456,462	172,721	349,608	522,329	189,245	369,907	559,152	193,819	345,215	539,034	180,520	336,015	516,535
Tea	30,902	-	30,902	36,816	-	36,816	34,160	-	34,160	31,588	-	31,588	31,135	-	31,135
Hides and skins	9,517	-	9,517	14,040	-	14,040	13,261	-	13,261	8,720	-	8,720	2,229	-	2,229
Leather	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bone and bone meal	2,289	-	2,289	2,688	-	2,688	2,301	-	2,301	2,033	-	2,033	2,253	-	2,253
Paper	4,008	-	4,008	201	-	201	5	-	5	-	-	-	-	-	-
Oil cake	2,032	-	2,032	3,251	-	3,251	8,125	-	8,125	4,349	-	4,349	1,739	-	1,739
Fish dry and Frozen	4,831	-	4,831	5,109	115	5,224	7,464	21	7,485	65	-	65	1,136	51	1,187
Frog legs	-	119	119	-	219	219	-	357	357	453	322	775	601	494	1,095
Cotton waste	1,517	-	1,517	379	-	379	770	-	770	712	-	712	512	-	512
Timber	834	-	834	1,601	-	1,601	-	-	-	546	-	546	655	-	655
Chillies	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
Rayon	718	-	718	380	-	380	153	-	153	93	-	93	117	-	117
H. Hair	-	18	18	-	35	35	-	182	182	-	27	27	-	35	35
Sundries	11,350	-	11,350	22,170	-	22,170	51,893	-	51,893	57,077	-	57,077	59,975	-	59,975
Naptha/Molasses Bunker	82,364	-	82,364	255,152	-	255,152	150,526	-	150,526	109,124	-	109,124	59,724	-	59,724
Newsprint	-	13,009	13,009	-	7,765	7,765	-	2,899	2,899	-	3,982	3,982	-	80	80
Bamboo	-	2,213	2,213	-	5,743	5,743	-	5,642	5,642	-	5,704	5,704	-	6,136	6,136
Bran	10,596	-	10,596	12,359	-	12,359	20,151	-	20,151	18,293	-	18,293	32,656	-	32,656
Fertilizer	-	-	-	7,442	35,497	42,939	-	-	-	-	50,697	50,697	-	21,622	21,622
Shrimp	-	1,576	1,576	-	2,121	2,121	-	2,659	2,659	9,120	3,951	13,071	7,329	4,065	11,394
Tobacco	-	-	-	-	-	-	-	-	-	52	-	52	576	-	576
Cow bones	-	1,892	1,892	-	-	-	-	575	575	-	303	303	-	103	103
G. Cargo	-	11,927	11,927	-	1,768	1,768	-	2,413	2,413	-	2,986	2,986	-	2,451	2,451
Total	334,370	675,666	1,010,036	547,556	741,440	1,288,996	503,362	707,993	1,211,355	455,405	802,527	1,256,932	393,067	689,416	1,082,483

Source: Year Book Chittagong and Chalna Port

The major commodities of import cargo are food grains, cement, fertilizer, petroleum products and iron and steel, and the major commodities of export cargo are jute and jute goods. The volume of import cargo carried between the two ports and other regions is presented in Table 5.4.4 by transport mode.

Table 5.4.4 Imported Dry Cargo Carried from the Seaports to the Hinterland by Transport Mode

(Unit: tons)

	Road	Water	Rail	Total
Chittagong	1,855,344 (58%)	755,770 (23%)	606,795 (19%)	3,217,909 (100%)
Chalna	326,946 (29%)	640,482 (58%)	148,738 (13%)	1,116,166 (100%)
Total	2,182,290 (50%)	1,396,252 (33%)	755,533 (17%)	4,334,075 (100%)

Source: Annual Ports & Traffic Report 1982/1983

Table 5.4.4 shows that the ratio of water transport is 33%.

Furthermore,the import POL is handled only at Chittagong. According to Annual Port & Traffic Report 1982/83, the import volume of POL is 1,535.2 thousand tons, and the carried POL by IWT from Chittagong to other areas is 929.1 thousand tons.

Therefore, the IWT share of import POL from Chittagong to other areas in 60.5% (929.1/1,535.2 = 0.605).

The flow of major import commodities by transport mode from the two ports to the hinterland is presented in Fig. 5.4.2.

Fig. 5.4.3 shows the flow of major export cargoes by water transport from river ports to the two sea ports.

The share of water transport in cement transportation from Chittagong and Chalna is 47.1% and 19.1% respectively. Water transport carries 88.6% of the cement transported from Chittagong to Dhaka, and 75% of the cement carried from Chalna to Khulna.

Further, cement is also carried by secondary transport from Khulna to Dhaka and other points.

Food grains are carried by IWT from Chittagong and Chalna at a rate of 28.7% and 73.8% respectively. IWT carries 87.4% of food grains from Chittagong to Narayanganj, and 55.7% from Chalna to Khulna. Fertilizer is carried 21.8% by IWT, and 78.2% by rail and road.

As for exports, the study team estimates that approximately 50% of the jute and 35% of the jute goods are carried by IWT.

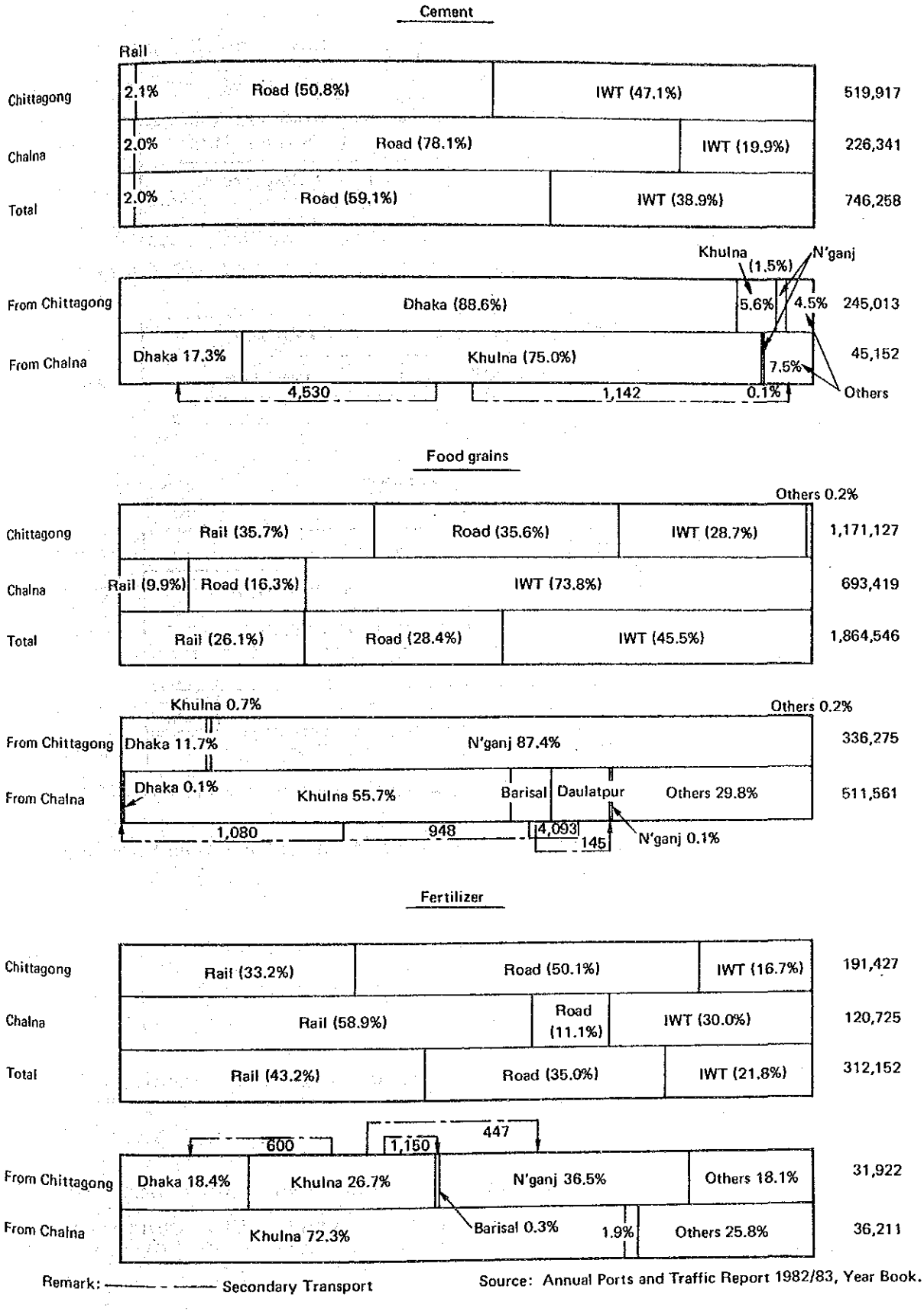
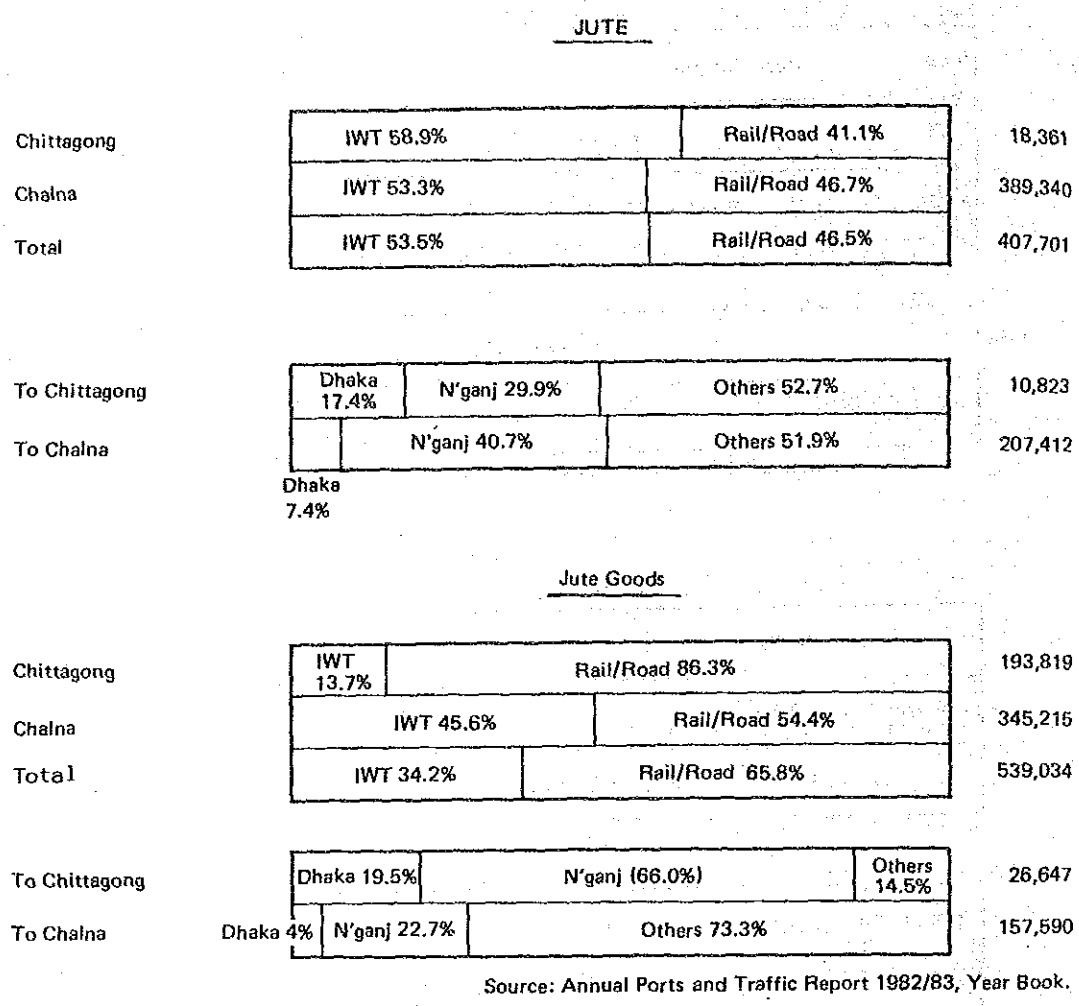


Fig. 5.4.2 Mode and Cargo Flow of Major Import Commodities from Seaports



Source: Annual Ports and Traffic Report 1982/83, Year Book.

Fig. 5.4.3 Mode and Cargo Flow of Major Export Cargo from River Ports to Seaports

5.4.2 Port Cargo Statistics

Dhaka and Narayanganj are two of the most important river ports in Bangladesh.

However, the development of these two ports has not kept pace with the development of the capital city Dhaka and its adjacent town Narayanganj.

The cargo handling volume at Dhaka and Narayanganj Ports increased from 0.167 and 0.714 million tons respectively in

1963/64 to 2.060 and 1.145 million tons respectively in 1983/84. The population of Dhaka city increased from 0.56 million in 1961 to 3.46 million in 1981.

The cargo traffic congestion is worse at Dhaka than at Narayanganj. Annual cargo handling volume at Dhaka and Narayanganj Ports is presented in Table 5.4.5.

Table 5.4.5 Cargo Handling Volume at Dhaka and Narayanganj Ports

Unit: million tons

Year	Dhaka	Narayanganj
1978-79	0.699*	0.844
1979-80	0.740*	0.872
1980-81	0.780*	0.900
1981-82	0.833*	0.922
1982-83	1.933	1.085
1983-84	2.060	1.145

* Based on data collected by BIWTA; does not cover other points in the port area

Source: Ports & Traffic Department and Planning Department of BIWTA

There are three types of jetties at Dhaka and Narayanganj Ports, as follows:

(1) Direct collection (IWTA jetties)
(2) Improvised facilities
(3) Private jetties

"Improvised facilities" refers to landing points where IWTA jetties are not developed.

There is no arrangement at present for daily recording of incoming and outgoing cargo movement at Dhaka and Narayanganj Ports.

The study team carried out a field traffic survey of dry

cargo movement at Dhaka and Narayanganj Ports for the period from 18.2.1986 to 19.3.1986.

The results of the one month field traffic survey are presented in Table 5.4.6.

Table 5.4.6 Principal Cargo Movement Based on the Field Traffic Survey

Unit: tons

(Dhaka)

Commodity	Incoming	Outgoing	Total
Cement	48,858	200	49,058
Fertilizer	6,971	-	6,971
Sugar	6,287	61	6,348
Wheat/Rice	3,186	563	3,749
Newsprint	2,914	12	2,926
Iron & Steel	927	169	1,096
Others	2,225	774	2,999
Total	71,368	1,779	73,147

(Narayanganj)

Commodity	Incoming	Outgoing	Total
Raw Jute	37,833	17,001	54,834
Wheat/Rice	35,925	13,077	49,002
Fertilizer	42,500	784	43,284
Jute goods	209	20,492	20,701
Salt	999	943	1,942
Sugar	591	499	1,090
Others	1,797	2,165	3,962
Total	119,854	54,961	174,815

Source: Field traffic survey of dry cargo movement by the study team (18.2.1986 - 19.3.1986)

The quantities of dry cargo handled at Dhaka and Narayanganj ports during the survey were 73,147 tons and 174,815 tons respectively, and the total quantity was 247,962 tons.

The quantity of cargo movement by vessel type is presented in Table 5.4.7.

Table 5.4.7 Type & Number of Vessels and Quantity and Percent of Cargo Handled

Type of Vessels	Dhaka			Narayanganj			Total		
	Number of Vessels	Quantity (tons)	Percent (%)	Number of Vessels	Quantity (tons)	Percent (%)	Number of Vessels	Quantity (tons)	Percent (%)
Coaster	48	31,213	42.7	43	33,030	18.9	91	64,243	25.9
Cargo launch	99	27,334	37.4	214	59,544	34.1	313	86,898	35.0
Passenger launch	488	2,659	3.6	225	240	0.1	713	2,899	1.2
Flat barge	41	10,981	15.0	68	23,738	13.6	109	34,719	14.0
Mechanized Country boat	16	162	0.2	48	997	0.6	64	1,159	0.5
Manual Country boat	72	776	1.1	2,599	57,202	32.7	2,671	57,978	23.4
Others	-	-	-	4	59	0	4	59	0
Total	764	73,145	100.0	3,201	174,810	100.0	3,965	247,955	100.0

Source: Field traffic survey of dry cargo movement by the study team (18.2. 1986 - 19.3. 1986)

Most of the cargo transported over a short distance is carried by manual country boats. During the survey period a total of 57,978 tons of cargo was carried by manual country boats at both ports.

Dry cargo movement by vessels other than manual country boats was 189,977 tons in one month bringing the annual movement to 2.28 million tons (189,977 x 12). An OD survey was also carried out at both ports during the same period.

The results are presented in Table 5.4.8.

Table 5.4.8 Cargo Flow of All Commodities at Both Ports

(Incoming)

(Unit: tons)

Origin & Destination \ Via Port	Origin to Jetty			Jetty to Destination		
	Dhaka	N'ganj	Total	Dhaka	N'ganj	Total
Chittagong	32,421	37,888	70,309	140	302	442
Chit. H.T	-	-	-	20	-	20
Comilla	665	21,590	22,255	2,978	2,484	5,462
Noakhali	-	113	113	40	170	210
Sylhet	400	1,405	1,805	1,688	-	1,688
Dhaka	4,678	31,748	36,426	61,259	97,712	158,971
Faridpur	384	4,673	5,057	290	471	761
Jamalpur	-	2,740	2,740	295	3,594	3,889
Mymesingh	-	1,774	1,774	2,491	7,485	9,976
Tangail	-	261	261	671	6,743	7,414
Barisal	482	928	1,410	115	245	360
Jessore	1,382	209	1,563	80	-	80
Khulna	30,593	7,640	38,233	-	2	2
Kushtia	-	-	-	-	-	-
Patuakhali	87	11	98	1	-	1
Bogra	-	69	69	10	171	181
Dinajpur	-	423	423	-	78	78
Pabna	302	1,851	2,153	75	-	75
Rajshahi	-	495	495	15	200	215
Rangpur	-	6,037	6,037	-	200	200
Total	71,366	119,855	191,221	70,168	119,857	190,025

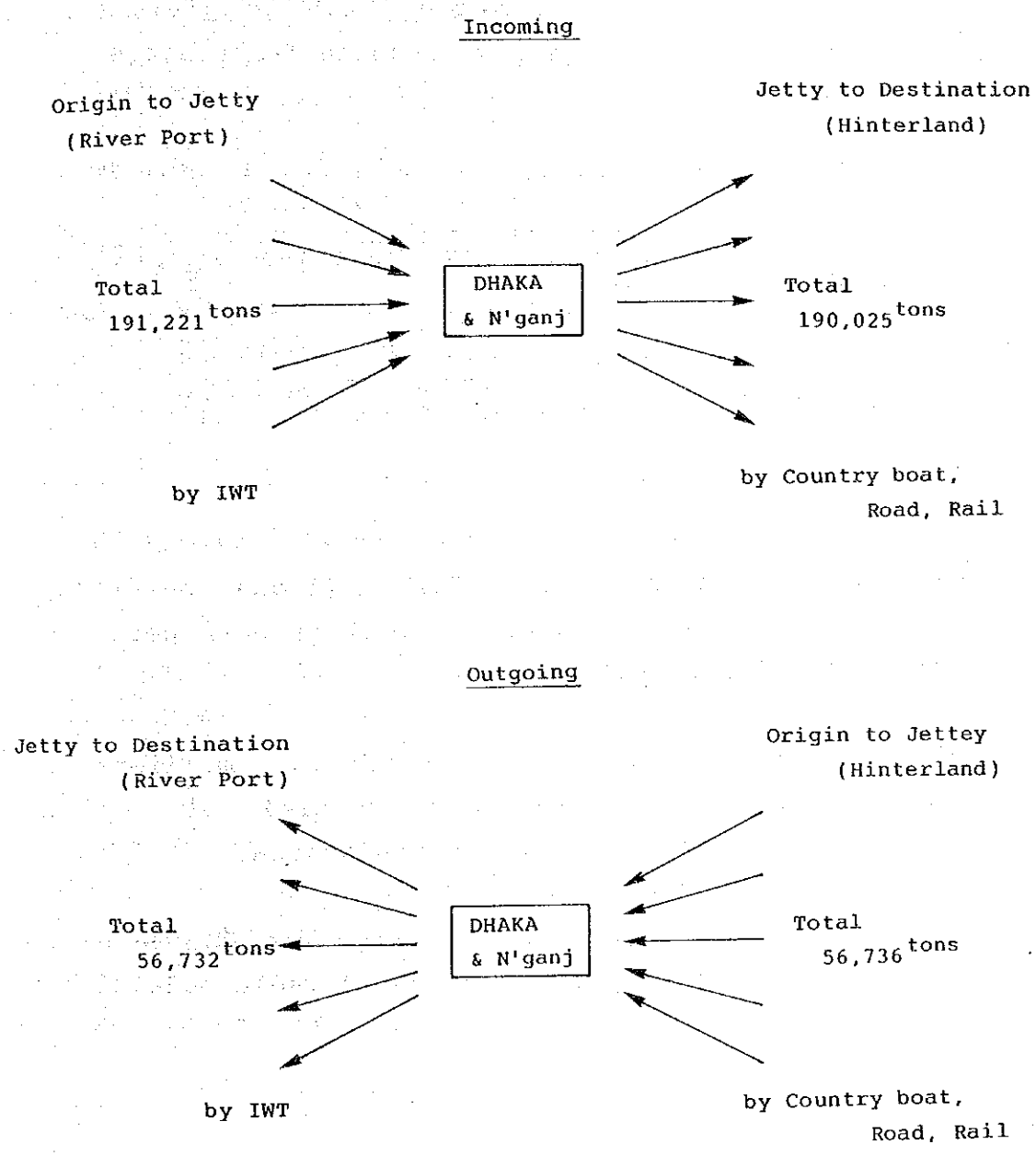
(Outgoing)

(Unit: tons)

Origin & Distination \ Via Port	Origin to Jetty			Jetty to Destination		
	Dhaka	N'ganj	Total	Dhaka	N'ganj	Total
Chittagong	-	51	51	30	653	683
Chit. H.T	-	-	-	-	-	-
Comilla	-	159	159	57	2,036	2,093
Noakhali	-	-	-	-	13	13
Sylhet	-	-	-	-	30	30
Dhaka	1,778	43,568	45,346	605	25,326	25,931
Faridpur	-	360	360	139	78	217
Jamalpur	-	1,266	1,266	-	10	10
Mymesingh	-	4,506	4,506	167	1,087	1,254
Tangail	-	1,582	1,528	-	18	18
Barisal	-	-	-	407	104	511
Jessore	-	-	-	2	350	352
Khulna	-	-	-	191	24,961	25,152
Kushtia	-	6	6	-	-	-
Patuakhali	1	-	1	179	-	179
Bogra	-	136	136	-	11	11
Dinajpur	-	63	63	-	-	-
Pabna	-	41	41	-	229	229
Rajshahi	-	7	7	-	19	19
Rangpur	-	3,266	3,266	-	30	30
Total	1,779	54,957	56,736	1,777	54,955	56,732

Source: OD Survey by study team (18.2.1986 - 19.3.1986)

Further, a simplified picture of the cargo flow in Table 5.4.8 is shown in Fig. 5.4.4.



Source: OD Survey by Study Team (18.2.1986 - 19.3.1986)

Fig. 5.4.4. Cargo Flow of All Commodities at Both Ports

In Table 5.4.8 incoming origin and outgoing destination cargoes are transported by IWT, and incoming destination and outgoing origin cargo are mostly transported by road and rail.

The IWT cargo listed in Table 5.4.8 is divided between inter regional and intra-regional cargo in Table 5.4.9.

Table 5.4.9 Cargo Handling Volume by IWT at Both Ports

Unit: tons

	Dhaka			Narayanganj			Total		
	Incoming	Outgoing	Total	Incoming	Outgoing	Total	Incoming	Outgoing	Total
Movement between regions	66,688	1,172	67,860	88,107	29,629	117,736	154,795	30,801	185,596
Movement within the Dhaka area	4,678	605	5,283	31,748	25,326	57,074	36,426	25,931	62,357
Total	71,366	1,777	73,143	119,855	54,955	174,810	191,221	56,732	247,953

Source: OD Survey by the study team

According to the survey, the annual movement of cargo between regions at both ports is 2.23 millions tons (185,596 x 12), and the annual total cargo movement at both ports is 2.98 millions tons (247,953 x 12).

The total cargo movement figure of 3.205 millions tons at both ports (Table 5.4.5) presented by BIWTA is regarded as including cargo movement within the Dhaka area.

The seasonal variation of dry cargo and POL according to the 1982/83 BIWTA report are presented in Table 5.4.10.

Table 5.4.10 Seasonal Variation

Month	Traffic (tons)				Total	Percentage of Total
	Dry	Percent	POL	Percent		
July '82	226,242	8.17	90,034	8.60	316,276	8.3
August '82	240,532	8.69	80,440	7.69	320,972	8.4
September '82	239,223	8.64	84,048	8.03	323,271	8.5
October '82	230,226	8.32	97,579	9.32	327,805	8.6
November '82	207,819	7.52	95,549	9.12	303,368	8.0
December '82	224,021	8.09	76,615	7.33	300,636	7.9
January '83	250,518	9.05	82,356	7.87	332,874	8.7
February '83	218,497	7.89	84,517	8.08	303,014	7.9
March '83	218,341	7.89	103,731	9,91	322,072	8.4
April '83	221,404	8.00	89,411	8.54	310,815	8.2
May '83	246,640	8.91	83,278	7.96	329,918	8.6
June '83	244,340	8.83	79,987	7.55	323,327	8.5
Total	2,767,803	100.0	1,046,545	100.0	3,814,348	100.0

Source: Annual Ports & Traffic Report 1982/83, BIWTA

As shown in Table 5.4.10, the seasonal variation of cargo movement is very slight.

The cargo traffic volumes by commodity at Dhaka and Narayanganj Ports according to the BIWTA report are presented in Table 5.4.11 and Table 5.4.12, respectively. The flow of cargo movement between ports is presented in Table 5.4.13, and cargo movement between Dhaka and Narayanganj Ports and other major ports is presented in Fig. 5.4.5.

Table 5.4.11 Cargo Traffic 82/83 (Excluding Country Boats)

(Unit: tons)

	DHAKA AREA PORTS											
	DHAKA			PAGLA			FATULIAH			TOTAL		
	For-warded	Re-ceived	Total	For-warded	Re-ceived	Total	For-warded	Re-ceived	Total	For-warded	Re-ceived	Total
Bamboo												
Bitumin		1,558	1558								1,558	1,558
Bricks	1,619		1619	722		722				2,341		2,341
Cement	2,566	333,682	336248		250	250				2,566	333,032	336,498
Coal		9,292	9292								9,292	9,292
Cotton yarn		850	850								850	850
Fertilizer	855	28,170	29025							855	28,170	29,025
Firewood		5,127	5127								5,127	5,127
Fish		535	535								535	535
Food grains	318	47,065	47383							318	47,065	47,383
Gewa & Sundari Wood		442	442								442	442
Gur & Molasses												
Ice	513		513							513		513
Iron & Steel	300	43,281	43581		1,400	1,400				300	44,681	44,981
Jute	15,239	539	15778							15,239	539	15,778
Jute goods	12,001	350	12351							12,001	250	12,351
Limestone		732	732								732	732
Machinery		1,650	1,650								1,650	1,650
Oil (edible)		2,261	2,261								2,261	2,261
Paper and Board		10,890	10,890								10,890	10,890
Petroleum Products		756	756				51,017	169,328	220,345	51,017	170,084	221,101
Pulp												
Rayon & Dilphane												
Salt	150	4,002	4,152							150	4,002	4,152
Sand	2,619	8,676	11,295		3,688	3,688				2,619	12,364	14,983
Stone, etc.	1,131	78,270	79,401		7,526	7,526		427	427	1,131	86,223	87,354
Sugar	350	1,291	1,641							350	1,291	1,641
Sulphur		1,022	1,022								1,022	1,022
Sundries	2,203	57,036	59,239							2203	57,036	59,239
Sweet water												
Timber		2,105	2,105								2,105	2,105
Total	39,364	639,582	679,446	722	12,864	13,586	51,017	169,328	220,345	91,603	822,201	913,804

Source: Annual Ports & Traffic Report 1982-83, BIWTA.

Table 5.4.12 Cargo Traffic 82/83 (Excluding Country Boats)

(Unit: tons)

Commodity	Narayanganj Area Ports								
	Narayanganj			Godnail			Total		
	For-warded	Re-ceived	Total	For-warded	Re-ceived	Total	For-warded	Re-ceived	Total
Bamboo									
Bitumin		500	500					500	500
Bricks									
Cement	867	5,651	6,518				867	5,651	6,518
Coal									
Cotton yarn	868	917	1,785				868	917	1,785
Fertilizer		72,311	72,311					72,311	72,311
Firewood									
Fish		519	519					519	519
Food grains	1,876	279,367	281,243				1,876	279,367	281,243
Gewa & Sundari wood									
Gur & Molasses									
Ice	532		532				532		532
Iron & Steel									
Jute	90,613	2,998	93,611				90,613	2,998	93,611
Jute goods	53,627	250	53,877				53,627	250	53,877
Limestone									
Machinery									
Oil (edible)									
Paper & Board									
Petroleum products	352		352	53,211	281,107	334,318	53,563	281,107	334,670
Pulp									
Rayon & Dilphane									
Salt	1,651	17,371	19,022				1,651	17,371	19,022
Sand		165	165					165	165
Stone etc.	350	350	700				350	350	700
Sugar									
Sulphur									
Sundries	4,975	3,932	8,907				4,975	3,932	8,907
Sweet water									
Timber									
Total	155,711	384,331	540,042	53,211	281,107	334,318	208,922	665,438	874,360

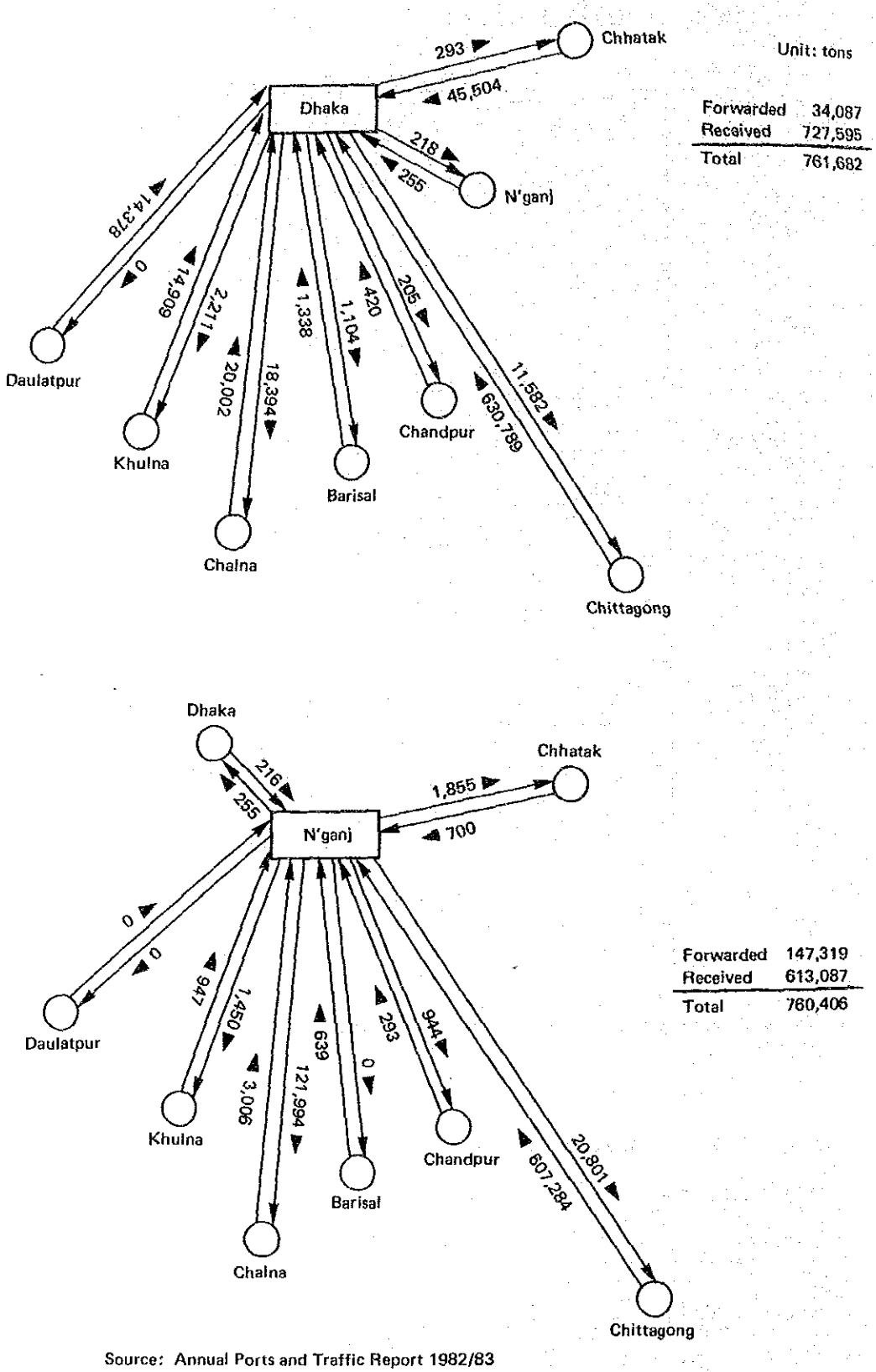
Source: Annual Ports & Traffic Report 1982-83, BIWTA.

Table 5.4.13 Station to Station (Port to Port) Cargo Movement

(Unit: tons)

From \ To	Baghabari	Barisal	Chandpur	Chandraghona	Chatak	Chittagong	Daulatpur	Dhaka	Fatullah	Ghorasal	Godnail	Khulna	M/Pasha	Mongla	Narayanganj	Other	Total
Baghabari	-	-	110	-	-	-	-	284	-	-	-	-	-	-	733	925	2,052
Barisal	-	-	547	-	-	76	-	1,338	-	-	-	664	-	-	639	24,277	27,541
Chandpur	2,470	360	-	-	-	54	-	420	-	-	-	308	-	11,588	293	8,208	24,201
Chandraghona	-	-	-	-	-	12,573	-	-	-	-	-	-	-	-	-	-	12,573
Chhatak	10,722	1,214	1,269	-	-	-	-	45,504	-	1,699	-	6,684	-	-	700	39,095	105,887
Chittagong	-	24,256	42,151	47,368	-	-	353,458	460,061	169,328	-	281,107	55,831	-	800	306,551	97,389	1,938,499
Daulatpur	-	433	-	-	-	2,111	-	13,310	-	-	-	938	-	116,614	-	1,732	135,138
Dhaka	200	1,184	622	-	293	11,582	-	-	-	-	-	2,211	-	18,334	218	5,160	39,864
Fatullah	42,185	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8,832	51,017
Ghorasal	3,787	2,878	2,125	-	-	300	-	12,966	-	-	-	42,557	-	21,092	45,300	51,528	182,533
Godnail	38,340	-	13,581	-	-	-	-	-	-	-	-	-	-	-	-	1,290	53,211
Khulna	-	3,518	880	-	450	3,692	-	14,909	125	-	-	-	-	105,092	3,902	10,638	143,206
M/Pasha	-	1,259	-	-	-	-	-	2,483	-	-	-	254	-	600	-	1,629	6,225
Mongla	-	31,421	893	-	-	101	43,711	20,002	-	7,718	-	415,863	58,070	-	3,006	103,195	583,980
Narayanganj	300	-	944	-	1,855	20,121	-	255	-	-	-	1,450	-	121,994	-	8,092	155,711
Others	4,747	8,037	11,618	11,141	18,314	41,186	-	68,050	302	490	-	52,508	-	50,487	5,618	79,511	351,910
Total	101,751	74,560	74,740	58,510	20,912	92,496	397,269	639,582	169,755	9,907	281,107	579,668	58,070	446,661	366,960	441,500	3,314,368

Source: Annual Ports and Traffic Report 1982-83



Source: Annual Ports and Traffic Report 1982/83

Fig. 5.4.5 Cargo Movement at Dhaka and Narayanganj Ports

5.4.3 Passenger Statistics

Passenger service is separated into public sector and private sector service.

The number of vessels by sector is presented in Table 5.4.14.

Table 5.4.14 Number of Vessels by Sector

Type of Vessel	Private Sector		Public Sector	
	No. of vessels	Capacity	No. of vessels	Capacity
Pass. (inland)	-	-	22	10,048
Pass. Vessel	95	27,036	-	-
Pass. Launch	1,230	100,996	-	-
Ferries	-	-	17	2,060
Sea Truck	-	-	2	260
Total	1,325	128,032	41	12,368

Source: Annual Ports & Traffic Report 1982/83

Most of the passenger vessels belong to the private sector. Passenger traffic by sector in the whole country is presented in Table 5.4.15.

Table 5.4.15 Passenger Traffic by Sector

Service	Length of water route (km)	Number of passengers (millions)	Million passenger kilometers	Average lead (km)
Private sector	5,350	45.87	1,193.1	26.01
Public sector	1,091	2.81	300.2	106.8
Total	-	48.68	1,493.3	30.7

Source: Annual Ports & Traffic Report 1982/83.

The private sector carries many more passengers than the public sector, but the "average lead", that is the average number of kilometers per passenger, is longer in the public sector than in the private sector. Overall, the private sector

accounts for almost 80% of the total passenger-kilometers.

The passenger routes between Dhaka and Narayanganj Ports and other major ports are presented in Table 5.4.16 and Table.4.17.

Table 5.4.16 Passenger Routes from Dhaka Port

Name of Route	No. of Vessels	Capacity	No. of Trips (per day)	Total Passengers Movement (per day)
Dhaka ∿ Barisal	6	3,117	6	3,117
Patuakhali	4	1,859	8	3,718
Barguna	4	2,090	4	2,090
Khepurpara	4	1,435	4	1,435
Torki	4	1,257	8	2,514
Sureswar	4	610	8	1,220
Madaripur	12	3,493	12	3,493
Khulna	6	1,542	12	3,084
Bhola	4	1,650	8	3,300
Borhanuddin	2	915	12	915
Lalmohan	2	1,037	2	1,037
Gosherhat	2	439	2	439
Bagerhat	3	1,441	3	1,441
Hularhat	7	2,534	21	7,604
Doher	35	4,919	35	4,919
		3,424		3,424
Ekrashi	39	4,844	39	4,844
		4,450		4,450
Sreenagar	7	560	7	560
Gazaria	1	180	1	180
Nagerhat	5	355	5	355
Ikarkandi	3	563/		563/
		375		375
Narisha	3	335/	3	335
		245		245
Chandpur	2	518/	2	518
		260		260
Wapda-Bhejeswar	6	1,294	6	1,294/
		719		719
Damuddya	3	917/	3	917/
		533		533
Maqsudpur	3	386	3	386/
		305		305
Munshiganj	1	148/	1	148/
		102		102
Jaypara	1	65	1	65
Balasur	2	239/	2	239/
		207		207
Simpara	4	212	4	212
Sirajdikhan	2	122	2	122

Source: BIWTA

Table 5.4.17 Passenger Routes from Narayanganj Port

Name of route	No. of Vessels	Capacity	No. of trips per day Up + Down	Total	Total passenger movement per day in	out
N'ganj to						
Chandpur	15	2,149	11 + 11	22	1,575	1,575
Machuakhal	14	1,880	9 + 9	18	1,015	1,015
Matlab	2	253	1 + 1	2	126	126
Danga	2	269	1 + 1	2	134	134
Sorajdikhan	1	156	2 + 2	4	312	312
Rasulpur	1	143	1 + 1	2	143	143
Taltala	22	1,407	22 + 22	44	1,386	1,386
Munshiganj	1	152	5 + 5	10	760	760
Gopaldj	2	174	2 + 2	4	174	174
Jibanganj	1	145	1 + 1	2	145	145
Ramchandrapur	10	1,447	7 + 7	14	1,008	1,008
Batakandj	1	105	1 + 1	2	105	105
Sureswar	2	319	2 + 2	4	318	318
Torkey	2	780	1 + 1	2	390	390

Source: BIWTA

Passenger vessels are arranged by route, and the vessels do not operate for approximately 30 days per year for maintenance works.

Passenger traffic statistics at Dhaka and Narayanganj Ports are presented in Table 5.4.18.

Table 5.4.18 Passenger Traffic at Dhaka and Narayanganj Ports

Unit: million persons

Year	Dhaka	Narayanganj
1978-79	9.984	3.554
1979-80	12.142	4.223
1980-81	12.573	4.485
1981-82	13.472	4.805
1982-83	14.371	5.124
1983-84	15.467	5.516

Source: Ports & Traffic Department and Planning Department of BIWTA

The study team carried out a passenger survey at Dhaka, and Narayanganj Ports from 27.2.1986 to 19.3.1986 as shown in Tables 5.4.19 and 5.4.20.

Table 5.4.19 Number of Passenger Vessels & Number of Passengers at Dhaka and Narayanganj Ports by Route

(From 27/2 to 19/3)

Dhaka

District		Vessel Type						Total	
		Single Deck		1 + 1/2 Deck		Double Deck			
		Steel	Wooden	Steel	Wooden	Steel	Wooden	Vessels	Passengers
Dhaka	Dhaka-1	25	194	79	184	4	0	486	63,805
	Munshiganj	7	263	21	201	1	1	494	68,950
Faridpur	Faridpur	16	44	121	90	89	15	375	79,438
	Madaripur	9	13	64	36	9	1	132	26,369
	Shariatpur	1	3	25	11	45	15	100	23,511
Barisal	Barisal	-	1	21	13	155	3	193	68,773
	Bhola	1	-	9	2	72	2	86	29,715
Patuakhali	Patuakhali	-	-	1	2	79	1	83	34,170
	Barguna	-	1	-	1	31	-	33	13,295
Khulna	Khulna	1	1	-	-	19	-	21	10,155
	Bagerhat	-	-	1	-	24	2	27	9,722
Comilla	Comilla	-	-	-	1	-	-	1	104
	Chandpur	6	1	47	21	166	3	244	65,334
Total		66	521	389	562	694	43	2,275	493,341

Narayanganj

District		Vessel Type						Total	
		Single Deck		1 + 1/2 Deck		Double Deck			
		Steel	Wooden	Steel	Wooden	Steel	Wooden	Vessels	Passengers
Dhaka	Dhaka-1	-	-	-	3	-	-	3	327
	Dhaka-3	-	-	-	13	-	-	13	1,642
	Munshiganj	3	19	12	885	1	-	920	99,691
Faridpur	Faridpur	-	-	3	1	20	-	24	8,632
	Shariatpur	-	-	22	21	5	-	48	10,134
Comilla	Comilla	-	1	8	348	-	-	357	55,067
	Chandpur	-	1	20	281	4	-	306	56,151
Total		3	21	65	1,552	30	-	1,671	231,644

Source: Passenger survey by the study team 27.2.1986 - 19.3. 1986

Table 5.4.20 Passenger Survey by Date

Dhaka	Date	Incoming		Outgoing		Total	
		No. of Vessels	No. of Passengers	No. of Vessels	No. of Passengers	No. of Vessels	No. of Passengers
	27/2	66	14,156	79	14,803	145	28,959
	28/2	67	14,082	73	15,836	140	29,918
	1/3	59	12,137	79	17,126	138	29,263
	2/3	68	11,586	73	15,915	141	27,501
	3/3	67	12,079	76	17,957	143	30,036
	4/3	66	13,212	76	18,929	142	32,141
	5/3	65	13,833	79	18,548	144	32,381
	6/3	69	14,369	83	19,654	152	34,023
	7/3	69	13,186	78	19,945	147	33,131
	9/3	66	14,001	77	18,118	143	32,119
	10/3	62	12,356	76	18,319	138	30,675
	11/3	59	11,392	72	17,938	131	29,330
	12/3	68	13,128	83	18,868	151	31,996
	13/3	67	12,937	76	18,401	143	31,338
	14/3	64	12,993	75	17,496	139	30,489
	15/3	64	12,609	74	17,432	138	30,041
	Total	1,046	208,056	1,229	285,285	2,275	493,341

Narayanganj	Date	Incoming		Outgoing		Total	
		No. of Vessels	No. of Passengers	No. of Vessels	No. of Passengers	No. of Vessels	No. of Passengers
	27/2	45	5,948	46	6,360	91	12,308
	28/2	45	6,096	48	6,182	93	12,278
	1/3	43	6,406	46	5,196	89	11,602
	2/3	55	7,744	56	6,808	111	14,552
	3/3	58	7,729	56	7,528	114	15,257
	4/3	54	7,375	54	7,328	108	14,703
	5/3	59	7,496	56	7,689	115	15,185
	6/3	56	7,730	59	8,217	115	15,947
	7/3	50	7,045	49	5,947	99	12,992
	9/3	51	8,122	47	6,335	98	14,457
	10/3	53	7,533	47	7,016	100	14,549
	11/3	52	7,495	51	7,298	103	14,793
	12/3	52	7,790	54	7,839	106	15,629
	13/3	60	8,361	53	8,096	113	16,465
	14/3	48	6,716	55	8,052	103	14,768
	15/3	51	7,477	62	8,682	113	16,159
	Total	832	117,071	839	714,573	1,671	231,644

Source: Passenger survey by the study team 27.2. 1986 - 19.3. 1986

Table 5.4.19 shows the number of incoming and outgoing passengers at the two ports during the survey period by vessel type.

Table 5.4.20 shows the daily incoming and outgoing of passengers at the two ports during the survey period. According to the survey, the total number of passengers at the two ports during the 16 day survey was 493,341 at Dhaka, and 231,644 at Narayanganj for a total of 724,985.

The average number of passengers per day at the two ports was 45,312 persons, and annual passengers at the two ports total 16.5 millions persons.

According to BIWTA data (Table 5.4.18), annual passengers at the two ports total 20.985 millions persons, and the number of passengers per day at the two ports is 57,488 persons. The number of passengers in BIWTA's data is larger than the result of the study team survey.

5.5 Port Operations and Cargo Handling

5.5.1 Port Operations

(1) The following paragraphs, taken from the "BIWTA Cargo Handling Systems within Inland River Ports" report, cover the major points of port operation.

The local Port Authority is headed by a Port Officer reporting directly to the Director of Ports and Traffic, BIWTA. The major responsibilities of the local Port Officer and his staff are today concentrated towards the safe passage of passengers and passenger vessels through the port, ship allocation and conservancy administration within the port area.

Today BIWTA's involvement in the daily cargo handling operation is limited to berth allocation and collection of landing and shipping charges.

The local port authorities are to be notified upon vessels arrival in port whereupon berth will be allocated by the Traffic Inspector. Normally no notification (ETA) is given prior to arrival and if berths are available, vessels will at times berth without giving any notification to port authorities.

The master of the vessel or an appointed agent informs consignees/consignors of cargo availability who in turn arrange for the unloading/loading of the vessel through the cargo handling contractor appointed by BIWTA. If lifting gear is required, the vessel's derricks are used or available equipment is leased by the port authority.

Loading/unloading is normally performed between 0800 - 1800 with a break of one hour (1300 - 1400). Work during night hours is performed provided sufficient lighting exists.

Labourers are enrolled with the cargo handling contractor by name, address and photograph. A list of enrolled labourers is provided to the local authority. Action for any irregularities caused by the labourers is taken by the port authority via the handling contractor.

The cargo handling is performed by one handling contractor per port. Cargo handling contracts for a period of one year are given to contractors following a public auctioning of each one year contract. The highest bidder is rewarded the contract which is based on a unit price set by the local port authority. The same unit price is applied in all ports.

(2) Gang formation

Normally a gang consists of 30-35 men who are engaged in the loading/unloading of a vessel.

(3) Labour cost per worker

50 taka per 8 hours (February, 1986)

(4) Port Tariff

The port tariff as of February 1986 is shown below:

Item	Nature of Levy	Basis of Assessment	Rate
Conservancy	Surveying and dredging the IWT system	Per gross ton per annum	Coasters Tk 39.00 Self prop Tk 14.00 Tugs Tk 12.00 Flats Tk 7.00 Barges Tk 7.00
Pilotage fees	Fee for use of pilot (Note: pilotage is compulsary)	Per boat	Tk 56 per boat
Canal Tolls	Toll for use and operation of specified canals		M-G canal Tk 1.00 per ton. Gabkhan Canal free
Landing & shipping charges (LSC)	Charge for landing & shipping goods at IWT ports	Weight or volume	BIWTA berths Tk 5.36 per tonne & at licensed berths Tk 3.00 per tonne
Berthing charges	Charge for inland port berthing facilities	Cargo carrying capacity of the vessel	Ranges from Tk 22.60 to Tk 605.00 per berthing day at BIWTA facilities only

Storage charges	Charge for use of storage space	Sq. ft, number of days & type of storage space	Foreshore - covered Tk. 0.50 uncovered Tk. 0.07 Godown Tk. 3.50 Floating Tk. 3.00
Road charge	Charge for trucks, buses & carts using the port	per trip separate rates for full and empty	Truck over 5 ton cap. Tk 14.00 full Tk 6.00 empty under 5 ton cap. Tk 9.00 full Tk 3.00 empty
Stevedoring	Discharging/ loading of cargo or vessel & handling of Cargo to godown another jetty or transport	per ton	Ship/shore with dericks Tk 7.00, without dericks Tk 15.75 Transfer of cargo upto 200 yds Tk 10.50. For each additional 50 yds Tk 2.25
Licenses	Fee for the use of the foreshore (50 yds beyond HW mark) & the installation of structures (e.g. jetties)	per sq. ft per annum with additional charges on the same basis for important areas (e.g. Dhaka/ Narayanganj)	Depends upon type of structure (Note: LSC charge also have to be paid at the rate of Tk 3.00 per ton to the BIWTA

5.5.2 Cargo Handling at Dhaka Port

(1) Principal port facilities at Dhaka port are the jetties located in Old Dhaka (Sadarghat and Badamtali) and at Mill Barracks. Facilities in Old Dhaka include two R.C.C. Jetties for coasters at Badamtali, one passenger terminal composed of 8 pontoons with 4 steel gangways and other pontoons with wooden or steel gangways. Facilities at Mill Barracks include one R.C.C. Jetty, one pontoon with a wooden gangway and two wooden jetties.

Table 5.5.1 shows the cargo handling volume by area/vessel type.

Table 5.5.1 Cargo Handling Volume by Jetty

(Unit: tons)

	Badamtali		Mill Barrack		M.M. Oil Mill		Khanpur		Ekranpur		Ghat No. 5 - 8	
	No. of vessels	Cargo handling volume	No. of vessels	Cargo handling volume	No. of vessels	Cargo handling volume	No. of vessels	Cargo handling volume	No. of vessels	Cargo handling volume	No. of vessels	Cargo handling volume
Coaster	22	13437.00	3	2475.00	7	4865.00	0	0	4	2011.65	10	2623.03
Cargo Lunch	37	8988.90	2	975.00	23	7160.00	22	3895.00	0	0	81	23909.40
Passenger Lunch	52	510.89	0	0	0	0	0	0	0	0	0	0
Flat Barge	13	3655.97	0	0	19	5517.00	12	3170.00	0	0	26	8969.65
Mechan. Country Boat	3	121.30	3	27.99	0	0	1	63.00	0	0	17	271.25
Manual Country Boat	6	248.26	66	527.07	0	0	11	305.94	226	3671.53	70	902.03
Other	0	0	0	0	0	0	0	0	0	0	0	0
Total	122	26962.32	74	4005.06	49	17542.00	46	7433.94	230	5683.18	204	36675.36

Source: Traffic Survey by the Study Team (Feb.18 - Mar.19, 1986)

(2) Cargo Handling Capacity

(i) "Cargo Handling System" Report

R.C.C. jetty	300 tons/day
Wooden Jetty with T-head	200 tons/day
Pontoon with wide access	200 tons/day
Small wooden jetty with narrow access	150 tons/day

(ii) "Inter-modal Study" report

R.C Construction with mobile crane	280-300 tons/day
Pontoon with easy two-way passage plank	150-200 tons/day

(iii) JICA Team Observations

(a) R.C.C. Jetty at Radamtall

(Ship's crane)

Cycle time	2 min
Handling cargo volume	1.0 ton (20 bags of cement)
Number of laborers	30 persons = 1 gang

(Handling capacity)

60 min/2 min x 1.0 tons - loss time = 25 tons/hour/crane

(Capacity/day)

25 tons/hour/crane x 8 hours = 200 tons/day/crane

1 hatch operation 200 x 1 = 200)
2 hatch operation 200 x 2 = 400)

300 tons/day - vessel

(b) Pontoon/wooden Jetty at Badamtali

Cycle time of labourers	4 min
Number of laborers	30 persons
Handling capacity (headload)	1 bag/person or 1.5 mds/person

8 hours x 60 min/4 min x 30 persons x 50-60 kg
= 180 - 216 tons/day

5.5.3 Road Traffic Around the Port

	Dhaka-N'ganj (Pagla, Apr.'83)	Dhaka-Demra (Kajla, Apr.'83)	Demra-N'ganj (Adamjee, May '83)
Truck	1,095	1,267	568
Pick-up Van	984	597	276
Bus	923	1,298	433
Car	987	707	317
Auto Rickshaw	372	709	565
Motorcycle	234	244	82
Sub Total	4,595	4,822	2,241
Bicycle	332	284	66
Rickshaw	2,497	2,087	1,326
Pushcart	112	118	17
Sub Total	2,941	1,489	1,412
Total	7,536	7,311	3,653
P.C.E. (Passenger car equivalent)	10,147	11,491	4,991

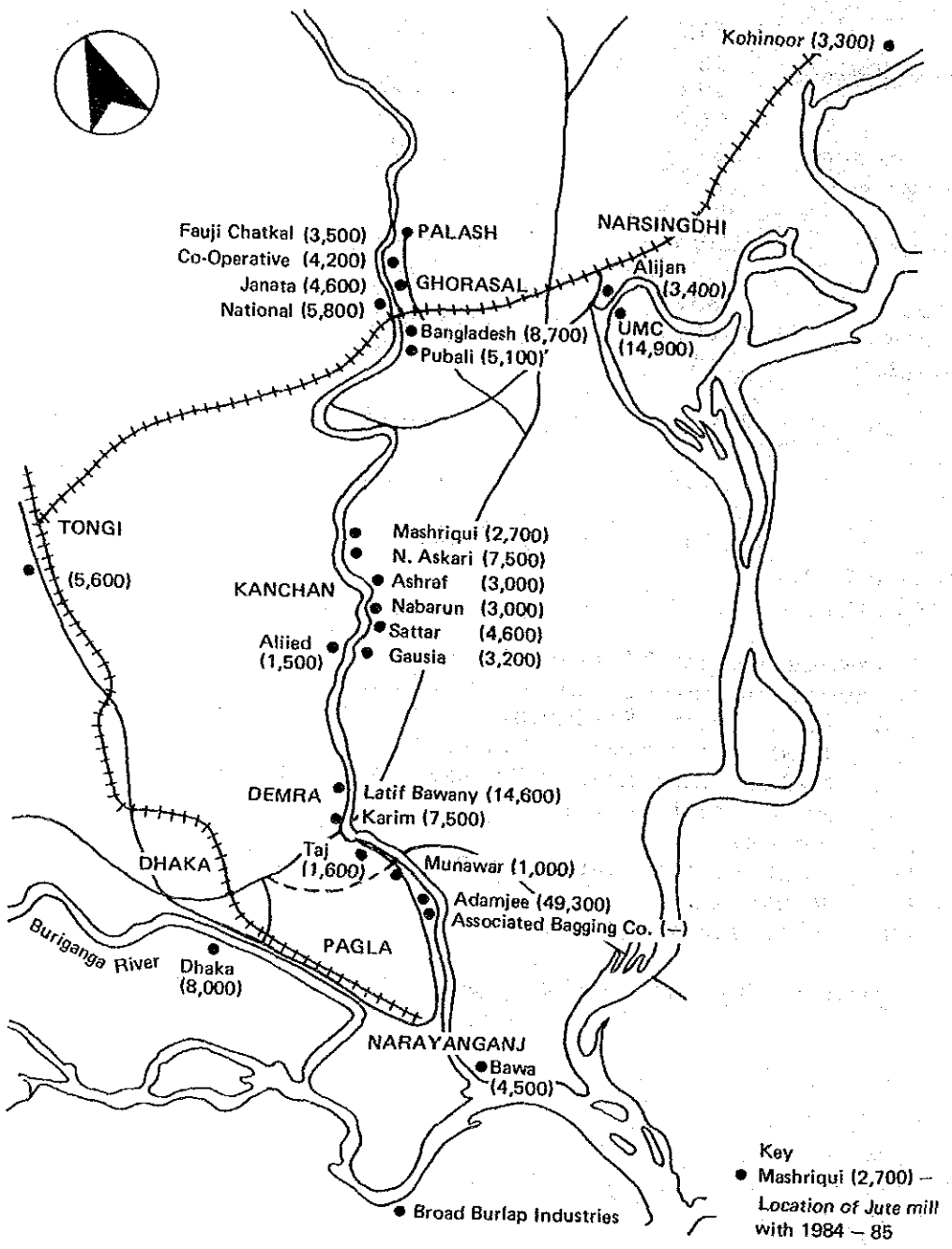
*Average daily 24 hour traffic
*Conversion coefficients (P.C.E.)

(1)	Car, Jeep, Pickups. Motorcycles etc.	1
(2)	Light Commercial Vehicles	1
(3)	Medium and Heavy Commercial Vehicles	3
(4)	Buses and Coaches	3
(5)	Trucks	3
(6)	Push Carts, Bullock Carts and Animal drawn carts	3
(7)	Bicycles	0.5
(8)	Rickshaws	0.5

Source: Annual Traffic Survey 1981-83 (RHD)

5.6 Main Industries Located in the Port Area

5.6.1 Jute Mills



Location of Jute Mills in Dhaka Region

Source: Transport of Containers in Bangladesh

5.6.2 Shipbuilding

Name of Shipyard	Location	Capacity (DWT)	Permanent Employees
1.M/s Highspeed Shipbuilding & Heavy Eng. Co., Ltd.	Fatulla	1200 tons	100
2.M/s Dhaka Shipbuilder	Char Kaligonj Mirerbag, Dhaka	450 tons	20
3.M/s Dhaka Dockyard & Eng. Works Ltd.	"	800 tons	72
4.M/s Commila Shipbuilder	"	450 tons	8
5.M/s Shakil Ahmed Dockyard	"	600 tons	25
6.M/s Goalondo Shipbuilders & Dockyard	"	450 tons	8
7.M/s Alammagar Dockyard	"	500 tons	20
8.M/s Narayanganj Dock Ltd.	Narayanganj	600 tons	40
9.M/s Bangladesh Marine Service	"	500 tons	8
10.M/s Allied Eng. & Dockyard	Zinjira Dhaka	500 tons	12
11.M/s Parjoar Dockyard	Mirerbag, Dhaka	450 tons	10
12.M/s Delta Dockyard	Narayanganj	700 tons	20
13.M/s Shah River Crafts	Fatullah	600 tons	25
14.M/s Imam Dockyard	Fatullah	500 tons	20
15. M/s Pearl Eng. Co.,Ltd.	Zinjira	400 tons	8

Remarks:
(1) No crane facilities at shipyards 2 to 15. They hire equipment when necessary.
(2) Shipways available only at No.1, 3, 7.
(3) These are all private sector yards. The only public sector yard in this region is "Narayanganj Dockyard Ltd."
(4) The above are permanent shipyards not including rented land.

Source: Bangladesh Shipbuilders Association

5.6.3 Brick Production

		Keraniganj	Fatulla	Dhaka District
(1)	Number of brick fields	25	77	219
(2)	Daily average number of laborers	2,550	9,200	20,370
(3)	Number of bricks manufactured ('000)	3,000	144,200	2,813,850
(4)	Number of bricks sold out ('000)	1,500	96,500	1,827,090

Source: Dhaka District Statistics

CHAPTER 6
DEMAND FORECAST

CHAPTER 6 DEMAND FORECAST

6.1 Macroeconomic Framework

6.1.1 Demography

(1) Future Population Projection

The population of Bangladesh in 1986 is about 100 million people, which is an estimated figure based on the 1981 census - 87 million as described in Chapter 2. Since the census was executed, various population projections up to the year 2000 have been carried out by several agencies. However, these projections show a wide variation because of different basic assumptions such as fertility and mortality rates. The Outline National Physical Plan (hereinafter referred to as ONPP), which is one of the projections prepared for the national Third Five Year Plan (TFYP), showed three alternate scenarios up to the year 2000, giving low, middle and high rates for fertility and life expectancy. These assumptions and the results of the population projections are summarized as follows:

(a) The high projection assumes a constant fertility rate of 6.3 per thousand and an increase in life expectancy from 51 to 60 years during the period. This leads to a 1990 population of 117 million and a 2000 population of 164 million.

(b) The middle projection assumes that the fertility rate will decrease from 6.0 to 4.8 per thousand and the life expectancy will increase from 50 to 56 years by the end of the century. This results in population projections of 113 million and 147 million in 1990 and 2000, respectively.

(c) The low projection assumes a fertility rate decline from 5.6 to 3.8 per thousand and a constant life expectancy of 48 years. This leads to a 1990 population of 109 million and a 2000 population of 131 million.

The middle scenario (b) is recommended in the ONPP as the most preferable scenario, and is adopted as a basis of this study.

Thus, the future national population and labour force up to the year 2005 are estimated as shown in Table 6.1.1. From the table, it can be seen that the national annual average growth rate of the population is expected to continue at about 2.6%. This means that the population of Bangladesh in 2005 will be about 170 million people, or 70% more than at present.

Table 6.1.1 Future Population and Labour Force

Year	Population (Thousands)	G.R.(%)	L. Force (thousands)	G.R.(%)
1980/81	89,912	-	24,360	-
1984/85	99,529	2.57	27,509	3.09
1989/90	113,304	2.63	32,202	3.20
1994/95*	129,147	2.65	37,807	3.26
1999/00	147,147	2.64	44,353	3.25
2004/05*	167,395	2.61	51,869	3.18

Source: ONPP (Ministry of Works and UNCHS, 1985)
*: Interpolated and extrapolated

(2) Future Regional Population Projection

Assuming that the net migration for the country as a whole is zero and the natural growth rates of each district for each age/sex group are equal, the ONPP estimates future regional population taking into account the continuation of 1974-81 migratory trends for each age/sex group for each district.

The estimated future regional population taking into account the inter-district migration is shown in Table 6.1.2 based on the ONPP middle projection. The labor force distribution in each district is also estimated in Table 6.1.3 based on the ONPP middle projection.

In this projection, the male labour paticipation rates for the age groups up to 19 and over 65 years are assumed to gradually decrease due to increased school attendance, and the rates of other age groups are projected to remain at existing levels up to the year 2000. The female paticipation rates, on the other hand, are assumed to increase during the period because of changes in the religious lifestyle and working habits of Bangladeshi women.

The growth rates of population, especially in Chittagong Hill Tracts and Dhaka, are remarkably high, and the population of Dhaka is projected to reach 16.6 percent of the national population in the year 2005 from 12.4 percent in 1985.

These figures show that the centralization of population into urban areas will probably remain at a high level in spite of the government's decentralization policies. These policies will affect the decentralization of population somewhat. However, the migration of people into urban areas is likely to continue as long as the employment opportunities and income levels in urban and rural areas remain unbalanced.

This large increase of the population, especially in Dhaka and Chittagong, will bring about a sharp increase in the demand for all types of transport.

Table 6.1.2 Future Regional Population Projection
(Thousand persons)

	District	1980/81	(g.r. %)	1984/85	(g.r. %)	1989/90	(g.r. %)	1994/95*	(g.r. %)	1999/00	(g.r. %)	2004/05*
1	Chittagong	5664	3.32	6454	3.15	7537	3.12	8790	3.03	10204	2.90	11772
2	Chit. H.T.	782	7.93	1061	7.47	1521	7.13	2146	6.85	2989	6.54	4104
3	Comilla	7103	1.72	7603	1.84	8327	1.91	9153	2.00	10105	2.10	11209
4	Noakhali	3938	1.57	4192	1.68	4556	1.73	4963	1.77	5417	1.79	5921
5	Sylhet	5835	1.88	6287	1.81	6877	1.66	7468	1.55	8065	1.46	8671
6	Dhaka	10340	4.61	12382	4.24	15241	4.17	18698	4.11	22865	4.03	27854
7	Faridpur	4918	1.06	5129	1.33	5479	1.39	5871	1.43	6305	1.46	6778
8	Jamalpur	2530	2.02	2741	2.10	3041	2.12	3378	2.15	3757	2.18	4185
9	Mymensingh	6776	1.98	7328	2.04	8107	2.06	8978	2.07	9947	2.07	11021
10	Tangail	2527	1.68	2701	2.09	2996	2.20	3340	2.09	3704	1.84	4058
11	Barisal	4819	1.59	5133	1.53	5538	1.44	5950	1.40	6378	1.39	6833
12	Jessore	4145	2.57	4587	2.78	5262	2.81	6045	2.68	6901	2.46	7793
13	Khulna	4469	2.49	4931	2.43	5560	2.37	6250	2.23	6978	2.04	7719
14	Kushtia	2365	2.77	2638	2.95	3051	2.98	3534	2.85	4067	2.63	4630
15	Patuakhali	1897	2.34	2081	1.99	2296	1.70	2498	1.56	2700	1.53	2913
16	Bogra	2814	2.91	3156	3.06	3669	3.08	4270	3.05	4961	2.98	5746
17	Dinajpur	3300	3.34	3764	3.31	4429	3.25	5197	3.23	6091	3.21	7134
18	Pabna	3534	2.71	3933	2.96	4550	3.09	5297	3.10	6171	3.04	7167
19	Rajshahi	5440	2.80	6075	2.89	7006	2.77	8032	2.54	9105	2.25	10177
20	Rangpur	6716	2.29	7353	2.36	8261	2.37	9288	2.36	10437	2.33	11711
	Bangladesh	89912	2.57	99529	2.63	113304	2.65	129147	2.64	147147	2.61	167395

Source: ONPP (Ministry of Works and UNCHS, 1985)

*: Interpolated and Extrapolated

Note: g.r. = growth rate

Table 6.1.3 Future Regional Labour Force
(Thousand persons)

	District	1980/81	(g.r. %)	1984/85	(g.r. %)	1989/90	(g.r. %)	1994/95*	(g.r. %)	1999/00	(g.r. %)	2004/05*
1	Chittagong	1644	3.37	1877	3.12	2189	3.10	2550	3.27	2995	3.51	3558
2	Chit. H.T.	242	8.95	341	8.21	506	8.11	747	8.04	1100	7.77	1599
3	Comilla	1821	1.04	1898	1.48	2043	1.79	2233	1.87	2450	1.78	2676
4	Noakhali	965	0.82	997	1.33	1065	1.64	1155	1.65	1254	1.43	1346
5	Sylhet	1605	1.88	1729	2.17	1925	2.20	2146	1.96	2365	1.55	2554
6	Dhaka	3090	5.23	3789	4.65	4755	4.54	5936	4.73	7478	4.96	9527
7	Faridpur	1289	0.86	1334	1.29	1422	1.43	1527	1.23	1623	0.75	1685
8	Jamalpur	666	2.04	722	2.33	810	2.53	918	2.59	1043	2.54	1182
9	Mymensingh	1826	2.19	1991	2.40	2242	2.51	2537	2.47	2867	2.35	3220
10	Tangail	667	2.21	728	2.38	819	2.46	925	2.40	1041	2.27	1164
11	Barisal	1290	2.05	1399	2.24	1563	2.23	1745	2.03	1930	1.71	2101
12	Jessore	1099	4.11	1291	4.18	1584	3.93	1920	3.50	2281	3.02	2647
13	Khulna	1261	3.21	1431	2.95	1655	2.76	1896	2.68	2165	2.67	2470
14	Kushtia	620	4.20	731	4.08	893	3.79	1076	3.44	1274	3.08	1482
15	Patuakhali	496	2.29	543	2.62	618	2.67	705	2.46	796	2.10	883
16	Bogra	757	4.59	906	4.76	1143	4.80	1445	4.70	1818	4.54	2270
17	Dinajpur	893	3.48	1024	3.80	1234	3.92	1496	3.84	1806	3.67	2162
18	Pabna	919	3.73	1064	3.86	1286	3.81	1551	3.64	1854	3.40	2192
19	Rajshahi	1465	4.38	1739	4.37	2154	3.98	2618	3.39	3092	2.74	3540
20	Rangpur	1766	2.84	1975	3.06	2296	3.15	2681	3.09	3121	2.95	3610
	Bangladesh	24381	3.06	27509	3.20	32202	3.26	37807	3.25	44353	3.18	51869

Source: ONPP (Ministry of Works and UNCHS, 1985)
*: Interpolated and Extrapolated
Note: g.r. = growth rate

6.1.2 National Economy

(1) Future Gross Domestic Product Projection

The economy of Bangladesh has been dominated by the agricultural sector which still accounts for nearly half of GDP, although the share of the agricultural sector has steadily declined from some 60 percent in 1972/73 to an estimated 47 percent in 1984/85 as described in Chapter 2.

The forecasting of future GDP largely depends on the existing economic framework and the investment policy. Assuming that the economic growth is led by capital accumulation, the Bangladesh Energy Planning Project (hereinafter referred to as BEPP) designed a macroeconomic model and estimated the future GDP up to the year 2000 based on some investment allocation scenarios.

In the BEPP study, three different scenarios of the future growth and pattern of investment are examined. These are the reference, the low and the high scenarios, and they give rise to three alternative projections of the GDP growth. The average annual growth rates of total investment used in the three scenarios are shown in Table 6.1.4.

Table 6.1.4 Total Investment Growth Rate (%)

Period	Low	Reference	High
1985/86-1989/90	7	7	10
1990/91-1994/95	7	10	10
1995/96-1999/2000	7	9	10

Source: BEPP (Planning Commission, 1985)

The allocation of investment between sectors is also projected in the study using the following policy criteria:

(a) Agricultural output should be increased to achieve self-sufficiency in food within 10 years.

(b) The investment in the other sectors should achieve increase employment in the industrial sector and improved services and infrastructures in rural areas in order to discourage migration to urban areas.

The projected sectoral value added and GDP at constant 1982/83 prices projected by BEPP are shown in Table 6.1.5, and the projected sectoral shares of GDP are shown in Table 6.1.6 for all three scenarios. The projected average annual growth rates for each five year period for each sector are shown in Table 6.1.7, and the reference scenario is adopted as a basis of this study.

According to the Third Five Year Plan published by the Planning Commission, a target GDP growth rate of 5.4% per annum is adopted. However, this fiture is an optimistic target compared with the past achievement as listed below.

	FFYP (1973/74--77/78)	TYP (1978/79--79/80)	SFYP (1980/81--84/85)	TFYP (1985/86--89/90)
Target (%)	5.5	5.6	5.4	5.4
Real (%)	4.0	3.5	3.8	-

Note: FFYP First Five Year Plan
TYP Two Year Plan
SFYP Second Five Year Plan
TFYP Third Five Year Plan

In this study, therefore, the annual growth rate of GDP in the period of the TFYP is assumed to be 4.58% estimated by the BEPP as the reference scenario, and the future GDP estimation is summarized in Table 6.1.8.

Table 6.1.5 Projected Sectoral Value Added and GDP in million Tk (At constant 1982/83 prices)

Year	VAA	VAI	VAT	VAC	VAE	VAS	GDP
(Low Scenario)							
1985	142440	31805	25996	16935	1376	97659	316211
1990	162012	42411	31692	22317	2261	134929	395621
1995	186733	60590	40066	30159	3414	185034	505996
2000	211499	88484	51993	44646	5163	261250	663035
(Reference Scenario)							
1985	142473	31773	25989	16935	1376	97657	316203
1990	162141	42293	31665	22317	2261	134927	395604
1995	192125	65137	41727	31583	3590	193026	527188
2000	228901	103228	58386	50885	5895	294039	741334
(High Scenario)							
1985	143161	32464	26159	17093	1394	98555	318826
1990	169185	47046	33738	24117	2489	145124	421699
1995	209032	75521	47028	36238	4191	219657	591667
2000	258390	125641	69009	61308	7172	350537	872057

Note: VAA Value Added in Agriculture
VAI Value Added in Industry
VAT Value Added in Transport
VAC Value Added in Construction
VAE Value Added in Energy
VAS Value Added in Services
GDP Gross Domestic Product

Source: BEPP (Planning Commission, 1985)

Table 6.1.6 Projected Sectoral Share of GDP in percent

Year	Agr	Ind	Tra	Con	Ene	Ser	Total
(Low Scenario)							
1985	45.0	10.1	8.2	5.4	0.4	30.9	100.0
1990	41.0	10.7	8.0	5.6	0.6	34.1	100.0
1995	36.9	12.0	7.9	6.0	0.7	36.5	100.0
2000	31.9	13.4	7.8	6.7	0.8	39.4	100.0
(Reference Scenario)							
1985	45.1	10.0	8.2	5.4	0.4	30.9	100.0
1990	41.0	10.7	8.0	5.6	0.6	31.1	100.0
1995	36.4	12.4	7.9	6.0	0.7	36.6	100.0
2000	30.9	13.9	7.9	6.9	0.8	39.6	100.0
(High Scenario)							
1985	44.9	10.2	8.2	5.4	0.4	30.9	100.0
1990	40.1	11.2	8.0	5.7	0.6	34.4	100.0
1995	35.3	12.8	8.0	6.1	0.7	37.1	100.0
2000	29.7	14.4	7.9	7.0	0.8	40.2	100.0

Note: Agr Agriculture
Ind Industry
Tra Transport
Con Construction
Ene Energy
Ser Services

Source: BEEP (Planning Commission, 1985)

Table 6.1.7 Projected GDP and Value Added
Annual Growth Rate (%)

Year	Agr	Ind	Tra	Con	Ene	Ser	GDP
(Low Scenario)							
1985	-	-	-	-	-	-	-
1990	2.61	5.92	4.04	5.50	10.44	6.68	4.58
1995	2.88	7.40	4.80	6.38	8.59	6.52	5.04
2000	2.52	7.87	5.35	8.16	8.62	7.14	5.55
(Reference Scenario)							
1985	-	-	-	-	-	-	-
1990	2.62	5.89	4.01	5.67	10.44	6.68	4.58
1995	3.45	9.02	5.67	7.19	9.69	7.42	5.91
2000	3.56	9.65	6.95	10.01	10.43	8.78	7.06
(High Scenario)							
1985	-	-	-	-	-	-	-
1990	3.40	7.70	5.22	7.13	12.29	8.05	5.75
1995	4.32	9.93	6.87	8.48	10.98	8.64	7.01
2000	4.33	10.72	7.97	11.09	11.34	9.80	8.07

Note: Agr Agriculture
Ind Industry
Tra Transport
Con Construction
Ene Energy
Ser Services

Source: BEPP (Planning Commission, 1985)

Table 6.1.8 Future GDP Estimation

(1) Future sectoral value added and GDP in million Tk
(At constant 1982/83 prices)

Year	Agr	Ind	Tra	Con	Ene	Ser	GDP
1985	142473	31773	25989	16935	1376	97657	316203
1990	162141	42293	31665	22317	2261	134927	395604
1995	192125	65137	41727	31583	3590	193026	527188
2000	228901	103228	58386	50885	5895	294039	741334
2005	269804	167278	86337	82020	9713	464062	1079214

(2) Future sectoral share of GDP in percent

Year	Agr	Ind	Tra	Con	Ene	Ser	Total
1985	45.1	10.0	8.2	5.4	0.4	30.9	100.0
1990	41.0	10.7	8.0	5.6	0.6	31.1	100.0
1995	36.4	12.4	7.9	6.0	0.7	36.6	100.0
2000	30.9	13.9	7.9	6.9	0.8	39.6	100.0
2005	25.0	15.5	8.0	7.6	0.9	43.0	100.0

(3) Future GDP and value added annual growth rate (%)

Year	Agr	Ind	Tra	Con	Ene	Ser	GDP
1985	-	-	-	-	-	-	-
1990	2.62	5.89	4.01	5.67	10.44	6.68	4.58
1995	3.45	9.02	5.67	7.19	9.69	7.42	5.91
2000	3.56	9.65	6.95	10.01	10.43	8.78	7.06
2005	3.34	10.14	8.14	10.02	10.50	9.56	7.80

Note: Agr Agriculture
Ind Industry
Tra Transport
Con Construction
Ene Energy
Ser Services
GDP Gross Domestic Product

Source: BEPP (Planning Commission, 1985)

(2) Future Regional Distribution of GDP

The regional distribution of GDP is a measure of interregional economic activity and the movement of goods and people. Many factors contribute to the regional distribution of Gross Domestic Product including governmental development policy, investment allocation policy, the location of industry, the availability of natural resources, and patterns of agricultural land use. Although it is hard to explain the relative importance of these factors, it is assumed that the existing distribution of GDP has been based on all these factors in this study.

In order to estimate the future regional distribution of GDP, the past regional GDP distribution for each sector is examined based on the data in the Statistical Yearbook of Bangladesh published by BBS. There are only 6 years of data available for this purpose. However, it can be found that the regional contribution in each sector has been almost stable throughout this period. (Appendix 4, Table 6.1.1-6.1.12) Especially in the industrial, construction and service sectors, the regional contribution was very stable over these 6 years. In the agricultural sector, Dhaka shows a decrease in its share of agricultural production. The economic structure of Dhaka is changing from agriculture to other sectors. In the transport sector, Chittagong, Comilla, Dhaka, Barisal and Chulna, which have the major transport routes, show changes in their contribution.

In estimating the future regional GDP distribution in each sector, therefore, the following trends are taken into consideration.

(a) The concentration of population due to the migration into urban areas pushes up the shares of the industry, transport, construction and service sectors in these areas.

(b) The changes of the economic structure from agriculture to other sectors in urban areas reduces the shares of the agricultural sector in these areas.

Taking these trends and the TFYP into consideration, the regional distribution of GDP is estimated as shown in Table 6.1.9 at constant 1983/84 prices, and the regional per capita distribution is estimated as shown in Table 6.1.10.

From Table 6.1.9 it can be said that the two major districts, Dhaka and Chittagong, show a high growth rate because of the high shares of the industry and service sectors in these urban areas. Although Dhaka shows a high growth rate in the GRP, the per capita GDP in Dhaka shows a relatively low figure compared with the national average. However, this is not so low as to discourage people from migrating to Dhaka.

Thus, the strong growth of the economy in Dhaka will still attract population, and Dhaka will remain the center of the nation's economic activity.

Table 6.1.9 Future Regional Distribution of GDP
(At constant 1983/84 prices)

	District	1984/85	(g.r. %)	1989/90	(g.r. %)	1994/95	(g.r. %)	1999/00	(g.r. %)	2004/05
1	Chittagong	35314	5.59	46354	6.89	64678	8.48	97166	8.74	147734
2	Chit. H.T.	12377	4.59	15490	4.83	19606	6.26	26555	5.94	35436
3	Comilia	27019	4.87	34279	5.96	45790	7.23	64923	7.90	94951
4	Noakhali	14240	4.69	17904	5.77	23700	6.47	32423	7.64	46840
5	Sylhet	24828	4.41	30805	5.70	40647	6.71	56251	7.48	80697
6	Dhaka	46919	5.38	60978	6.94	85288	8.80	130032	8.95	199574
7	Faridpur	16757	3.59	19988	5.62	26267	6.32	35683	7.62	51519
8	Jamalpur	8794	4.15	10774	5.37	13998	6.36	19050	7.16	26923
9	Mymensingh	24847	4.21	30536	5.44	39791	6.40	54274	7.24	76965
10	Tangail	10258	3.92	12430	5.41	16179	6.05	21700	7.15	30646
11	Barisal	16937	4.40	21011	5.70	27717	6.61	38176	7.68	55254
12	Jessore	14596	4.20	17932	5.66	23617	6.83	32866	7.40	46969
13	Khulna	20752	4.64	26038	5.92	34718	7.36	49529	7.83	72220
14	Kushtia	8036	4.26	9901	5.79	13117	5.88	17453	7.55	25118
15	Patuakhali	7694	3.60	9184	5.36	11925	6.45	16303	7.15	23030
16	Bogra	11054	3.81	13327	5.44	17365	6.13	23382	7.21	33110
17	Dinajpur	12768	4.32	15772	5.47	20588	5.56	26985	7.20	38208
18	Pabna	12110	4.46	15063	5.73	19899	6.49	27244	7.57	39248
19	Rajshahi	18935	3.99	23023	5.51	30100	6.21	40679	7.31	57892
20	Rangpur	24730	4.51	30826	5.44	40167	6.24	54359	7.20	76964
	Bangladesh	368965	4.58	461615	5.91	615155	7.06	865034	7.80	1259290

Source: BEPP (Planning Commission, 1985) and Statistical Yearbook of Bangladesh (BBS, 1984/85)
Note: g.r. = growth rate

Table 6.1.10 Regional Distribution of Per Capita GDP
(At constant 1983/84 prices)

	District	1984/85	(g.r. %)	1989/90	(g.r. %)	1994/95	(g.r. %)	1999/00	(g.r. %)	2004/05
1	Chittagong	5472	2.37	6150	3.65	7358	5.29	9522	5.68	12550
2	Chit. H.T.	11666	-2.68	10184	-2.15	9136	-0.56	8884	-0.57	8634
3	Comilla	3554	2.98	4117	3.98	5003	5.13	6425	5.69	8471
4	Noakhali	3397	2.96	3930	3.97	4775	4.62	5985	5.74	7911
5	Sylhet	3949	2.55	4479	3.97	5443	5.09	6975	5.94	9307
6	Dhaka	3789	1.09	4001	2.66	4561	4.51	5687	4.73	7165
7	Faridpur	3267	2.23	3648	4.16	4474	4.81	5660	6.08	7601
8	Jamalpur	3208	2.00	3543	3.18	4144	4.12	5071	4.87	6433
9	Mymensingh	3391	2.12	3767	3.31	4432	4.25	5456	5.06	6984
10	Tangail	3798	1.79	4149	3.14	4844	3.88	5859	5.21	7553
11	Barisal	3300	2.83	3794	4.19	4659	5.14	5986	6.20	8086
12	Jessore	3182	1.38	3408	2.77	3907	4.04	4763	4.82	6027
13	Khulna	4208	2.16	4683	3.47	5555	5.03	7098	5.68	9356
14	Kushtia	3046	1.27	3245	2.72	3712	2.94	4291	4.80	5425
15	Patuakhali	3697	1.59	4000	3.60	4773	4.82	6038	5.54	7907
16	Bogra	3502	0.73	3632	2.29	4067	2.99	4713	4.10	5762
17	Dinajpur	3392	0.98	3561	2.15	3961	2.26	4430	3.87	5356
18	Pabna	3079	1.46	3311	2.56	3756	3.28	4415	4.40	5476
19	Rajshahi	3117	1.06	3286	2.66	3748	3.58	4468	4.95	5689
20	Rangpur	3363	2.10	3732	2.99	4325	3.79	5208	4.76	6572
	Bangladesh	3707	1.91	4074	3.17	4763	4.30	5879	5.06	7523

Source: Table 6.1.2 and Table 6.1.9
Note: g.r. = growth rate

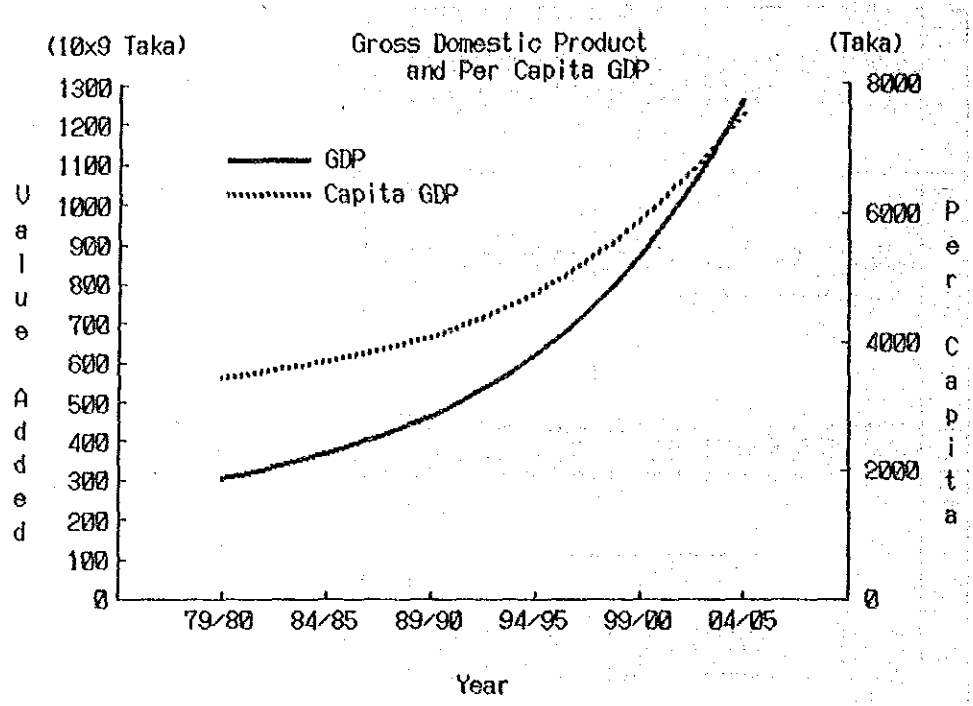


Fig. 6.1.1 GDP and Per Capita GDP

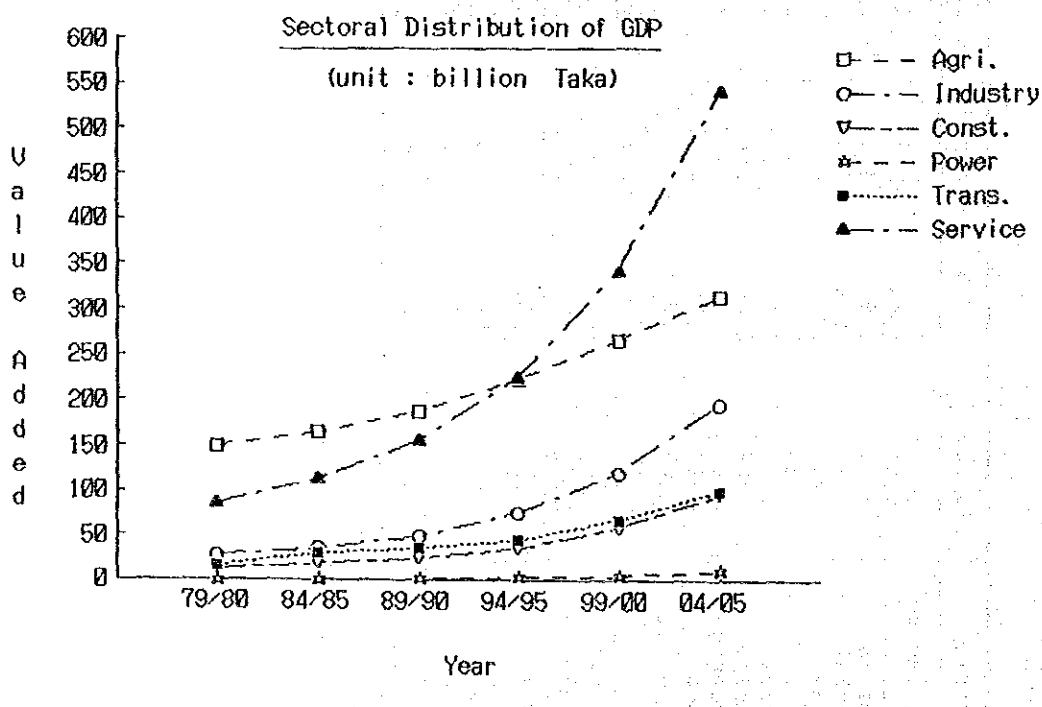


Fig. 6.1.2 Sectoral Distribution of GDP