

PEOPLES REPUBLIC OF BANGLADESH

JAMUNA RIVER BRIDGE CONSTRUCTION PROJECT

FEASIBILITY STUDY REPORT

VOLUME II

TRAFFIC AND ECONOMIC BENEFITS

AUGUST 1972

JAPAN INTERNATIONAL COOPERATION AGENCY

PEOPLE'S REPUBLIC OF BANGLADESH  
JAMUNA RIVER BRIDGE CONSTRUCTION PROJECT

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VOLUME VII  
TRAFFIC AND ECONOMIC BENEFITS

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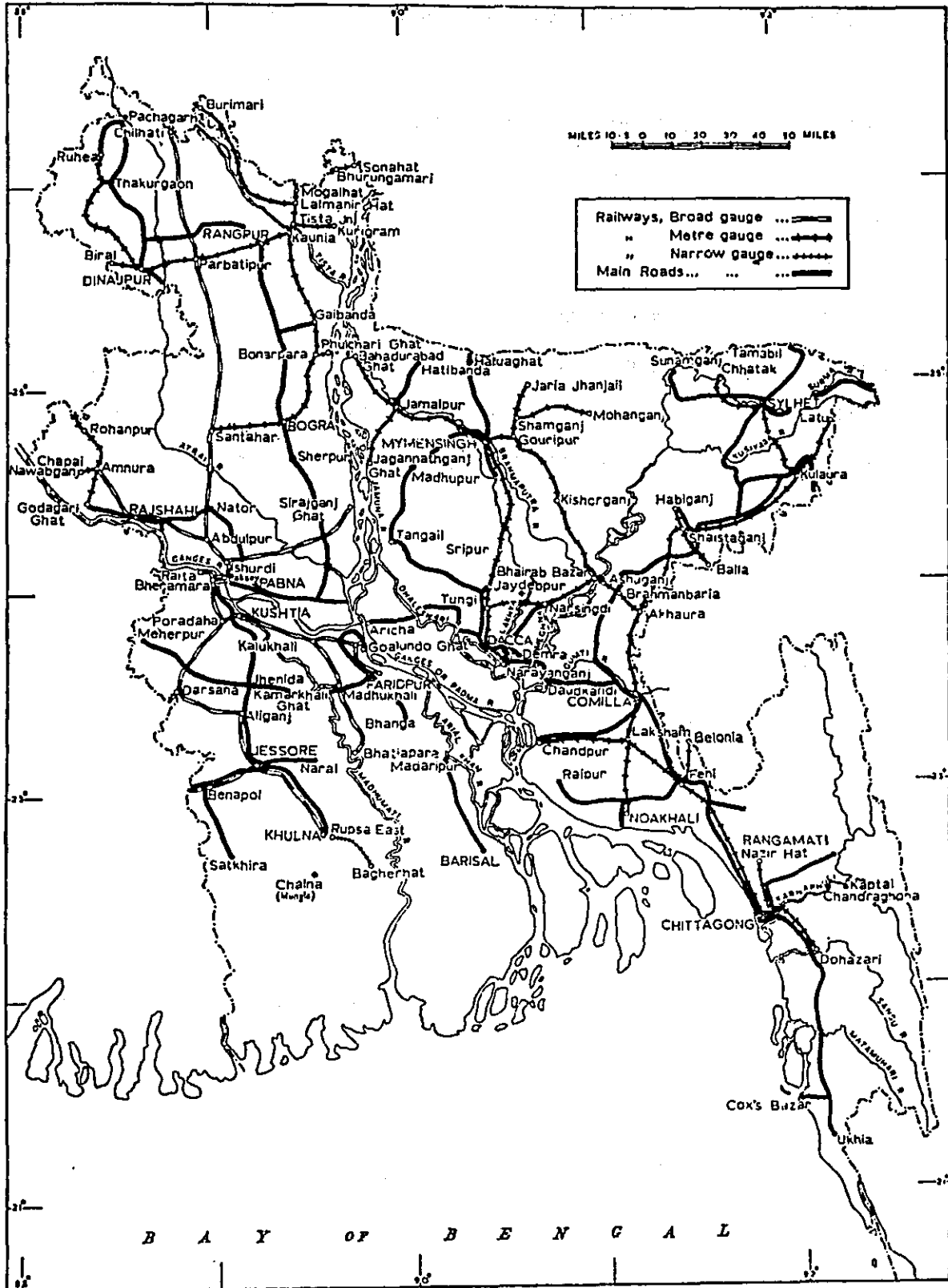
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FEASIBILITY STUDY REPORT ON JAMUNA RIVER BRIDGE CONSTRUCTION PROJECT

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## SUMMARY

The transport system of Bangladesh comprises inland waterways, railways, roads and airways. Of them the inland waterways provide communication and shipping routes of particular importance to Bangladesh the land of which is a huge delta divided by distributary rivers, large and small. In the pre-war days the railways transport more than half of the freight of Bangladesh, but after the war the waterways outweighed the railways which were devastated by the war. In the eastern region separated by the Jamuna and Padma rivers the railways are built to meter gauge and the Western region has broad-gauge systems. The two regions are connected by three ferry routes across the Jamuna river (ferry operated between Bahadurabad and Tistamuka to cater for both passenger and freight traffic and another operated between Jagannathganj and Sirajganj to cater for passenger traffic only).

However, the operation of ferry boats is hampered by cumbersome transshipment due to the difference in railway gauge and on top of that, the ferry terminals have to be moved from one place to the another depending on the bank condition which varies with the season. On the other hand, the ferry system itself is a bottleneck to vehicle traffic. The boats which ply between Aricha and Nagarbari and between Aricha and Goalundo do not have a enough capacity to carry across the Jamuna river all the vehicles arriving at Aricha one after another. Since the eastern and western regions of Bangladesh are connected by such inefficient ferry systems, no significant traffic occurs across the whole country except between the southwestern and northwestern districts with Khulna in between in the western region and between the southeastern and northeastern districts with Chittagong and Dacca in between in the eastern region. In this country, however, the roads still do not play such an important role as the railways. The railways carried across the Jamuna river about 5,900 persons per day in 1973 and 1974 and about 1,600 tons per day of freight in 1968 and 1969, whereas road traffic consisted of about 2,300 per day of persons in 1973 and 1974, and about 118 vehicles per day and 88 tons per day of freight in 1973 and 1974. The inland waterways carried 436 tons per day of freight in 1972 and 1973.

As suggested by the underdeveloped transport system of Bangladesh, the economic activities are rather slow. For the past ten years the GNP grew at an average annual rate of about 4.4%, while her population increased at an average annual rate of about 3%. Bangladesh economy is essentially based on agriculture to which a little more than 55% of the national income is attributable (1969 and 1970), but the country is not self-sufficient in food grains.

This may be in part accounted for by the lack of technical renovation of agriculture, but the main obstacle to self-sufficiency in food supply seems to be the population. In 1973 and 1974 the country had a population of about 76 millions, giving an average

density of 528 persons per sq.km. (far higher than the average density of 292 persons per sq.km in Japan). Judging by the fact that the nation's agriculture only grew at an average annual rate of about 3.2% in the period of from 1961 to 1974, the problem of population is of paramount importance to this country.

The output of the manufacturing industry accounted for no more than 8.5% of GNP, showing an average annual growth rate of 10.5% from 1964/65 to 1969/70. The fact that the absolute level of industrial development is rather low suggests that little change is taking place in the industrial structure of the country.

The first five-year plan which was announced under such an economic situation aims to boost the nation's GDP at least at an annual rate of 5.5% by 1977/78, achieve self-sufficiency in food supply and control population growth. In the light of the slow economic activities and unstable political situation of the country, however, it seems rather difficult for the nation to achieve these objectives of the first five-year plan.

The transport system and economy of Bangladesh have been broadly sketched as an introduction to the Study Report on the Jamuna Bridge Construction Project. The estimation of future traffic in this country which is required for materialization of this project has made it necessary to analyze the regional aspect of the nation's economy, to respect the economic targets set by the first five-year plan, to estimate the regional economic development and the resulting traffic growth and to determine the effects of the Jamuna river bridge on the transport system of the country. In Tables 1 and 2 are shown the flow charts of future traffic growth estimation. The estimate of future traffic crossing the Jamuna river at Sirajganj which has been made through these processes is shown in Table 3. Concerning the benefits which are expected to result from the construction of the bridge, a distinction has been drawn between direct and indirect benefits. In the present survey future traffic has been estimated for the years 1993 and 2020, and a simple estimate has been made for other years (from 1990 to 2020).

Table 1

Flow Chart for Estimation of Future Traffic (Passengers)

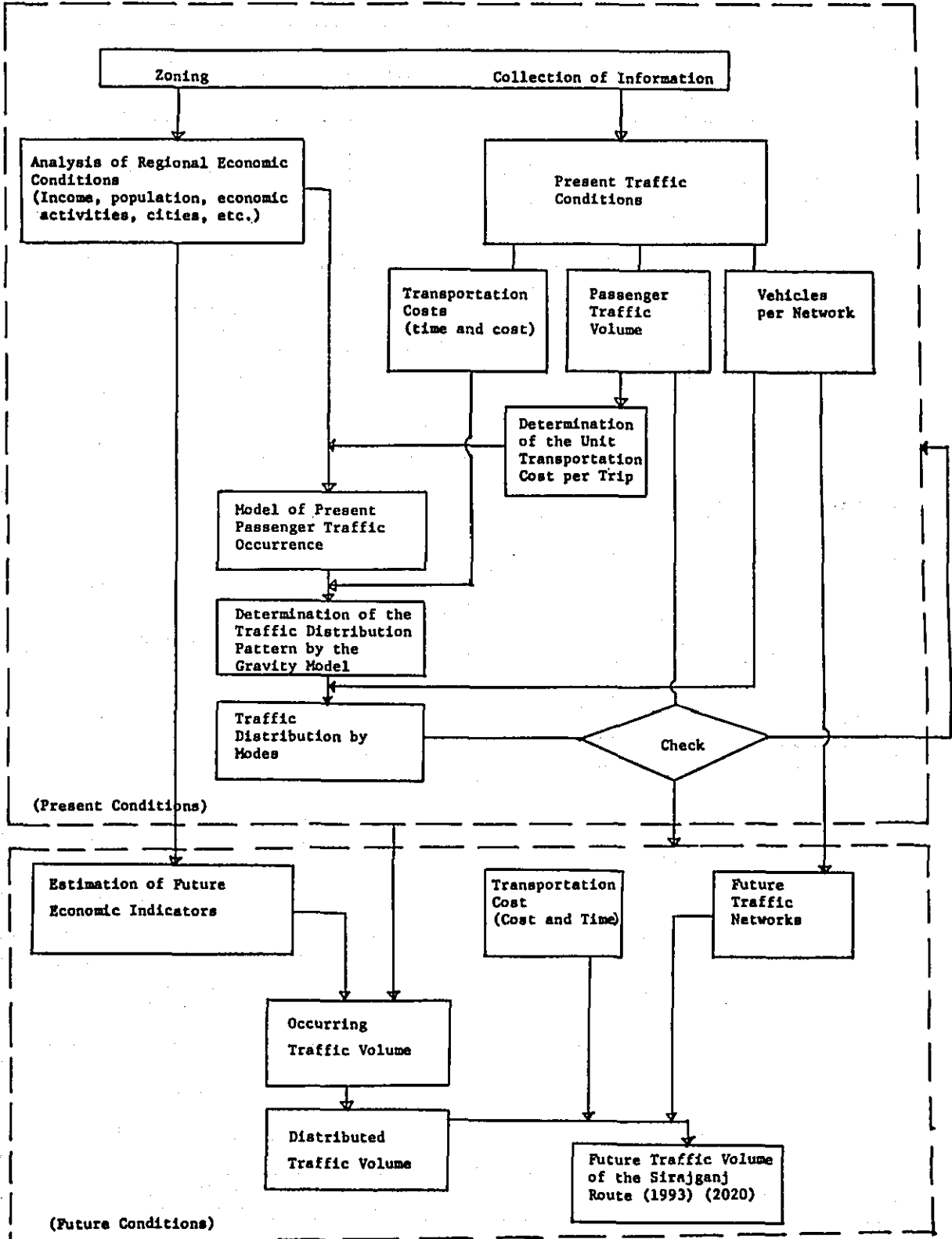




Table 2

Flow Chart for Estimation of Future Traffic (Freight)

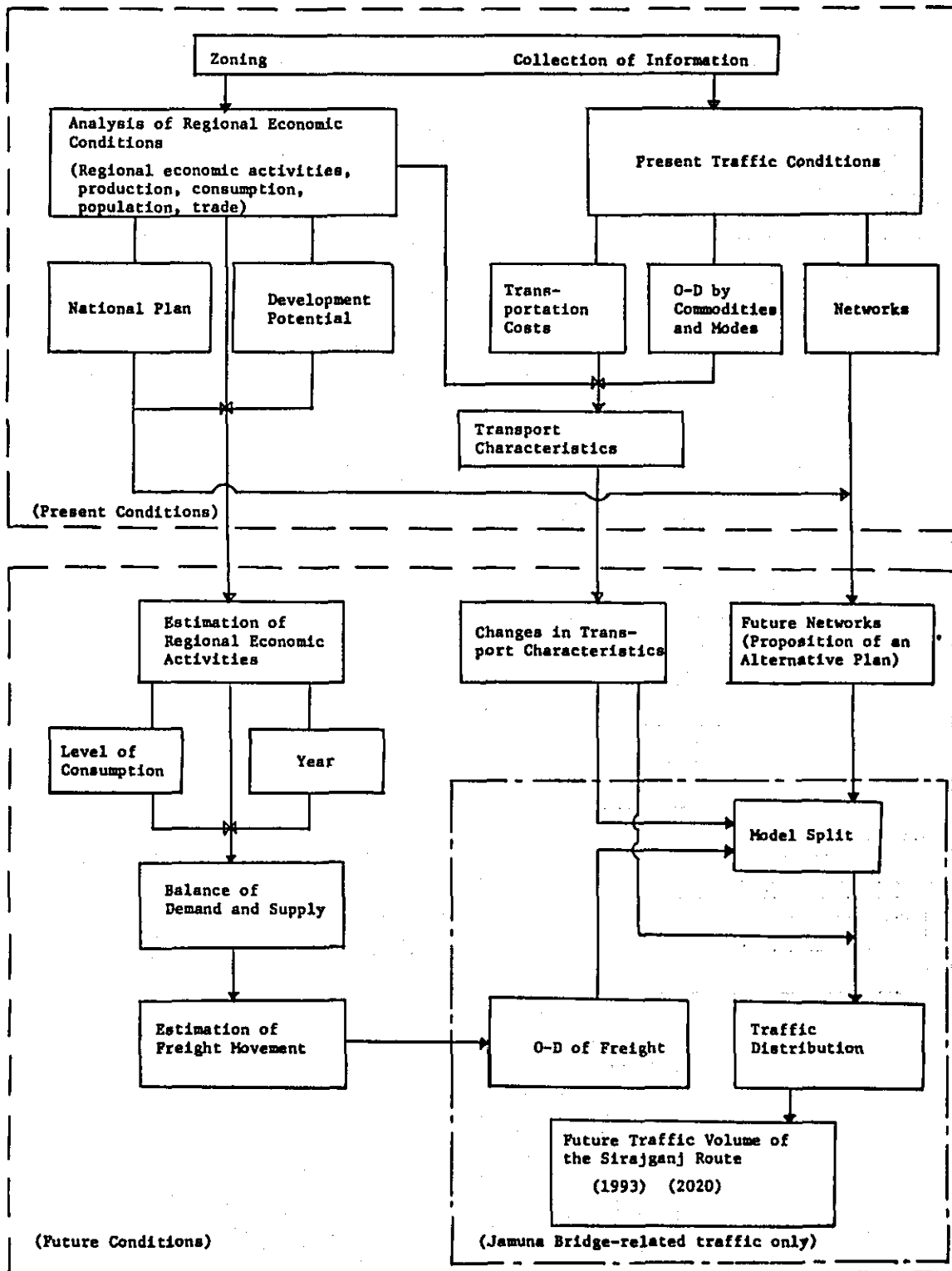


Table 3 Volume of Future Traffic Crossing the Jamuna River Bridge (at Sirajganj)

Item	1 9 9 3		2 0 2 0	
Passenger Cars	12,629 units/year	3,460 units/day	20,057 units/day	5,495 units/day
Roads				
Buses	1,106	303	1,752	480
Trucks	617	169	2,015	552
Total	14,352	3,932	23,824	6,527
Railways				
Passenger Trains	8,760 trains/year	24 trains/day	13,870 trains/year	38 trains/day
Freight Trains	2,555	7	7,665	21
Total	11,315	31	21,535	59

Table 4 Passenger and Cargo Traffic across the Jamuna Bridge by the  
Composition of Traffic Generation

Mode of Traffic	Composition of Traffic Generation	Year 1993			Year 2020			Total
		Normal Traffic	Diverted Traffic	Induced Traffic	Normal Traffic	Diverted Traffic	Induced Traffic	
Road	(Passenger Car)	823	2,183	454	1,761	3,013	721	5,495
	(Bus)	72	191	40	153	264	63	480
	(Truck)	-	169	-	-	552	-	552
	Total	3,438	494	3,932	5,743	784	6,527	
Railway	(Passenger Train)	8,051	21,456	4,438	16,784	23,822	6,877	52,493
	(Cargo Train)	0	6,860	-	0	19,758	-	19,758

Annual Average Daily Traffic Crossing the Jamuna Bridge

Annual average daily traffic crossing the Jamuna Bridge was estimated by a simplified (direct) method for all years between 1990 and 2020. The years before 1990 were excluded from the estimation, because the completion of the Jamuna Bridge is set for 1990.

Table 5 Annual Average Daily Traffic across the Jamuna Bridge by Modes of Transport

Year	Cars (Veh./day)				Trains (Trains/day)		
	Passenger Cars	Buses	Trucks	(Total)	Passenger Trains	Freight Trains	(Total)
1990	3,234	283	126	3,643	23	6	29
1991	3,309	290	141	3,740	23	6	29
1992	3,385	296	155	3,836	24	7	31
1993	3,460	303	169	3,932	24	7	31
1994	3,535	310	183	4,028	25	8	33
1995	3,611	316	197	4,124	25	8	33
1996	3,686	323	212	4,221	26	9	35
1997	3,761	329	226	4,316	26	9	35
1998	3,837	336	240	4,413	27	10	37
1999	3,912	342	254	4,508	27	10	37
2000	3,988	349	268	4,605	28	11	39
2001	4,063	355	283	4,701	28	11	39
2002	4,138	362	297	4,797	29	12	41
2003	4,214	369	311	4,894	29	12	41
2004	4,289	375	325	4,989	30	13	43
2005	4,364	382	339	5,085	30	13	43
2006	4,440	388	353	5,181	31	14	45
2007	4,515	395	368	5,278	31	14	45
2008	4,591	401	382	5,374	32	15	47
2009	4,666	408	396	5,470	32	15	47
2010	4,741	415	410	5,566	33	16	49
2011	4,817	421	424	5,662	33	16	49
2012	4,892	428	439	5,759	34	17	51
2013	4,967	434	453	5,854	34	17	51
2014	5,043	441	467	5,951	35	18	53
2015	5,118	447	481	6,046	35	18	53
2016	5,194	454	495	6,143	36	19	55
2017	5,269	460	510	6,239	36	19	55
2018	5,344	467	524	6,335	37	20	57
2019	5,420	474	538	6,432	37	20	57
2020	5,495	480	552	6,527	38	21	59

Table 6 Annual Economic Direct Benefits by year

<u>Year</u>	<u>Million TK/year</u>
1990	483
1991	501
1992	520
1993	538
1994	557
1995	575
1996	594
1997	612
1998	631
1999	649
2000	668
2001	686
2002	705
2003	723
2004	742
2005	760
2006	779
2007	797
2008	816
2009	834
2010	853
2011	871
2012	890
2013	908
2014	927
2015	945
2016	964
2017	982
2018	1,001
2019	1,019
Total (30 years)	22,530

Table 7 Benefits from Ferry System Saving  
(in Economic Cost)

Unit: Million Tk

Year	Ferry facilities' cost saving		Maintenance & Management Expenses saving		Total
	Ferry	Pontoon	Ferry	Pontoon	
	1990	434.7	116.90	104.92	
91	52.4	-	106.94	9.1	168.54
92	127.16	-	121.28	9.1	257.54
93	52.5	4.2	123.30	9.34	189.34
94	52.5	-	125.31	9.34	187.15
95	52.5	-	127.32	9.34	189.16
96	52.5	-	129.33	9.34	191.17
97	81.66	-	129.33	9.34	220.33
98	99.16	4.2	136.72	9.58	249.66
99	52.5	-	138.73	9.58	200.81
2000	173.81	125.65	140.75	9.58	449.74
01	35.0	-	142.76	9.58	187.34
02	35.0	4.2	144.77	9.82	193.79
03	81.66	-	146.79	9.82	238.27
04	35.0	-	148.80	9.82	193.62
05	156.31	-	163.15	9.82	329.28
06	35.0	4.2	165.16	10.06	214.42
07	81.66	-	172.54	10.06	264.26
08	116.66	-	174.55	10.06	301.27
09	52.5	-	174.55	10.06	237.11
2010	144.66	-	176.56	10.06	331.28
11	70.0	8.4	178.57	10.30	267.27
12	70.0	-	180.59	10.30	260.89
13	70.0	-	182.60	10.30	262.90
14	70.0	-	184.61	10.30	264.97
15	145.81	4.2	192.00	10.54	352.55
16	116.66	4.2	194.01	10.54	325.41
17	70.0	-	196.03	10.54	276.57
18	191.31	-	210.37	10.54	412.22
19	127.16	129.85	212.39	10.78	480.18
20	-806.21	-114.31	-	-	-920.52

CHAPTER I  
REGIONAL ECONOMY

1. Outline of Economy.

1.1. General.

No reliable data concerning GNP or GDP which shows a level of economic activities of the country have been available. In the East Pakistan period broad statistics of domestic production up to 1969/70 was published by the Central Bureau of Statistics, but its authenticity is questionable from the fact that there is found a probable over-estimation in the statistics, compared with that estimated by the Planning Commission after the independence.

The estimate of the Planning Commission has revealed that GDP in 1969/70 was Taka 31.4 billion (approximately US 4.3 billion at 1969/70 price), per capita GDP Taka 457 (approximately US 63), and its average annual rate of growth remained as low as 4.4%. Due to the big blow by the war in 1972/73 GDP decreased by 10% of the 1969/70 GDP and currently it has not recovered to its prewar level.

In the structure of GDP the ratio of agricultural sector which is on the decrease to the whole economy occupied over 55% in 1969/70, while that of manufacturing 8.7%. However, the average annual rate of growth of the former was 3-3.3%, while that of the latter was recorded at 10.5% in 1964/65 - 1969/70. Especially the growth rate of large-scale industries is remarkable. This is because an investment allocation to East Pakistan was increased during the third plan period (1965-70). It can be said, however, that with the absolutely low economic level in consideration, the economic structure by industries has not changed greatly as indicated in Table 1-1.

The structure which is so agriculture-oriented would continue in the future because the First-Five-Year Plan establishes its targets of agriculture and manufacturing at 55.1% and 11.2% of GNP respectively at the end of the plan period.

As shown in Table 1-1, the average annual rate of growth of GNP for the last decade has remained 4.4%. With consideration of the growth rate in population of 3%, the rate of per capita income amounts to slightly over 1%.

Under these circumstances the First-Five-Year Plan is established. The basic targets of the plan are as follows:

- (1) Through the increase of employment opportunities, to aim at eliminating poverty;
- (2) Recovery from the war damages. Especially in agricultural and manufacturing sectors to recover the production capacity to the 1969/70 level by 1973/74;

- (3) To attain an annual rate of growth in GNP of at least 5.5%, exceeding the rate of growth in population (approximately 3%), and to raise per capita income;
- (4) To secure basic consumer goods, such as foodstuff, clothes, edible oils, sugar, fuels, etc.;
- (5) To control the rising prices;
- (6) To set the lowest annual rate of growth in per capita income at 2.5%;<sup>1</sup>
- (7) To secure benefits from socialization, enlarging gradually the scope of national participation and reforming the economic institutions according to the political and social change;
- (8) To decrease the dependency on the foreign aids by mobilizing and developing the national resources. To expedite an alternate import to get rid of dependency upon unreliable supply from foreign countries of, especially, fertilizer, cement, steel, etc.;
- (9) To attain self-sufficiency in foodstuff, avoiding an inflow of population to urban areas, by enlarging employment in rural areas and conducting institutional and technical reformation in agriculture;
- (10) To lower the rate of growth in population which threatens the national economic developments from 3% at the present level down to 2.8%;
- (11) To improve educational, hygienic, rural housing, water supply facilities in order to improve quality of labour force; and
- (12) To secure impartial allocation of income and employment opportunities. To expedite migration of labour force into the areas where employment opportunities are open.

In the First Five Year Plan the planned investment amounts to Taka 44,55 billion and its financial sources consisting of Taka 26.98 billion from the domestic savings and Taka 11.99 billion from foreign aids (which amounts to 40.4% of the total). The domestic savings consist of the surplus revenue, additional tax and tax increase of the Government and private savings. The total outlay of the Plan is estimated at an increase of 10% to the average per capita outlay during the period 1965-70. Table 1-2 shows the development expenditure and its revenue sources of the Five Year Plan.

As for the sectoral investment allocation, 24% of the total outlay goes to agriculture and water resources (compared with 33.3% of the total investment for East Pakistan during the fourth Five Year Plan period of Pakistan) and 19.7% to manufacturing (compared with 10.7% during the same period). Although slightly more emphasis on manufacturing sector can be perceived, there would be no big change in industrial structure through the Plan as illustrated in Table 1-3.



According to the plan, the annual rate of growth in GDP is 5.5% and the rate of growth in per capita GDP 2.5%. However, these rates are based on a level in a normal year before the war. To a level in 1972/73 after the war they go up to as high as 28.8% and 5.7% respectively. This comes from the assumption that the production would be restored by the year 1973/74, the initial year of the plan. In this table the rate of growth in the primary industry is 4.6% which is a high rate compared with the past actual result of 3.0-3.3%.

Table 1-1 Components of Gross National Product 1959/60 - 1969/70

Unit: Million Rupee

Sector	Year	1959/60	1964/65	1969/70	Rate of Growth per annum (2)	
					59/60 - 64/65	64/65 - 69/70
Agriculture		9,919(62.1)	11,481(58.1)	13,514(55.1)	3.0 %	3.3 %
Manufacturing		965( 6.0)	1,293( 6.5)	2,128( 8.7)	6.0	10.5
Scale	Large	434( 2.7)	679( 3.4)	1,422( 5.8)	9.3	16.1
	Small	531( 3.3)	606( 3.1)	691( 2.9)	2.7	2.7
Construction		240( 1.5)	954( 4.8)	1,447( 5.9)	32.0	8.7
Public Services		23( 0.1)	123( 0.6)	218( 0.9)	41.0	11.2
Transportation		990( 6.2)	1,268( 6.4)	1,494( 6.1)	5.1	3.3
Other Services		3,801(22.8)	4,653(23.5)	5,735(23.4)	4.1	4.3
Total		15,938 (100.0)	19,777 (100.0)	24,566 (100.0)	4.4	4.4

Source: Economic Survey of East Pakistan (1969/70), Planning Department, Government of East Pakistan.  
Statistical Digest of Bangladesh (1970/71).

Table 1-2 Development Expenditure and Revenue Source

Unit: 10 Million Tk

Item	Monetary Expenditure	Non-monetary Expenditure
<b>1. Developmental Expenditure</b>		
Governmental	3,952	
(Investment)	(3,298)	
(Non-investment)	(654)	
Non-governmental	503	585
(Investment)	(471)	(585)
(Non-investment)	(32)	
Total Expenditure	4,455	585
(Investment)	(3,769)	(585)
(Non-investment)	(686)	
<b>2. Domestic Savings</b>		
(Government Savings)	2,698	
(Non-government savings and Bank loans)	(1,618)	
	(1,080)	(585)
<b>3. Inflow of Foreign Capital</b>		
Equivalent Domestic Resources	1,799	
	1,757	

Source: The First Five Year Plan.

Table 1-3 Gross Domestic Product and its Components

Unit: 10 Thousand Tk 1972/73 prices

Item	Benchmark GDP	Estimated actual GDP 1972/73	Projected GDP 1977/78	Annual percent-age rate of Growth over Benchmark GDP	Annual percent-age rate of Growth over Benchmark 1972/73 GDP
Agriculture, Live-Stock, Forestry and Fishery	2,883 (57.6)	2,407 (56.1)	3,602 (55.0)	4.6	8.4
Manufacturing	520 (10.4)	358 ( 8.3)	731 (11.2)	7.1	15.4
Construction	184 ( 3.7)	171 ( 4.0)	326 ( 5.0)	12.1	13.7
Power and Gas	15 ( 0.3)	15 ( 0.3)	25 ( 0.4)	11.0	11.0
Housing	236 ( 4.7)	236 ( 5.5)	288 ( 4.4)	4.1	4.1
Trade, Transport and other services	1,165 (23.3)	1,107 (25.8)	1,570 (24.0)	6.2	7.2
Total	5,003 (100.0)	4,294 (100.0)	6,542 (100.0)	5.5	8.8
per capita GDP (taka)	676	580	766	2.5	5.7

Source: The First Five Year Plan 1973-78.

Note: Figure in ( ) is percentage of total.

## 1.2. Agriculture.

### 1.2.1. General.

Agriculture is of basic importance to Bangladesh, occupying 55% of GDP. The past economy of Bangladesh was agriculture-oriented at the rates of growth of 3.0% for the whole agricultural products and of only 2.0% for foodgrains products, which were too low, compared with the rate of growth of 3.0% in population.

For this reason the unbalance between supply and demand of foodstuff has been increasing, and the resulting increase of foodstuff imports has been accelerating. The imports of foodstuff in 1969/70 amounted to 1.5 million tons, which is 13% of the production of rice and wheat and 29% of the total imports in the same year.

Bangladesh has been unable to maintain self-supply in foodgrains including rice although her economy is of an agriculture-oriented structure. This is the most fundamental problem for agriculture and eventually for the whole economy of the country, that is, without surplus of agricultural yield the growth in other sectors is obliged to be restrained, thus her economic take-off being hindered.

Although the agricultural development has been treated as top-priority since the East Pakistan period, the yield has not been so successful as intended. This may be due to the following interrelated causes:

- (1) Absence of suitable policies of agricultural development;
- (2) Insufficient encouragement policies;
- (3) Technical handicaps;
- (4) Low level of investment;
- (5) Inefficient implementation of developmental programmes; and
- (6) Infrastructures which is ill-installed and unsuitable.

In addition to the above, there is another big factor that farmers have no ability to understand and accept new knowledge and improvement of techniques, with less than 20% of the spread of education.

In South East Asia in the 1960's there were some examples that great success was made in agricultural production increase by introducing new techniques and species improvement. In Bangladesh there has been a similar motivation in recent years, but no good results have come out.

Industrial development in Bangladesh being oriented traditionally to her agriculture, the main outputs, especially, rice crops of aus (summer harvested rice) and aman (winter harvested rice), and jute are subject to the climatic and physiographic conditions and the fluctuation of their annual production is great.

In the latter half of the 1960's varieties of high-yield rice were introduced throughout the country. However, due to scanty systems of irrigation facilities, which are indispensable for the spread of the species, and which occupy only 7% of the total cultivated acreage, farmers are obliged to depend upon the old low-yield species. The effect of the high-yield species is great, but its cropping acreage occupies only 5% of the total rice cropping area.

### 1.2.2. Natural conditions and land use.

#### (1) Natural conditions

##### a. Topography

Bangladesh may be roughly divided into three main topographical divisions:

- i) Tertiary deposit (terrace)
- ii) Diluvial terrace, and
- iii) New alluvial plain

The agrarian economy of Bangladesh is in activity on the three areas of the new alluvial plain and on a part of the diluvial terrace.

The diluvial terrace which had been subject to past erosion and afterwards covered with deposits, filled with substance from its upstream and vicinity. On its surface additional deposits were made, thus forming the new alluvial plain where some terraces are recognized.

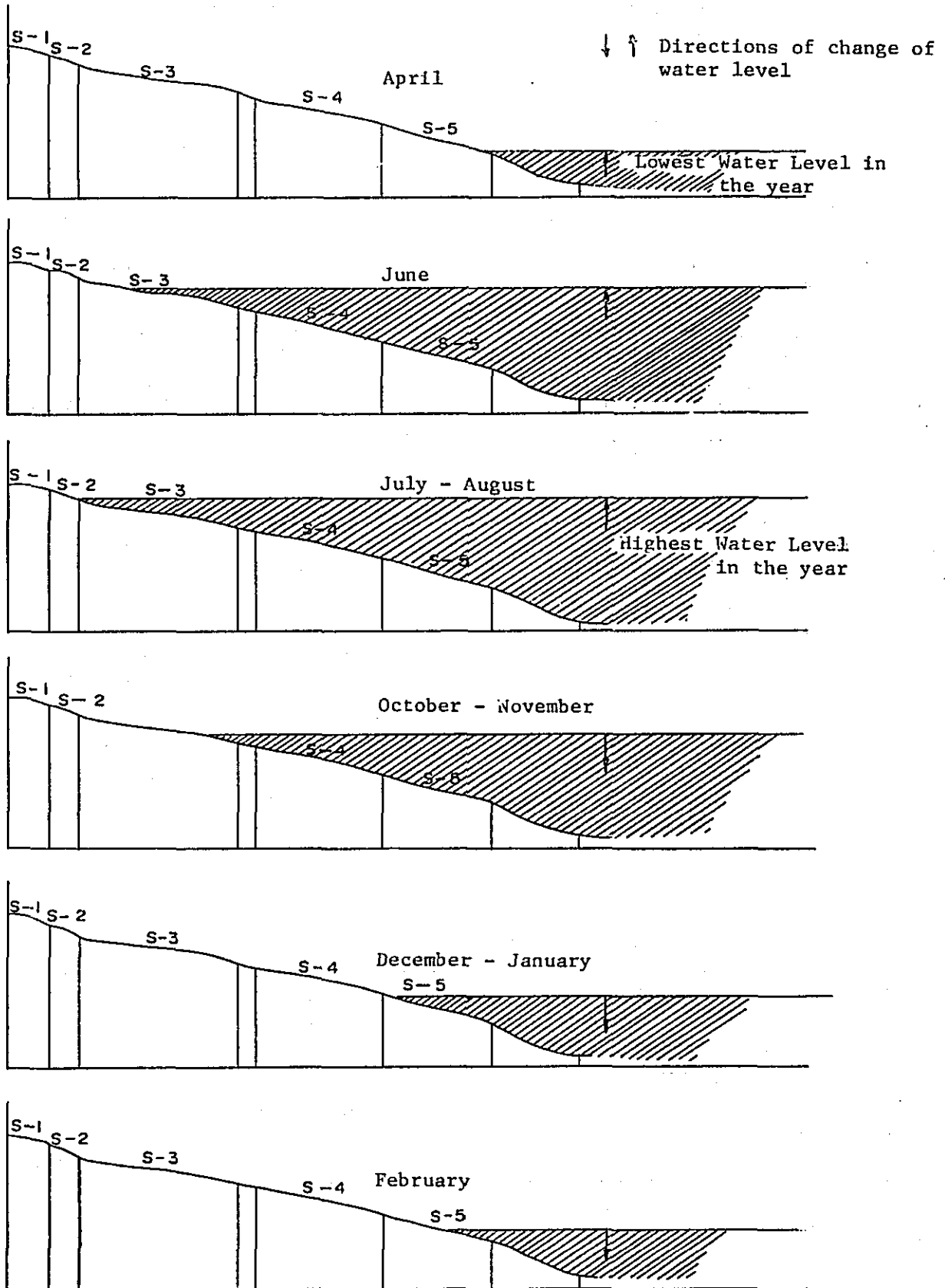
##### b. Rainfall areas

Annual rainfall varies with the locations; Rajshahi in the northwest and Khulna receive the least rainfall with less than 60 inches (1,524 mm) and from there the rainfall increases radially to the east, reaching as much as 90 inches (2,286 mm) in the whole Sylhet district, the north of Rangpur and Dinajpur, and the coastal area of the Bay of Bengal.

On the basis of the seasonal variation of the rainfall, one year can be divided into three seasons:

<u>Seasons</u>	<u>Period</u>	<u>Rainfall to the total by percentage</u>
i) Monsoon or rainy	June- October	78
ii) Dry or winter	November- February	3
iii) Nor'wester or summer	March- May	19

Figure 1-1 Seasonal Change of Water Table for Five Arable Land Surfaces



Such seasonal fluctuation of rainfall which fits in well with the low arable plains, have direct relation to a pondage for arable lands and exert a great influence on the use of arable lands and agricultural cropping.

c. Water elevation of arable land

The distribution of the current agricultural products is considered to have a relation to the difference of delicate relative height between cropping lands, and this relation seems to be at work as absolute relative height in some area according to the difference of its water utilization.

The arable lands of Bangladesh can, in terms of agricultural products, be divided into five terraces or slopes, which are of great importance. If they can be classified in the order of the higher relative height, they will be Surface-1, Surface-2, Surface-3, Surface-4 and Surface-5 (hereinafter called S-1, S-2, ..... and S-5). These surfaces are not always connected with other surfaces with the difference of their relative height, but flushed with gentle slope.

Both S-1 and S-2 are mainly on the diluvial terrace including some higher portions covered with soil deposits. These two faces are free from the floods in the monsoon or rainy season and they will not have the same water level in their areas as that for the other surfaces, S-3 to S-5, that are lower than the first. Figure 1-1 shows the seasonal variation of the water level for the five cropping land surfaces.

The varieties of agricultural activities in Bangladesh consist of the different waterholding conditions of the cropping surfaces of different relative heights.

Innumerable natural canals (Khal) run through the plains, being serviceable for drainage purpose in the rainy season as well as for irrigation purpose of rice cultivation in the dry season.

Table 1-4 Five Arable Surfaces and Related Cultivated Crops

Farming Season	Surface S - 1	S - 2	S - 3	S - 4	S - 5
First April-August	Aus	Aus	Ans, Jute		
Second August-December	T.aman	T.aman	T.aman	B.aman	
Third December-April		Vegetables pulses	Oil seeds pulses Boro - 2	Sugarcane Boro - 2	Boro - 1

- Note: 1) Aus is a rice variety which is sensitive to temperature and flowers with integral temperature.
- 2) Aman is a rice variety which is photosensitive and flowers with the reduction of time from sunrise to sunset.
- 3) Boro is a kind of Aus which is cultivated in winter in the tropical regions.
- 4) B. Aman = Broadcast Aman is the most important rice paddy which is cultivated from the second cropping season. It is sown broadcast as well as transplanted, though the latter method is more usual than the former: the reasonability of naming "broadcast has recently been thinning out.
- 5) Boro rice is divided into two types for the above tabulation: Boro-1 which is cultivated traditionally on lower land and Boro-2 which is cropped by means of artificial irrigation made in recent years.
- 6) Sugarcane cultivation extends through the first, second and third cropping seasons.

## (2) Land use

Bangladesh, with an area of 35.3 million acres (approximately 142.7 thousand square kilometers), has a cultivated area of 22.48 million acres (approximately 64% to the whole area) and climate and soils are suitable for cropping throughout the year.

With a cropping area of 31.53 million acres, the rate of double cropping land averages 48%. Therefore, almost all arable land is under utilization and enlargement of cultivated land is very difficult. From this fact it can be said that the improvement of productivity is the only approach to raise agricultural production.

As shown in Table 1-5, each district has a high rate of cultivated land and very little uncultivated land, and seems to have utilized every possible area. This rate has not have a big change in the historical trend.

The districts of Chittagong, Chittagong Hill Tracts and Khulna have a relatively low rate with a larger forested area. The divisions which have a higher rate are Dacca with 70.5% and Rajshahi with 72.6%. By districts, Comilla has the highest rate with 80.5%, followed by Noakhali with 76.8%, Bogra with 76.2%, Jessore with 75.0%, Dinajpur with 74.9% and Mymensingh with 74.2%. Almost all other districts have a high rate with over 60%.

As for the rate of double cropping land all districts have over 120%. Especially, Rangpur, Faridpur, Comilla and Mymensingh show high figures.

Table 1-5 Land Use by District in 1970/71

Unit: Thousand acres

DISTRICT	Area	Forested (Rate:%)	Uncul- tivable (Rate: %)	Uncul- tivated (%)	Suspended (%)	Cultivated(A) (%)	No. of Crops		Gross Cropping Area	Rate of Cropping (B/A: %) in 1971/72	Rate of Cultivated (B/A: %) in 1971/72
							Year Single	Year Two			
CHITTAGONG DIVISION	7,838	3,568(45.5)	798(10.2)	253(3.2)	138( 1.8)	3,179(40.6)	1,789	1,207	183	4,752	149
CHITTAGONG	1,731	545(31.5)	320(18.5)	56(3.3)	57( 3.4)	751(43.4)	502	234	15	1,015	135
CTG. H.T.	3,259	3,002(92.1)	66( 2.1)	10(0.3)	6( 0.2)	173( 5.3)	82	78	13	277	160
COMILLA	1,660	18( 1.1)	255(15.4)	14(0.8)	28( 1.7)	1,344(80.5)	638	593	113	2,113	161
NOAKHALI	1,187	1( 0.1)	156(13.1)	72(6.1)	47( 4.0)	911(76.8)	567	302	42	1,297	142
DACCA DIVISION	8,978	450( 5.0)	1,887(21.0)	169(1.9)	316( 3.5)	6,056(67.5)	3,287	2,517	251	9,075	150
SYLHET	3,062	205( 6.7)	825(26.9)	39(4.5)	8( 0.2)	1,885(61.6)	1,289	530	66	2,547	135
DACCA	1,844	64( 3.5)	396(21.5)	8(0.5)	128( 6.9)	1,247(67.6)	779	373	95	1,811	145
MYMENSINGH	3,238	112( 3.5)	544(16.8)	95(2.9)	82( 2.5)	2,403(74.2)	932	1,408	63	3,939	164
TANGAIL	833	67( 8.2)	121(14.5)	25(3.0)	98(11.8)	520(62.5)	288	206	27	779	150
KHULNA DIVISION	9,923	1,442(14.5)	2,124(21.4)	81(0.8)	354( 3.6)	5,921(59.7)	3,865	1,724	333	8,311	140
BARISAL	1,669		448(26.8)	26(1.6)	30( 1.8)	1,165(69.8)	763	235	167	1,734	149
PATUAKHALI	1,044	15( 1.5)	308(29.5)	15(1.4)	1( 0.1)	715(67.5)	502	165	38	946	134
FARIDPUR	1,724		440(25.6)	8(0.5)	85( 4.9)	1,190(69.0)	512	604	74	1,943	163
JESSORE	1,624		340(20.9)	24(1.5)	43( 2.7)	1,222(75.0)	890	289	43	1,598	131
KHULNA	2,977	1,425(47.9)	446(15.0)	6(0.2)	104( 3.5)	995(33.4)	753	242	-	1,237	124
KUSHITIA	877		140(16.1)	2(0.2)	91(10.4)	644(73.4)	445	188	11	853	123
RAJSHAHI DIVISION	8,542	36( 0.4)	1,756(20.6)	236(2.8)	309( 3.6)	6,205(72.6)	3,407	2,407	390	9,392	151
BOGRA	961		214(22.3)	2(0.2)	13( 1.4)	732(76.2)	383	295	54	1,134	155
DINAJPUR	1,670	23( 1.4)	292(17.5)	68(4.1)	34( 2.1)	1,250(74.9)	828	327	95	1,768	141
PABNA	1,201		230(19.2)	1(0.1)	79( 6.6)	890(74.1)	519	312	58	1,319	148
RAJSHAHI	2,339	7( 0.3)	498(21.3)	76(3.2)	66( 2.8)	1,691(72.3)	1,194	459	38	2,226	132
RANGPUR	2,371	5( 0.2)	520( 2.2)	89(0.4)	115( 4.9)	1,641(69.2)	482	1,014	145	2,945	179
TOTAL	35,281	5,496(15.6)	6,565(18.6)	739(2.1)	1,118( 3.2)	21,361(60.5)	12,348	7,855	1,158	31,531	148

Source: Agriculture Directorate



In order to study the land use by regions in connection with its production and the nature the country is to be divided into areas by the natural demarcations, the Jamuna, the Ganges and the Meguna, which almost agree to the current administrative divisions. Each region is as follows:

a. South-west (Khulna Division with an area of 9.92 million acres)

This includes six districts: Kushtia, Jessore, Khulna, Barisal, Patuakhali and Faridpur. The rate of cultivated land is 60.0% to the whole division and 70.9% if Khulna is excluded. The rate of double cropping land in Faridpur shows a remarkable figure of 16.3%.

This region is subject to large damage from high tide by seasonal cyclones. Especially area along the Bay of Bengal (Faridpur, Khulna and Barisal) which occupies approximately 3.0 million acres can, in the presence of salt damage, be utilized only around the beginning of the monsoon season and subsequently a single rice cultivation (aman) is to be kept all the year round.

The Coastal Embankment Project which lasted for the past 10 years has protected a cultivated land of 1.0 million acres, contributing to the increase of T. Aman production. The remaining cultivated land that has no embankment suffers from great damage from the flooding.

Therefore, should irrigation facilities be provided the region would be free from the shortage of water before the harvest of aman with the subsequent increase of the rice production and with the possibility of cultivation of other crops in the dry season. Since the cultivated land of 2.0 million acres described above is subject to less salt damage, an irrigation project which is for the cropping in the dry season is of great importance with a secondary flood protection project.

In this region the prevention of the water invasion from the high tide is more important than that from heavy rainfall and river run-off. Portions of Faridpur and Barisal are subject to heavy damage resulting from the overflow of the Arikalkhan, a branch of the Pabna. On the contrary, the districts of Kushtia and Jessore are subject to heavier damage from droughts than floods.

b. South-east (Chittagong Division with an area of 7.84 million acres)

This includes four districts: Comilla, Noakhali, Chittagong and Chittagong Hill Tracts. The rate of cultivated land is 42.5%, which is the lowest among the four divisions in the presence of large forested areas, as mentioned before. However, the rate for Comilla and Noakhali is approximately 80% and the rate of double cropping land in Comilla is over 160%.

The land of this region is subjected to salt damage from high tide, although it is protected with partial embankments.

The Megna and the Gumti bring flooding to most part of Noakhali and the whole of Comillia, and the Kanafuri and the Sanga will affect many areas of Chittagong Hill Tracts.

Some areas of Chittagong and Chittagong Hill Tracts are provided with flood protection facilities, but these areas will have a trouble of drought. Both of these districts have good snady soils unlike areas of the other regions, and their yields of cotton, dry land rice and fruits are remarkable.

- c. North-east (Dacca Division with an area of 8,98 million acres)

This includes four districts: Sylhet, Dacca, Memensingh and Tangail. It has a higher rate of cultivated land with 67.5%. The rate of double cropping land in Memensingh is high with 164%.

This region has the worst conditions for cropping in Bangladesh in terms of terrain, climate and river networks. The main stream of the Brahmaptra is assumed to have run through the Sylhet basin by the 18th century, the ground of which is said to have subsided by from 30 to 40 feet during the past several hundred years. Currently it has a relative height of from 10 to 20 feet.

The plain in the region is too low to drain the flooding water resulting from the rainfall during the monsoon season,

- d. North-west (Rajshahi Division with an area of 6,54 million acres)

This includes five divisions: Dinajpur, Rangpur, Bogra, Rajshahi and Pabna. It has a high rate of cultivated land with over 70% and also a high rate of double cropping land with 145%. This is the only region that can produce surplus food grains.

The region has great trouble of droughts during the dry season of 7-month duration, while the monsoon season is shorter. The cultivation of Boro rice is not possible except on some lower areas.

The region is protected with embankments on the right banks of the Braphmaptra and the Jamuna, but subjected to the flooding from the Ganges and the Atrai. The southeast portion of Pabna will frequently be flooded from both the Ganges and the Brahmaptra.

### 1.2.3. Agricultural products.

Bangladesh agriculture consits mainly of crops production, and 78% of the total cropping land is utilized for the production of rice, staple of this country, which amounts to 28% of GDP.

Other important crops are: jute which is the main cash crop, rabi crops which present a variety of food and other produce, including gram, pulses, wheat, barely, vegetables, mustard, oil-seeds, etc., and other cash or commercial crops such as tea, tobacco, sugar-cane, etc. Table 1-6 shown the yield of the main crops.

The productivity and rate of growth in production of these crops are all very low and among them rice, jute and sugar-cane, which are the three largest agricultural products, hang remarkably low.

The activities and characteristics of the regions in terms of main crops is to be discussed crop by crop below.

a) Rice

The consumption of rice in Bangladesh amounts to 90% of the total food grains consumption and the remaining 10% is wheat. The rice production is very important for the country from the point of its rate to GNP and to cropping area, since the increase of productivity of rice directly connects to growth in GDP and decrease of foodgrains increase of foodgrains import.

Although the production of rice has a great bearing on the national economy, it has shown little increased: the annual rate of growth in the 1950's and 1960's were only 0.7% and 2.5% respectively, while the corresponding rates of growth in population were 2.8% and 3.0% respectively.

Therefore the imports of foodgrains from foreign countries have been increasing steadily from 800 thousand tons in 1960 to 1.5 million tons in 1969/70, amounting to 2.5 million tons in the years after the war.

The rice cropping can be divided into three parts as shown in Table 1-4 according to the difference of their farming seasons. Figure 1-2 shows rough farming patterns of rice varieties. The production of Aus and Aman are rather affected largely by natural factors, while that of Boro depends upon enlargement of irrigation facilities and effective management thereof.

Table 1-7 shows cropping areas and production of rice by variety and by periods. The productivity of Boro rice is remarkably high, with 20% of the total rice production in spite of covering only 10% of the total area of rice planting.

Since there is no possibility of enlarging farm land in Bangladesh, the increase of rice production must depend upon the increase of productivity of the area. The productivities of Aus, Aman, and Boro are 0.35, 0.45 and 0.80 ton per acre respectively, which are all low compared with those in other countries.

The productivity by location is, as shown in Table 1-8, so sporadical that production of each variety of rice varies with

Table 1-6 Production Trends of Main Agricultural Products

Crops	Unit: Thousand Tons										Production per acre 66/67-69/70 tons/acre	
	Average											
	1964-65	1965-66	1966-67	1967-68	1968-69	1969-70	1970-71	Cropping Area 66/67-69/70 (100,000 acres)				239.00 (77.5%)
Rice	10,337	10,333	9,424	10,995	11,160	11,816	10,968	10,968	11,816	10,968	239.00 (77.5%)	0.447
Wheat	34	35	58	58	92	103	110	110	103	110	2.15	0.320
Pulse	234	239	274	272	275	293	296	296	293	296	8.68	0.300
Edible Oil	124	133	152	188	203	207	210	210	207	210	8.15	0.320
Potato	395	486	591	701	786	857	849	849	857	849	1.80	3.640
Sugarcane	6,231	7,550	8,070	7,589	7,429	7,418	7,598	7,598	7,418	7,598	4.21	18.000
Jute (1,000 bales)	5,328	6,693	6,400	6,670	5,754	7,171	6,670	6,670	7,171	6,670	23.00	0.517
Mesta (1 million lbs)	N.A.	N.A.	N.A.	N.A.	N.A.	220	131	131	220	131	--	--
Tea	63	60	63	65	62	67	69	69	67	69	0.99	0.293
Tabacco	61	83	83	86	86	85	86	86	85	86	1.12	0.296

Source: Directorate of Agriculture.

Note: N.A. means not available.

Figure 1-2 Farming Patterns of Rice in Bangladesh

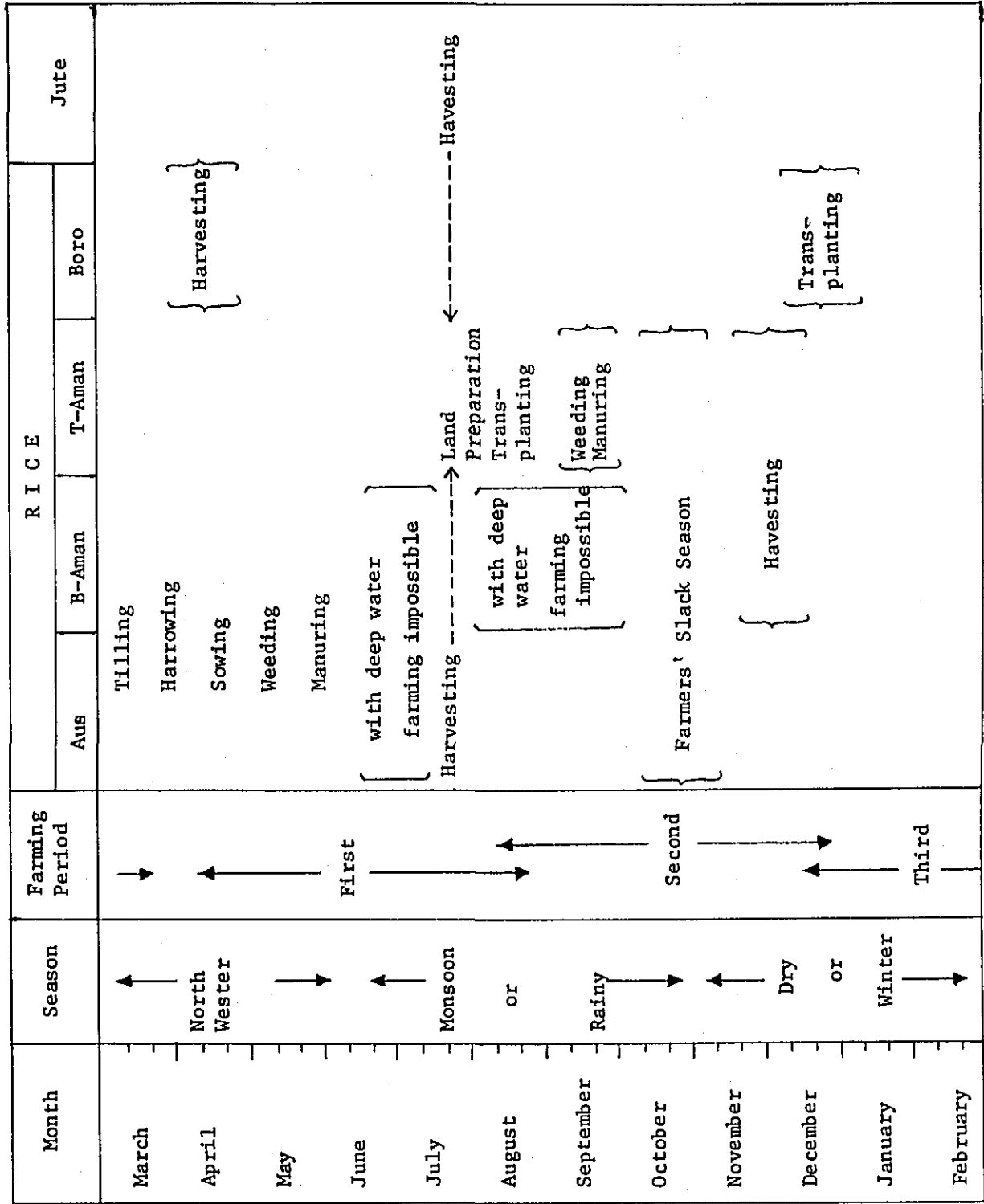


Table 1-7 Cropping Area, Production and Productivity of Rice by Variety

Variety	Aus			Aman			Boro			Total		
	Cropping area (1 million acres)	Pro-duction (1 million tons)	Pro-duction per acre (tons/acre)	Cropping area (1 million acres)	Pro-duction (1 million tons)	Pro-duction per acre (tons/acre)	Cropping area (1 million acres)	Pro-duction (1 million tons)	Pro-duction per acre (tons/acre)	Cropping area (1 million acres)	Pro-duction (1 million tons)	Pro-duction per acre (tons/acre)
1950/51 - 1954/55	5.71 (27.3)	1.83 (24.3)	0.32	14.34 (68.7)	5.55 (71.2)	0.37	0.83 (4.0)	0.34 (4.5)	0.41	20.88 (100)	7.51 (100)	0.36
1955/56 - 1959/60	5.84 (28.9)	1.94 (25.8)	0.33	13.48 (67.0)	5.23 (69.6)	0.39	0.79 (3.9)	0.34 (4.6)	0.43	20.11 (100)	7.51 (100)	0.37
1960/61 - 1964/65	6.32 (28.9)	2.44 (25.1)	0.34	14.52 (66.4)	6.76 (69.7)	0.47	1.04 (4.7)	0.50 (5.2)	0.48	21.88 (100)	9.70 (100)	0.44
1965/66 - 1969/70	7.72 (32.3)	2.86 (26.6)	0.37	14.53 (60.8)	6.67 (62.1)	0.46	1.65 (6.9)	1.21 (11.3)	0.73	23.90 (100)	10.74 (100)	0.45
1970/71 - 1971/72	7.63 (32.5)	2.60 (25.1)	0.34	13.59 (57.7)	5.78 (55.7)	0.43	2.31 (9.8)	1.99 (19.2)	0.86	23.55 (100)	10.37 (100)	0.44

Source: Directorate of Agriculture.

Note : Figure indicates the average annual amount during each period.

Figures in ( ) indicate percentage to total.

Table 1-8 District-Wise Cropping Area, Production and Productivity of Rice (1967/68)

District	A U S			A M A N			B O R O			Total
	Area (1000 acres)	Production (1000 t) per acre	Area (1000 acres)	Production (1000 t) per acre	Area (1000 acres)	Production (1000 t) per acre	Area (1000 acres)	Production (1000 t) per acre		
Chittagong	337	0.48	96	0.61	98	0.82	80	0.82	545	
Chittagong HT	119	0.51	53	0.59	15	1.00	15	1.00	107	
Comilla	517	0.37	947	0.58	95	0.76	72	0.76	806	
Noakhali	371	0.38	718	0.49	29	0.55	16	0.55	509	
Chittagong	1,344	0.41	2,214	0.56	237	0.77	183	0.77	1,967	
Sylhet	367	0.46	1,256	0.56	523	0.62	322	0.62	1,189	
Dacca	442	0.40	768	0.45	124	0.77	95	0.77	613	
Mymensingh ] Tangail	1,361	0.31	1,870	0.39	474	0.83	392	0.83	1,543	
Dacca	2,170	0.35	3,896	0.45	1,121	0.72	809	0.72	3,345	
Barisal	650	0.42	1,590	0.40	18	0.56	10	0.56	921	
Patuakhali ]	607	0.29	806	0.36	19	0.63	12	0.63	479	
Faridpur	610	0.41	578	0.45	7	1.14	8	1.14	514	
Jessore	122	0.47	1,030	0.59	26	0.65	17	0.65	678	
Khulna	397	0.38	118	0.56	3	1.00	3	1.00	221	
Kushtia	2,386	0.38	4,122	0.45	73	0.68	50	0.68	2,813	
Bogra	250	0.35	598	0.47	15	0.67	10	0.67	378	
Dinajpur	411	0.40	811	0.50	4	1.00	4	1.00	575	
Pabna	318	0.26	577	0.34	9	0.78	7	0.78	285	
Rajshahi	440	0.33	1,163	0.38	64	0.63	40	0.63	630	
Rangpur	902	0.40	1,301	0.48	12	0.83	10	0.83	1,001	
Rajshahi	2,321	0.36	4,450	0.44	104	0.68	71	0.68	2,369	
Total	8,221	0.37	14,682	0.46	1,535	0.73	1,113	0.73	10,994	

the location of its cropping area. However, on the divisional base the productivity shows roughly similar figures. It is assumed from this fact that rice farming will depend much upon its natural conditions and be sensitive to the change of the conditions of the areas in which rice is cropped.

As the rice cropping acres of 25 million areas occupies 70% of the total area of the country, the low productivity of rice cannot be overlooked. The causes are supposed as follows:

- influences of seasonal cyclones, consequent high tide, floods and droughts;
- poor irrigation facilities through the whole year necessary for the cropping of high yield varieties (HYV);
- delay of the introduction of HYV to the irrigated areas;
- unimplemented agricultural projects resulting from the shortage of finance;
- delay of requests for foreign aids;
- execution of uneffective projects;
- lack of application of fertilizer and agricultural chemicals;
- unsuitable support; and
- administrative defects.

#### b) Rabi crops

Rabi crops are cultivated mainly in the dry season and their productivity is very low, compared with that of rice crops. However, the production of rabi crops has remarkably increased with their enlarging cropping lands.

##### 1) Wheat

The production of wheat has greatly increase by more than three times during the 6-year period from 1964/65 to 1970/71 as the results of the introduction of HYV and enlargement of its cropping land, although a strong preference to rice is one of the causes that still hinder the farmers' will of increasing the production of wheat.

In the northwest, however, the merit of wheat is great because wheat replaces Boro rice for the winter cropping. Therefore irrigation systems by tube-wells have developed in this region. One tube-well can irrigate an area of only 60 - 80 acres for rice cropping but an area of approximately 200 acres for wheat cropping, which is almost triple. As West Bengal in India, where there has been no habit of living on rice, presently produces annually more than 1 million tons of wheat, wheat cropping in Bangladesh would be applicable in the future. Wheat



production is concentrated in Divisions of Khulna and Rajshahi as shown in Table 1-9, Districts of Faridpur, Rajshahi, Pabna and Kushtia produce more than half of the wheat in the country.

ii) Potatoes

Potato cropping was begun in the 1930's and in 1965 there was a production of 350 thousand tons. Since the subsequent introduction of European varieties its production has rapidly increased to 700 thousand tons in 1967/68 and 850 thousand tons in 1970/71.

The First-Five-Year Plan aims at raising potato production up to 1.1 million tons without enlarging the cropping land but with spreading HYV varieties. The plan also shows the necessity of more fertilizer and of storage facilities necessary both for seed potatoes and potato for consumption. Districts of Dacca, Rajshahi, Comilla, Bogra, Dinajpur and Rangpur are the main cropping areas of potatoes.

iii) Vegetables and fruits

Little change has been made during the last 20 years with farming area of 630 thousand acres as in 1970/71. The products of vegetables and fruits are 800 thousand tons and 1.6 million tons respectively, the productivity of which is very low. However, their per capita consumption has been decreasing with 1.33 ounces per day (approximately 12 kg per year).

Soils and climate are suitable for their cropping. And more production can be obtained by enlarging farming areas and improving their productivity. However, limitations which hinder the production are supposed as follows:

- underdeveloped transportation systems;
- absence of systematic marketing;
- shortage of information on modern techniques;
- unsuitable facilities of warehousing, packing and storage; and
- shortage of human resources in terms of techniques.

Banana cropping scatters almost in the whole country, while vegetables are produced around larger communities. Relatively more production is made in the northwest.

iv) Pulse

The production of pulse was 290 thousand tons in 1972/73 with a cropping area of 920 million acres, the productivity of pulse cropping being 0.3 ton per acre. The cropping area of pulse occupies one quarter of that of rabi crops, and is the largest among all the rabi.

Table 1-9 District-wise Production of Main Rabi Crops

Unit: Thousand Tons

DIVISION	Wheat		Pulse		Vegetables		Fruits		Potato	
	1960/61 -1964/65	1967/68	1960/61 -1964/65	1967/68	1960/61 -1964/65	1967/68	1960/61 -1964/65	1967/68	1960/61 -1964/65	1967/68
Chittagong Div.	1.7	3.2	23.3	24.7	110.7	122.2	143.5	278.5	46.3	139.2
CHITTAGONG	0.1	0.1	7.2	11.7	31.5	42.7	47.7	99.2	17.6	45.8
CTG. H.T	-	-	0.8	0.5	7.8	7.3	15.5	70.7	1.9	5.5
CONILLA	1.4	3.0	10.4	8.2	63.8	63.5	48.0	54.8	14.7	66.8
NOAKHALI	0.2	0.1	4.9	4.2	7.6	8.6	33.3	53.7	12.1	21.1
Dacca Div.	4.7	7.2	60.4	49.6	150.2	185.7	283.9	419.7	101.1	257.5
SYLHET	0.1	0.1	1.2	0.9	21.6	22.1	99.1	142.0	24.1	36.7
DACCA	2.0	4.7	28.2	23.0	53.9	54.1	78.0	126.7	39.1	173.6
MYMENSINGH TANGAIL	2.6	2.4	31.0	25.7	74.7	109.5	106.8	150.9	37.9	47.2
Khulna Div.	11.4	21.3	86.4	89.7	196.3	269.3	325.8	350.7	33.7	53.6
BARISAL DATUAKHALI	0.0	0.2	19.4	14.9	62.9	95.0	55.7	107.5	5.4	14.7
FARIDPUR	5.6	12.6	20.6	26.2	43.4	46.6	69.2	57.6	13.4	5.7
JESSORE	1.4	1.9	19.2	21.1	28.3	33.9	62.9	54.5	4.2	6.8
KHULNA	0.1	0.1	3.6	3.3	37.4	69.3	71.2	88.7	9.1	23.8
KUSHTIA	4.3	6.5	23.6	24.2	24.3	24.4	66.8	42.5	1.6	2.6
Rajshahi Div.	19.1	26.2	85.0	82.4	257.6	242.4	548.8	549.7	167.0	250.6
BOGRA	0.8	1.7	9.9	8.8	70.6	57.0	72.3	86.0	43.3	63.8
DINAIPUR	1.2	1.6	5.1	5.0	39.8	46.6	90.5	92.4	37.9	52.3
PABNA	5.5	9.9	28.7	28.5	37.3	33.9	63.3	70.1	6.8	9.9
RAISHAHI	6.8	8.9	28.7	28.2	57.3	57.7	226.8	199.0	32.1	42.3
RANGPUR	4.8	4.1	12.6	11.9	52.6	47.2	95.9	102.2	46.9	82.3
Total	36.9	57.9	255.1	246.5	714.8	819.5	1,303.0	1,599.0	348.0	700.9

Pulse which are the material of bean soup indispensable for daily meals of low income earners are consumed at the rate of 8 g per day (2.9 kg per year) per capita, which is very far from a specified standard of nutrition of 29 g per day per capita.

With the spread of artificial irrigation facilities an annual production of 350 thousand tons in pulse which is the fixed target of the Five-Year-Plan is expected through improvement in productivity.

Pulse are mainly produced in Divisions of Khulna and Rajshahi and precisely in Districts of Mymensingh, Pabna, Rajshahi, Faridpur, Kushtia, Dacca and Jessore.

### c) Jute

Jute, the largest cash crop in Bangladesh, is by far the most important means of obtaining the foreign exchange earnings. Since the Pakistan period, the amount of foreign currencies from export of allied jute products was a large 43% of the total exports during the period 1964-67 and after the independence the amount is estimated to have risen to more than 85%. With keen competition from other countries, Bangladesh's share of jute to the whole world went down to 35% in 1961 and have remained almost unchanged since then.

The statistics shows that the productivity of jute is very low with only 2.9 bales per acre (0.52 ton per acre). A pilot test for intensive farming in an area of 360 thousand acres conducted in 1970 showed a good productivity of 4.0-4.5 bales per acre (0.73-0.82 ton per acre). With improved varieties, better sowing method and suitable use of fertilizer and insecticides, an improvement of its productivity will not be difficult.

The competition of jute products in the world market has been on the increase. Unless the range of use of jute increases, its consumption will be either on the decrease or remain on the same level as today's. Its future depends largely on a development of the new applications and on stable supply, both in volume and price.

The natural conditions of cropping of jute is almost the same as that of Aus rice except in high-flooding areas, and they are on competitive relations in terms of land use. Whether farmers produce rice or jute will depend upon the relative price of rice to that of jute. Because the price of rice is high recently due to its shortage, a priority seem to have been given to the cropping of profitable rice.

Jute cultivation is concentrated, as shown in Figure 1-3, around the banks of the Jamuna, the Padma, the old Brahmaputra and the Megna. By districts, Mymensingh has the highest production with more than 30% in 1963/64 and 25% in 1967/68 to the

total production and is followed by Rangpur, Faridpur, Dacca and Comilla. Table 1-10 shows the production and productivity of jute by district in 1968/69.

d) Other agricultural products

i) Tea

The production in Sylhet District occupies 96.2% of the national total. The farming area is 280 thousand acres, out of which 110 thousand acres is under cultivation. The total production amounts to approximately 30 thousand tons with employees numbering approximately 140 thousand.

The tea exports occupied 10% of the total national export value before the war. After the war, however, owing to the loss of prewar sole markets of West Pakistan they have been exposed to severe international competition. Suitable counter-measures are required.

ii) Sugar-cane

The farming of sugar-cane scatters almost all over the country. Divisions of Rajshahi and Khulna occupy two-thirds of the whole farming area.

During the period 1962/63-1969/70 the farming area increased from 300 thousand to 400 thousand acres, and the production also increased from 470 thousand to 740 thousand tons. However, the productivity remained almost unchanged with 16-18 tons per acre. Per capita consumptions were 3 pounds of sugar and 4 pounds of gur in 1962/63 but it increased to 4 and 7 pounds in 1969/70 respectively. The Five-Year-Plan shows the consumptions with 5 pounds of sugar and 8 pounds of gur in 1977/78. The national consumptions will amount to 2.8 million tons for sugar and 4.6 million tons for gur, totalling 7.4 million tons of sugar-cane. The planned productivity is 18-20 tons per acre.

iii) Cotton

The farming area of cotton is 35 thousand acres with a production of approximately 13 thousand bales. The main producing areas are almost in Chittagong Hill Tracts District. Currently the farming area and production of cotton are on the decrease. The currently required amount estimated in the Five-Year-Plan is 51 thousand bales in terms of cotton yarn with 2.4 pounds equivalent. Most of cotton consumed in this country must depend on its import. The Five-Year-Plan has a target to raise a production to 63 thousand bales from a farming area of 50 thousand acres.

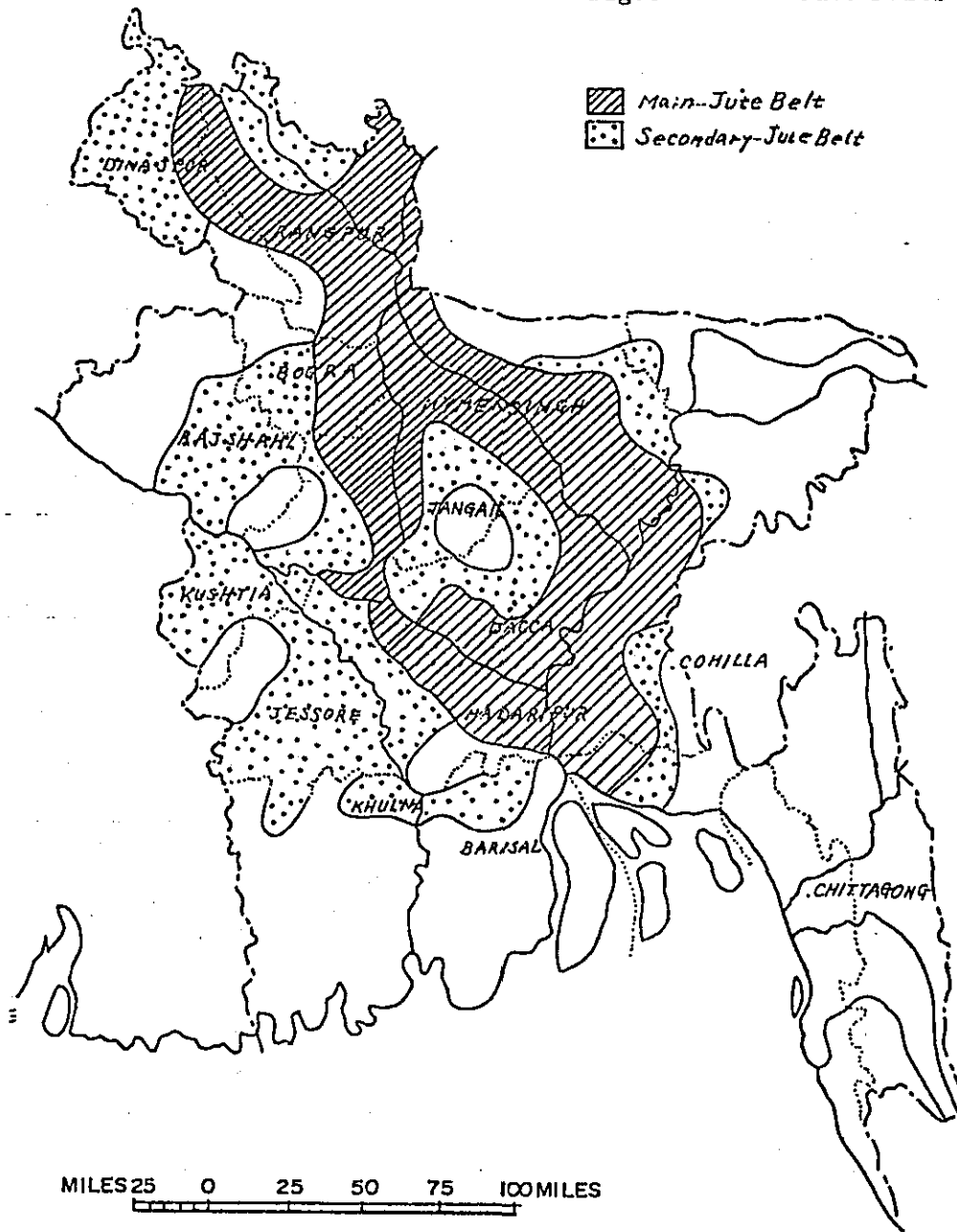
Table 1-10 Production and Productivity of  
Jute by District : 1968/69

District	Farming Area (1,000 acres)	Production (1,000 bales)	Production (1,000 tons)	Production per acre (bales/acre)	Rate Production to Total (%)
Chittagong	0.6	2	0.36	3.33	0.03
Chittagong H.T.	0.3	1	0.11	2.00	0.01
Comilla	184	605	109.78	3.29	9.07
Noakhali	37	102	18.51	2.76	1.53
Chittagong	221.9	710	128.82	3.19	10.64
Sylhet	23	66	11.98	2.87	0.99
Dacca	200	648	117.57	3.24	9.72
Mymensingh, Tangail	581	1,622	294.30	2.77	24.32
Dacca	804	2,336	423.87	2.91	35.03
Barisal Patuakhali)	70	200	36.29	2.86	3.00
Faridpur	250	703	127.55	2.81	10.54
Jessore	120	392	71.12	3.27	5.88
Khulna	45	159	28.85	3.53	2.38
Kushtia	34	101	18.33	2.97	1.51
Khulna	519	1,555	282.14	3.00	23.31
Bogra	84	225	40.82	2.68	3.37
Dinajpur	136	350	63.50	2.57	5.25
Pabna	111	290	52.62	2.61	4.35
Rajshahi	104	248	45.00	2.38	3.72
Rangpur	355	956	173.46	2.69	14.33
Rajshahi	790	2,069	375.40	2.62	31.02
Total	2,355	6,670	1,210.21	2.86	100.00

Source: Agriculture Directorate,

Note : 1 Bale = 0.18144 ton.

Figure 1-3 Jute Belts (1963/64)



Source: An Economic Geography of East Pakistan

Table 1-11 Other Main Agricultural Products

DISTRICT	Tea		Tobacco		Sugar-cane		Cotton	
	Production (tons)	Rate (%)	Production (tons)	Rate (%)	Production (tons)	Rate (%)	Production (tons)	Rate (%)
CHITTAGONG	1,107	3.8	1,485	3.9	101	1.3		
CTG. H.T.	18	0	455	1.2	14	0.1	14,529	99.8
COMILLA	9	0	1,470	3.8	87	1.1	2	0
NOAKHALI			40	0	63	0.8		
Sub-total	1,134	3.8	3,450	8.9	265	3.5	14,531	99.8
SYLHET	27,643	96.2	2,345	6.1				
DACCA			995	2.6	305	40.0		
MYMENSINGH			2,790	7.2	552	73	20	0.1
TANGAIL								
Sub-total	27,643	96.2	6,130	15.9	965	127	20	0.1
BARISAL			2,005	5.2	444	5.9		
PATUAKHALI								
FARIDPUR			1,560	4.0	647	8.5		
JESSORE			280	0.7	385	5.1		
KHULNA			500	1.3	90	1.2	3	0
KUSHTIA			320	0.8	681	9.0	4	0
Sub-total			4,665	12.1	2,247	29.6	7	0
BOGRA			235	0.6	391	5.2		
DINAJPUR			1,055	2.7	1,141	15.0		
PABNA			545	1.4	321	4.2		
RAJSHAHI			480	1.2	1,706	22.5		
RANGPUR			21,965	57.0	553	7.3	5	0
Sub-total			24,280	63.0	4,112	54.2	5	0
Total	28,777	100.00	38,525	100.00	7,589	100.00	14,563	100.0

Source: Agriculture Directorate.

iv) Tobacco

From the latter half of the 1960's the farming area and production of tobacco have not changed so much with approximately 110 thousand acres and 86 million pounds (=39 thousand tons) respectively. The producing areas scatter generally all over the land, but the production in Rangpur District is remarkable with 60% to the national whole. The Five-Year-Plan shows a meager increase of production and a self-sufficiency in tobacco.

1.2.4. Target production of the Five-Year Plan,

The Five-Year-Plan indicates that the fundamental strategies for the increase of agricultural production would consist in raising of production, bring about fully the potentials of each land by conducting more intensive farming with these countermoves of 1) improvement of land productivity with introduction of high-yield varieties; 2) more use of chemical fertilizer; 3) control of epidemic; and 4) introduction of farming methods and irrigation facilities suitable for the locality, etc.

The target production of the main products of the Five-Year Plan is tabulated in Table 1-12. By far the most attractive is that Bangladesh would attain self-supply of foodgrains of rice and wheat by executing the Five-Year-Plan programmes.

Table 1-12 Production Targets of Main Agricultural Products during the Five Year Plan Period

Unit: Thousand Tons				
Item	Unit	Production		Rate of increase(%)
		Base Year	1977/78	
Rice		1,240	15,080	34.0
Wheat		90	360	300.0
Jute		666 (7,200) <sup>1)</sup>	9,100	37.0 (26.0)
Sugarcane		6,000	7,420	24.0
Potato		780	1,100	41.0
Edible oil		200	400	100.0
Pulse		290	350	21.0
Tabacco	1,000 lbs	87,000	147,500	69.0
Vegetables and Fruits	1,000 tons	4,200	4,700	12.0
Cotton	1,000 bales	1,300	6,300	38.0

Source: The First Five Year Plan.

Note: 1) Mesta is not included in Jute. Figure in ( ) indicates the past peak production of Jute (1969/70).



Table 1-13 Supply and Demand of Foodgrains  
in the Five Year Plan

Unit: Million Tons

Year	Population (1 million persons)	Demand	Production	Supply 1)	Balance
1973/74	76.2	12.04	12.05	10.84	- 1.20
1974/75	78.5	12.39	13.22	11.90	- 0.49
1975/76	80.9	12.75	13.79	12.41	- 0.34
1976/77	83.1	13.11	14.41	12.97	- 0.14
1977/78	85.4	13.90	15.44	13.90	0

Source: The First Five Year Plan.

Note : 1) Supply is estimated by the subtraction of 10% from the production for seed-rice and loss.

Table shows annual targets to reach the self-supply, which are to be under several assumptions that suitable distributions of products as well as production under normal climates and natural conditions on the basis of per capita consumption of 16 ounces (454 g) per day.

#### 1.2.5. Supply and demand of food.

##### (1) Foodgrains

In Bangladesh the amount of imports of foodgrains has been on the increase, and the movement of foodgrains is also a main item in terms of transportation, in the presence of unbalance of supply and demand in each area.

The northwest is expected to be the greatest rice surplus region. A situation of supply-demand of foodgrains and a prospect thereof will have a great bearing on the future inter-regional movement of commodities. Brief discussion concerning a balance of foodgrains by regions is as follows:

##### a) Method of estimate

An administrative district is used as one unit. Probable consumption in each district is to be computed by subtracting the district consumption and required amount for reproduction (usually equivalent to 10% of the total production) from the district production. The demand is taken from the product of per capita consumption and the district population. Thus the level of a self-supplying capacity of a district can be estimated by comparing the above two figures.

Surplus or deficit amount = Production (of rice and wheat)  
x 0.9 - Population x per capita consumption

where: Population:  $P_n = P_c (1 + 0.029)^n$

$P_c$  = Population census in 1961

0.029 = 2.9%: Annual rate of growth in population

Per capita consumption:

Dr. S.R. Bose in his works "Foodgrain Availability and Possibilities of Famine in Bangladesh: states about levels of per capita consumption: 14 oz/day is the least possible amount with which a person is alive on the verge of starvation, which figure is very near to the actual amount in 1966/67, a lean year for the Aman rice crop; 15 oz/day is the average amount in the 1960's; and 15.3 oz/day is the average figure during the period 1962/63-1966/67. However, the figure of per capita consumption in this discussion is from the annual supply and import divided by the population. The Five-Year-Plan plans its per capita consumption as 16 oz/day at the end of the plan period.

b) Region-wise supply-demand of foodgrains

The results of the estimates described herein are shown in Table 1-14, in which surplus areas (above the national average consumption) and deficit areas (incapable of supplying the least amount of 14 oz/day and depending on the supply from other areas) are to be seen. Most districts have a considerable fluctuation by year, since their agricultural production is subject to the natural conditions. However, general characteristics are as follows:

- i) Division-wise there has been some constant surplus in Rajshahi, while Khulna Division had a heavy deficit in 1969/70 and its deficit is on the increase. In Dacca District the deficit has been growing yearly.
- ii) Per capita consumption rose up to 17.4 oz/day in 1969/70 with the imports of foodgrains of 1.55 million tons in the same year. If, with effective systems of inter-regional transportation, per capita consumption of 16 oz/day were able to be maintained, an import amount of 645 thousand tons would have been sufficient.
- iii) Per capita consumption in 1972/73 went down to only 14.7 oz/day with over 2 million tons of imports. At this rate imports of 3.2 million tons would be needed to maintain 16 oz/day.
- iv) Surplus/deficit areas by districts are as follows:  

Absolute deficit:	Dacca
Deficit:	Comilla, Chittagong, Tangail, Faridpur, Kushtia, Pabna, and Barisal.
Surplus:	Sylhet, Chittagong H.T., Mymensingh, Dinajpur, Rajshahi, Patuakhali, and Rangpur.

Table 1-14 Demand and Supply of Foodgrains by District

Unit: Thousand Tons

District	1969/70				1972/73		
	Year	1964/65	1968/69	(A)	(B)	(A)	(B)
CHITTAGONG DIVISION	-265 (D)	-250 (D)	-435 (D)	-490	-440 (D)	-525 (D)	-730
CHITTAGONG	+110 (D)	-50	-160 (D)	-175 (D)	-120 (D)	-130 (D)	-190
CHG H.T.	+25 (S)	-15 (D)	+10 (S)	+20 (S)	+30 (S)	-25 (D)	-30
COMILLA	-75 (D)	-125 (D)	-225 (D)	-250 (D)	-165 (D)	-315 (D.D)	-405
NOAKHALI	-105 (S)	-55 (D)	-60	-85	-40	-60 (D)	-105
DACCA DIVISION	-140	-265 (D)	-380 (D)	-270 (D)	-70	-555 (D)	-875
SYLHET	+60	+155 (S)	+310 (S)	+300 (S)	+365 (S)	+50	-20
DACCA	-295 (D.D)	-455 (D.D)	-555 (D.D)	-630 (D.D)	-535 (D.D)	-585 (D.D)	-690
MYMENSINGH	+95 (S)	+35 (S)	-135	-35	+100 (S)	+50	-65
TANGAIL						-70 (D)	-100
KHULNA DIVISION	-25	-135	-330	-715 (D)	-455	-870 (D)	-1,140
BARISAL	+70 (S)	+5 (S)	-100	-70	-10	-90 (D)	-150
PATUAKHALI						+43 (S)	+20
FARIDPUR	-80 (D)	-245 (D.D)	-250 (D)	-295 (D)	-235 (D)	-320 (D)	-385
JESSORE	-5	+35 (S)	-15	-100	-60	-130 (D)	-170
KHULNA	+10 (S)	+50 (S)	+80	-125 (D)	-75 (D)	-260 (D.D)	-310
KUSHIA	-20 (D)	+25 (S)	-50 (D)	-120 (D.D)	-100 (D.D)	-115 (D.D)	-140
RAJSHAHI DIVISION	-185	+300	+30	+25	+170	-215 (D)	-460
BOGRA	-10	+60 (S)	0	-20	-70	+10 (S)	-25
DINAJPUR	+115 (S)	+145 (S)	+145 (S)	+130 (S)	+165 (S)	+10 (S)	-25
PABNA	-90 (D)	-80 (D)	-160 (D)	-100 (D)	-60 (D)	-175 (D.D)	-215
RAJSHAHI	-120 (D)	+110 (S)	-35	+40 (S)	+95 (S)	-50 (D)	-105
RANGPUR	-60 (D)	+60 (S)	+80 (S)	-30	+40 (S)	-10	-90
Total	-610	-345	-1,115	-1,547	-645	-2,081	-3,205
Per capita consumption (OZ/day)	15.5	15.3	16.1	17.4	16.0	14.7	16.0

Note: 1) Each figure that is calculated on the per capita consumption for the corresponding year on the bottom line indicates the surplus or deficit of the district.

2) S = surplus area, D = deficit area (where per capita consumption is less than 14 oz/day), and blank indicates balanced area.

3) For the figures for 1969/70 and 1972/73, (A) indicates actual amounts while (B) indicates the balance where the per capita consumption is assumed 16 oz/day.

Balanced:

Probable deficit: Noakhali, and Jessore

Probable surplus: Khulna, and Bogra

(2) Other foods

a) Pulse

Khulna Division (except Districts of Barisal and Khulna) and Rajshahi Division (except Rangpur District) are surplus areas. Districts which have a great surplus are Kushtia, Pabna and Rajshahi and those which have a great deficit are Comilla, Sylhet and Mymensingh.

b) Vegetables

Khulna Division (except Districts of Faridpur and Jessore), Rajshahi Division (except Rangpur District) and Chittagong Hill Tracts District are surplus areas. Districts which have a great surplus are Barisal, Patuakhali, Khulna and Bogra and those which have a great deficit are Noakhali, Sylhet and Dacca.

c) Fruits

Rajshahi Division is the only area that has a surplus all over the division. Districts which have a surplus; Chittagong Hill Tracts, Sylhet, Khulna and Kushtia.

d) Potatoes

Rajshahi Division (except Pabna District) is the largest surplus area, followed by Dacca District in Dacca Division. Districts which have a great deficit are Mymensingh, Tangail, Barisal, Patuakhali, Faridpur and Pabna.

1.3. Industries.

1.3.1. General.

The industrial activities occupies only 10% of GDP in Bangladesh although the rate of growth in industry, the figure of which the distribution of the investments to large-scale industries during the East Pakistan period brought about, is relatively high, compared with that of other sectors as shown in Table 1-15. On the contrary, the rate of growth in small-scale industries is still lower than that of any other sectors. By large-scale industry is meant an establishment of more than 10 employees in Bangladesh and a considerable number of small establishments are supposed to be included in the range of large-scale industries.

The recent high rate of growth was supported by the economic policies of West Pakistan, but it would be difficult to imagine that the new country would also have an industrialization at such a rate, since the absolute economic level was extremely low.

(1) Classes of industries.

As of 1969/70 there were 3,134 registered factories (large-scale establishments with over 10 employees), over 20 thousand small-scale workshops, and more than 360 thousand workshops of cottage industry.

The difference in quality among these three classes of establishments is great. Foods, textile, timber and bamboo process belongs to cottage industry or small-scale industry, most of which are very primitive. Management of these establishments of domestic or small-scale industry is one of the greatest problems that would prevent the country from industrialization.

As the statistics concerning domestic and small-scale industry is deficient and uncertain, consideration has been given only to reported factories out of large-scale industry about which statistics is published by area.

(2) Composition of industries.

The 1969/70 industry census shows a composition of 3,130 registered factories as in Table 1-15. In the composition of the 1,491 factories that reported in the same year textile, chemicals, foods, etc. show a higher rate than others as is seen in Table 1-15, occupying approximately 60% of the whole.

The value of the products of foods, tobacco and textile shipped from the reported factories occupies approximately 70% to the total. Most of textile is of jute process. The ratio of metal products and machinery to the total is very small, in which steel and chemicals that belong to modern industry have a small ratio of 4.8% and 7.9% respectively.

The characteristics of Bangladesh industries, in terms of industrial structure, consist of unfledged consumer industries, especially in 1969/70, mainly depending upon the jute processing, the only export industry. This is not in the stage of heavy chemicals industry but in the stage of pre-industrialization. Table 1-16 shows the production of the prewar industries which are assumed to have been in normal operation.

1.3.2. Current status of industries.

The damage incurred by the independence was very large. Among the direct damages there are losses of the fixed assets of Taka 291.5 million and of markets in West Pakistan, cessation of supply of fuel therefrom, destroyed transportation systems, outflow of managing and skilled persons, etc. all of which hinder the production of the country in various forms. However, the production of each item is recovering at a high speed, by means of establishing corporation of large factories (as of 30 June, 1973, 313 factories with their fixed capitals of Taka 570 million) and introducing technical aids from abroad.

Progress of restoration of the industries in public sector and their problems are as follows:

- i) All production except for sugar, medicines, newspapers, cement, beverages and wooden products increased during the period from the first half through the latter half in 1972;

Table 1-15 Numbers of Registered Factories by Industry, 1969/79

Industry	No. of Factories	Rate to Total ( % )
Textile	791	25.3
Chemicals	576	18.4
Foods	406	13.0
Metal	257	8.2
Shoes	207	6.6
Hides & Skins and their products	149	4.8
Others	744	23.7
<b>Total</b>	<b>3,130</b>	<b>100.0 (%)</b>

- ii) The production of jute, cotton goods, steel products, foods diesel engines, petroleum refined goods decreased between the latter half of 1972 through the first quarter of 1973;
- iii) The production of sugar, shipbuilding, fertilizer, medicines, chemicals, paper, newspapers, cement and gas increased during the same year as in ii); and
- iv) The production of fabrics, steel, shipbuilding, fertilizer, glass, soap, processed marine goods, beverages, cement, newspapers and gas recovered to or exceeded the prewar level.

If reconstruction is meant by the restoration to the prewar level, many items of industry can reach their target, but generally the speed of their restoration is still very low. The rate of factories in operation is also a great problem. In 1972/73 no items industry existed that had a rate of operation of over 80%. Even in prewar days only the industries of paper, beverage and glasses has a rate of operation of over 90% while most of the others only 50 - 70%. The causes which seem to hinder their restoration and keep industries in low operation are as follows:

- i) a paralysis of business activities resulting from a sudden increase of public sector;
- ii) outflow of skilled workers and top-level staff;
- iii) labour problems;
- iv) collapse of goods movement systems;

Table 1-16 Production Trends of Main Industries

Unit	1962/63	1964/65	1966/67	1968/69	1969/70	1970/71
<u>Textile</u>						
Jute Products (1,000 tons)	298	289	404	518	593	470
Cotton Yarn (1 millions lbs)	54	64	74	96	105	74 a)
Cotton Cloth (1 million yards)	55	49	55	61	59	48 a)
Rayon Cloth (100 sq yards)	0.2	0.1	1	6	5	3 a)
<u>Foodstuff</u>						
Sugar (1,000 tons)	75	77	113	57	88	72 a)
Tea (1 million lbs)	54	62	67	64	68	52 a)
Cigarette (1 billion pcs)	4	6	13	17	18	11 a)
<u>Chemicals</u>						
Fertilizer (Urea) (1,000 tons)	72	72	93	87	94	51
Tire-tube (1,000 ca)	29	65	166	328	336	239 a)
Cement (1,000 tons)	94	56	75	63	64	59
Iron Products (1,000 tons)			63	210	174	47 b)
Bicycle (1,000 tons)			43	26	18	
Paper (1,000 tons)	32	41	34	44	42	30 a)

Note: a) Production between July 1970 and March 1971.

b) Production between July 1970 and January 1971.

Source: Statistical Digest of Bangladesh 1970-71.

- v) shortage of electric power, medicines and consumer goods;
- vi) defective financial structure;
- vii) a reduction of markets;
- viii) defective transportation systems; and
- ix) shortage of imports

These are common problems in other fields as well as in industries and it is by far most important to get over these problems.

### 1.3.3. Aspects in industries in the Five-Year-Plan.

For the future trend of industries and the future change of industrial structure, both short-range and long-range study will be required. In this stage, however, reference is to be made only to the First Five-Year Plan, as a forecast in long-range future is very difficult and subsequent results may be inaccurate.

The Five-Year-Plan establishes a production target of each item up to 1977/78 which would be a key to the next development and proposes for various policies of investment programmes which are required for the above period.

The purposes for industrial investments are as follows:-

- i) increase of main investment to the agricultural sector,
- ii) utilization of domestic materials,
- iii) gradual upbringing of capital goods industries,
- iv) promotion of small-scale industry, cottage industry and rural industry to scatter establishments and to improve productivity of private sector,
- v) attainment of economic self-support by means of development of export-oriented industry and import-substitute industry, and
- vi) balanced allocation of industries for effective distribution of income and employment.

The strategies of enlarging industrial production are as follows:-

- i) review of problems from and systems of nationalized industries which occupy most of the main industries,
- ii) direct assistance and induction to private investment,
- iii) control of foreign investment,
- iv) establishment of industrial policies for the underdeveloped areas,
- v) selection of labour intensive techniques,
- vi) effective use of production capacity, and
- vii) growth through the interrelated effects among the industries.



Table 1-17 shows the target amount of production for the Five-Year-Plan, the figures of which are to be used in this study as the future values in the national level. The plan aims at restoring to the prewar level with no special investment to new programmes. Most of the investments are for continuing the projects under way by increasing the current operational rate which is very low and by putting an emphasis on the effective use of the existing facilities. Brief description of the investments by industry is as follows:-

- i) investments in the industries of jute, paper, sugar, etc. which have a low operational rate are concentrated on the complete use of the existing facilities and investments in new industries are considered unnecessary.
- ii) for machinery industry, investments are successively made to Machine Tools Factory, General Electric Manufacturing Plant, etc.
- iii) for shipbuilding industry, a preference is given to Chittagong Dry Dock and Narayanganj Dry Dock, etc.
- iv) for medicines, cotton, paper, etc. investments are concentrated on the execution of the existing programmes.
- v) for textile, machinery, chemicals, food processing, etc. some new investments are contemplated.

#### 1.3.4. Regional distribution of industries.

Any index based on the shipping values of all industries or per capita shipping values in industry indicates the heavy concentration of industries in the three districts of Chittagong, Dacca and Khulna with the percentages in terms of shipping values of 22.4%, 42.3% and 12.7% respectively.

To the contrary the northwest region which produces a great agricultural surplus is in a very low position in industry: Rajshahi Division has an index of 5.7% in shipping value to the whole. This division is an absolutely undeveloped region that has no industrial centers as in the other divisions.

The point of such regional difference in industry is taken up in the Five-Year-Plan. Although the great difference of various regional conditions will naturally produce locational advantages and disadvantages, it is presumed to continue for long time except for jute and sugar industries which are both material source oriented.

Tables 1-18 and 1-19 show the shipping values of industries in 1968/69 and the ratios thereof to the whole country, from which the regional distributions by industry are considered as follows:-

Table 1-17 Target Production of Industries (the First Five-Year Plan)

Industry	Unit	Production Capacity											
		Public Sector			Private Sector			Total					
		Base year	Target year	Increase	Base year	Target year	Increase	Target year	Increase	Target year	Increase		
1. Jute	tons	587,000	766,000	179,000								766,000	179,000
2. Textile													
(a) Yarn	10 million lbs	8,630	19,740	7,110	0.025	0.0075	0.005					19,747.5	7,115
(b) Cloth	10 million yards	7,272	19,100	11,828	20,648	56,200	35,552					75,300	47,380
(c) Ready-made Clothes	10 million yards				0.600	7,760	7,160					7,760	7,160
3. Machinery	tons	5,555	33,800	28,245	106,655	391,300	284,645					425,100	312,890
	TAKA 10 million	3,276	24,235	20,959	7,740	58,940	51,200					83,175	72,159
4. Shipbuilding	TAKA 10 million	2,455	8,100	5,645								8,100	5,645
5. Iron & Steel													
(a) Iron manufacture	100,000 tons	0.85	4.50	3.70	0.50	1.50	1.00					4.50	3.70
(b) Others	100,000 tons	1.50	3.50	2.00								5.00	3.00
6. Chemicals	tons	300,000	837,825	537,825	35,760	98,214	52,454					936,039	590,279
	TAKA 10 million	60,275	71,000	4,775	18,098	56,196	38,098					127,196	42,873
7. Oil & Petroleum	tons	388,000	388,000	388,000								388,000	388,000
8. Pulp & Paper	tons	54,000	100,500	46,500	5,280	8,448	3,168					108,948	49,668
	TAKA 10 million				7,140	10,944	3,804					10,944	3,804
9. Lumber and allied products	tons	11,500	79,500	68,000	9,150	12,700	3,650					92,200	71,650
	TAKA 10 million				1,260	4,674	3,414					4,674	3,414
10. Mining & related works	tons	163,200	1,000,000	837,400	578,675	1,256,000	677,325					2,256,600	1,514,725
	TAKA 10 million				1,400	5,720	4,320					5,720	4,320
11. Sugar	tons	106,470	148,000	41,530								148,000	41,530
12. Foods	tons	19,920	99,875	79,955	1,347,000	4,190,000	2,843,000					4,289,875	2,922,955
	TAKA 10 million	3,303	9,018	5,615	20,533	99,375	78,275					108,393	84,457
13. Leather	10 million sq.ft	4,485	12,108	7,623	1,776	5,328	3,552					17,436	11,175
	TAKA 10 million		1,580	1,580	8,920	30,310	21,396					31,890	22,976
14. Other	tons				48,750	172,200	123,450					172,200	123,450
	TAKA 10 million				1,941	11,130	9,18					11,130	9,189
15. Service Facilities													
(a) Lodging	houses				34	39	5					39	5
(b) Cinema	houses				120	220	100					220	100

Table 1-18(1) Shipping Value of Industrial Goods by District in 1968/69 (1/3)

Unit: Thousand Taka

District	Cotton goods	Jute goods	Ferti-lizer	Cement	Pressed Packed jute	Hand woven cloth	Rubber foot-wear	Pulb & board paper	News-paper	Books & magazines	Other paper products
Chittagong	73,683	160,846	834					470			
Chittagong, H.T.								91,855			
Comilla	35,420	43,756	537	5,811							
Noakhali	6,188										
Sub-total	115,291	204,602	1,371	5,811				92,325			
Sylhet				11,525							
Dacca	234,757	521,221			193,453		16,044	1,455	14,936	10,123	5,244
Mymensingh		13,201			40,299						
Tangail											
Sub-total	234,757	534,422		11,525	233,752		16,044	1,455	14,936	10,123	5,244
Barisal											
Patuakhali											
Faridpur	9,238				4,706						
Jessore	5,957	13,558									
Khulna	11,043	332,168	459		67,998			51,708			
Kushtia	2,367										
Sub-total	28,605	345,726	459		72,704			51,708			
Bogra	9,256				2,182						
Dinajpur											
Pabna	8,696	21,639			2,646	14,160					
Rajshahi					1,100						
Rangpur					46						
Sub-total	17,952	21,639			5,974	14,160					
Total	396,605	1,106,389	1,830	11,525	318,241	27,301	16,044	145,488	14,936	13,951	9,789
Rate to total (%)	(9.7)	(27.1)	(0)	(0.2)	(7.7)	(0.6)	(0.3)	(0.3)	(0.3)	(0.3)	(0.2)

Source: Statistical Digest of Bangladesh.

Table 1-18 (2) Shipping Value of Industrial Goods by District in 1968/69 (2/3)

Unit: Thousand Taka

District	Rice Processing	Baking	Sugar	Edible Oil	Manu- factured tea	Pro- cessed tea	VANSPATI	Cigaret	Tabacco	Silk goods	Synthetic Fiber
Chittagong	1,987	2,391		58,487	6,066	83,293	31,039	172,354	64	22,006	61,096
Chittagong H.T.					139			39,715			
Comilla	115	228		786	102					76	
Noakhali		220		12,284							
Sub-Total	2,102	2,839		71,557	6,307	83,293	31,039	212,069	64	22,082	61,096
Sylhet	205	145		77	210,835		19,977	179,337	328	2,434	
Dacca	357	20,910		21,349							
Mymensingh		91	11,159								
Tangail											
Sub-Total	562	21,146	11,159	21,426	210,835		19,977	179,337	328	2,434	
Barisal	631							492			
Patuakhali											
Faridpur	247			1,194							
Jessore			2,101								
Khulna	1,107	221		4,445							
Kushtria			21,150								
Sub-Total	1,985	221	23,251	5,639				492			
Bogra	7,493	217	13,188	1,352				19,075			
Dinajpur	19,918		29,356	942							
Pabuna	84			184							
Rajshahi	1,025	487	26,126	699					330	1,510	
Rangrur	715		16,114	389				3,922	3,195		
Sub-Total	29,235	704	84,784	3,566				22,997	3,525	1,510	
Total	33,884	24,910	119,194	102,188	217,142	83,293	51,016	414,895	3,917	26,026	61,096
Rate to total (%)	(0.9)	(0.6)	(2.9)	(2.5)	(5.3)	(2.0)	(1.2)	(10.2)	(0.1)	(0.6)	(1.5)

Source: Statistical Digest of Bangladesh.

Table 1-18 (3) Shipping Value of Industrial Goods by District in 1968/69 (3/3)

District	Unit: Thousand Taka									
	Con- fection	Medicines	Soap & Cleanser	Match	Oil refining	Iron ore	Furni- ture	Other electric goods	Ship- building	Cotton spinning
Chittagong	39,521	28,852	34,258	9,525	16,405	60,240	3,922	4,741	847	3,158
Chittagong H.T.										
Comilla										
Noakhali										
Sub-Total	39,521	28,852	34,258	9,525	16,405	60,240	3,922	4,741	847	3,158
Sylhet										
Dacca	79,326	50,199	45,193	38,609		50,957	21,319	24,022	28,564	13,216
Mymensingh										
Tangail										
Sub-Total	79,326	50,199	45,193	38,609		50,957	21,319	24,022	28,564	13,216
Barisal										
Patuakali										
Faridpur										
Jessore				18,342		3,275				
Khulna										
Kushtia										
Sub-Total				18,342		3,275				
Bogra										
Dinajpur										
Pabna										
Rajshahi										
Rangpur										
Sub-Total										
Total	122,138	91,729	84,768	78,152	16,405	114,472	26,174	28,864	40,315	16,374
Rate to total (%)	(2.9)	(2.2)	(2.0)	(1.9)	(0.4)	(2.8)	(0.6)	(0.7)	(0.9)	(0.4)

Source: Statistical Digest of Bangladesh.

Table 1-19 Rate of Shipping Value of Industrial Goods by District

District	Cotton goods	Jute goods	Ferti-lizer	Cement	Pressed packed jute	Sugar	Cigaret	Tabacco	Manu-factured tea	Pressed tea manufact	Iron & Steel	Pulp & paper board	Total	Unit: Percent
Chittagong	18.57	14.54	45.6				41.54	1.49	2.79	100	52.6	0.3	22.4	
Chittagong H.T.							9.57		0.06			63.1	4.9	
Comilla	8.93	3.95	29.3		1.83				0.05				2.3	
Noakhali	1.56												0.6	
Sub-Total	29.07	18.49	74.9		1.83		51.11	1.49	2.90				30.2	
Sylhet				100					97.10				5.5	
Dacca	59.19	47.11			60.79		43.22	7.65			44.5	1.0	42.3	
Mymensingh		1.19			12.66	9.36							1.7	
Tangail													0.1	
Sub-Total	59.19	48.30		100	73.45	9.36	43.22	7.65	97.10				49.6	
Barisal							0.12						0.1	
Patuakhali														
Faridpur	2.33				1.48								0.4	
Jessore	1.50	1.23				1.76							0.5	
Khulna	2.78	30.02	25.08		21.37						2.8	35.5	12.7	
Kushtia	0.60					17.74							0.8	
Sub-Total	7.21	31.25	25.08		23.85	19.50	0.12				2.8	35.5	14.6	
Bogra	2.33				0.69	11.06	4.60						1.6	
Dinajpur						24.63							1.3	
Pabna	2.19	1.96			0.83								1.4	
Rajshahi					0.35	21.92		16.31					0.8	
Rangpur					0.01	13.52	0.95	74.55					0.6	
Sub-Total	4.52	1.96			1.88	71.13	5.55	90.86					5.7	
Shipping Value (TAKA 1,000)	396,605	1,106,389	1,830	11,525	318,241	119,194	414,895	4,286	217,142	83,293	114,472	145,488	4,081,543	
(Rate to Total: %)	(9.7)	(27.1)	(0)	(0.2)	(7.7)	(2.9)	(10.1)	(0.1)	(5.3)	(2.0)	(2.8)	(3.5)		

(a) Jute industry

In the above two tables are two items of "Jute" and "Pressed Pack Jute" separately tabulated. This comes from the two processings of jute; one is pressing raw jute for easy transport and the other jute textile to make jute cloth for such items as jute bags.

However, all raw jute is not always processed by the above two methods but there are several routes of processing:

Route 1: raw material → pressing → export

Route 2: raw material → pressing → manufacturing → export

Route 3: raw material → manufacturing → export

Route 1 is for exporting the best quality of raw jute; Route 2 is a normal process of jute; and Route 3 is for manufacturing of jute goods by using raw jute which is produced around the jute factories.

Pressed pack jute is produced in Dacca with 60.8% of the total, Mymensingh with 12.7% and Khulna with 21.3%, and the production of these three districts occupies 94.8% of the national total. Jute goods is manufactured in Chittagong with 14.5% of the total, Dacca with 47.1% and Khulna with 30.0%, and the production of these three districts covers 91.6% of the whole.

Mymensingh District has jute pressing only and does not make any jute goods. Jute pressed here is taken out to be exported or to be processed in the factories in other areas. On the contrary Chittagong District does only manufacturing and no pressing.

The above description indicates that the areas which have active jute manufacturing do not always agree to the cropping areas of raw jute. Locationally speaking, for the export of final processed goods of jute, jute allied factories might as well be located between cropping areas of raw jute and the ports for the export of final goods. There is no need that the cropping areas of raw materials be near the factories.

However, pressing process of raw jute can produce a saving of transport charge by reducing the volume to be transported. The location of pressing factories will be raw-material-oriented, and Mymensingh District which has jute pressing factories shows a good example.

Generally, except the pressing factories in Mymensingh District, the cropping areas of raw jute have no jute allied factories, which concentrate in Dacca which is neither the cropping area nor the port of export, and Chittagong and Khulna are under the same conditions. It can be considered that this is because each function of a large city would bring about great benefits.

The fact that an industry like jute industry, in which transport cost occupies a large part and which is a typical location-oriented industry, has a remarkable concentration into large cities and has never developed in the northwest region can indicate the importance of various urban functions; benefits from intensive effects, external economy from transport systems, presence of labour force, etc.

(b) Cotton industry

Products of cotton industry scatter in Chittagong with 18.6% of the total, Comilla with 8.9% and Dacca with 59.0%, and the production of these three districts occupies 86.7% of the whole. The reason why the concentration of cotton industry extends from Chittagong up to Dacca is that a major part of raw cotton amounting to 89% of the total is imported through Chittagong Port. This is a typical example of an industry, the raw material of which is import-oriented.

(c) Cement industry

Cement industry exists only in Sylhet District, where limestone, the material of cement is produced.

(d) Tea manufacturing

Tea manufacturing concentrates in Sylhet District, which is a large tea cropping area.

(e) Fertilizer industry

Fertilizer industry concentrates in Chittagong with 49.6% of the total, Comilla with 29.3% and Khulna with 25.1%. (Ghorasal also has fertilizer industry, but the data used for this description do not include Ghorasal because the time of collecting the data was before the commencement of the operation of the factory).

Arable lands, consuming fertilizers are distributed all over the country: from the point of transportation fertilizers flow from the above three areas to the whole country.

At the present time the pattern of fertilizer movement is as stated above because the material of fertilizer depends upon the import. However, if with the utilization of natural gas in the future a full supply of electric power is possible, the locations of fertilizer factories can be scattered in the rural areas.

Considering that effective demands of fertilizer are very great, fertilizer plants would be established in the northwest which has a vast arable land.



(f) Iron and steel industry

Iron and steel industry is concentrated in Chittagong and Dacca. The country must import all iron-ore and coal necessary for this industry. Locationally, Chittagong is a port city and has various industries in its hinterland. Dacca constitutes a great market of iron and steel products under the concentration of industrial activities in Dacca.

(g) Sugar manufacturing

Sugar manufacturing is located in Rajshahi Division (except Pabna District) and Districts of Kushtia and Mymensingh. This is because cropping lands of sugarcane scatter in the above regions. The location of the industry which must handle the heavy weight of material is reasonable in this point.

(h) Tobacco manufacturing

Tobacco manufacturing is concentrated in Districts of Rangpur and Rajshahi in Rajshahi Division and Dacca District. This is also because Rajshahi Division is the cropping area of tobacco.

The regional distribution of industries as described above indicates a remarkable concentration in Chittagong, Dacca and Khulna. Chittagong and Khulna are the only two foreign trade port cities in Bangladesh, and are convenient both for the supply of imported materials and for the export of products. Dacca as stated before has various urban functions so as to absorb various industries.

The concentration of modern industries such as iron and steel, fertilizer, chemicals and paper to the above three areas is remarkable and especially the industries the materials of which depend upon import have developed in the area extending from Chittagong to Dacca and in the Khulna area.

On the contrary the industries the materials of which are produced in the rural such as sugar, tea, tobacco are to find their development in the areas where their materials are produced. However, the jute industry, the material of which is also produced in the rural area is concentrated in the above three areas. This can be judged as an important strategy of the sole export industry, but principally the jute industry may as well be established in its material supply areas.

The concentration of the jute industry in Dacca, Chittagong, Khulna forms one of the characters in the regional distribution of Bangladesh industries. Rajshahi Division, the northwest of Bangladesh has only sugar and tobacco manufacturings to be noted, and the region can be said to be less-advanced in terms of industrialization.

1.3.5. Estimate of regional products by industry.

For the purpose of a quantitative understanding, the characteristics of the regional structure in industry has been described from the

Table 1-20 Production of Main Industrial Goods by District (1968/69)

Unit: Thousand Tons

District	Item	Jute Products	Cement	Sugar	Iron & Steel	Ferti-lizer (Urea)	Paper 1)	Cotton	Tea	Remarks
Chittagong		75			110	40	0	8	5	1) Excludes Newspaper
Chittagong H.T.		20				25		4	3	2) Equivalent to cotton yarn of 90 million lbs.
Comilla								1	0	
Noakhali										
Sub-Total		96			110	65	28	13	8	3) Equivalent to 64 million lbs.
Sylhet			63							
Dacca		244			93		0	25	17	
Mymensingh		6		5						
Tangail										
Sub-Total		250	63	5	93		0	25	17	
Barisal										
Patuakhali								1	1	
Faridpur		6		1				1	0	
Jessore		156			6	22	16	1	1	
Khulna				10				0	0	
Kushtia										
Sub-Total		162		11	6	22	16	3	2	
Bogra				6				1	1	
Dinajpur				14						
Pabna		10						1	1	
Rajshahi				12						
Rangpur				8						
Sub-Total		10		41				2	1	
Total		518	63	57	210	87	44	43	29	

standpoint of the shipping values of industrial products.

The final purpose of this report is to quantitatively estimate the production by region in order to find the movement of the commodities as practical as possible.

However, the data of industries by region available so far is limited to their shipping values only and the value of products is of the national total. Therefore, the estimate of the regional production of the main goods having a bearing on commodities movement is made as follows:-

For the production of the national total goods for industry, the figures for 1968/69 in the "Statistic Digest of Bangladesh", page 94 are used. For the allotment of regional production by industry the equation below is used:

$$\text{Regional production by industry} = \text{National total production} \times \frac{\text{Regional shipping values}}{\text{National total shipping values}}$$

The results are tabulated in Table 1-20. The figures in the table are to be used for the study in Chapter 2 " Goods Movement".

#### 1.4. Mining.

The data and information of mining resources in Bangladesh are scarce and the potentials thereof have not yet been qualified in detail.

Generally mining resources are very scarce, and most of the resources that have been discovered are not feasible in terms of mining economy. Actually natural gas can be of practical significance. The outline of the prospective resources is as follows:-

##### (a) Coal at Jamalganj

Coal stratum of 140 feet thick at Jamalganj area between Bogra and Rajshahi Districts discovered in 1963 with estimated amount of deposits of more than 700 million tons: the depth of the deposits extends from 800 to 900 meters from the ground surface, to which many technical problems give rise, and there would be no feasibility in this development before 1980.

##### (b) Limestone at Jamalganj and Jaipurhat

The deposits were discovered in 1963 with an estimated amount of deposits of 200 million tons: the depth of the deposits is 500 meters below the ground surface with a layer of 80 feet. A plan for limestone development and the installation of cement plants has been prepared.

##### (c) Limestone of Takerghat and Sylhet

The deposits were discovered during the period 1950-1951 with an estimated amount of deposits quantity of 3 million tons: the

annual exploitation of 130 thousand tons is for the use of Chattak Cement Factory.

(d) Limestone of St. Martin Isle, Chittagong

The deposits were discovered in 1960 with an estimated amount of 1.8 million tons. No development has been started.

(e) White clay at Bijaipur and Mymensingh

The deposits were discovered in 1957 with an estimated amount of 200 thousand tons, which is used for ceramics.

(f) Glass sand at Sylhet, Shajibuzar and Noyapara

The deposits were discovered in 1950 with an estimated amount of 400 thousand tons, which is used for glass manufacturing.

New deposits have recently been discovered in Districts of Sylhet and Chittagong.

(g) Hard rock at Rangpur and Ranipukur

The deposits which are 150 meters below the surface ground were discovered in 1966. A survey for the feasibility of the exploitation for the supply to meet growing construction demands has been under way.

(h) Petroleum

In 1973 the Soviet Delegation reported of the possibility of the development of petroleum in the following areas:-

(i) An area including parts of Barisal, Chandpur and Daudukandi with the Bengal lowland including parts of Khulna and Madupur is supposed to be prospective, but prospecting has not yet been started.

(ii) A belt area extending from Calcutta via Pabna to Hajipur.

(iii) An area including parts of Sylhet, Comilla, Noakhali and Chittagong. From this area natural gas has already been discovered.

(i) Natural gas

Natural gas is very important not only to attain the self-supply in agriculture but to expedite the industrialization from the point of fuel, fertilizer and relevant materials.

The deposits at Sylhet, Chattack, Chitas and Habiganj have already been developed while those at Racidpur, Kailas and Bagrabad have not yet been developed.

The estimated amount of these deposits amount to  $8-9 \times 10^{12}$

cubic feet (or  $17 \times 10^{12}$  cubic feet with the potential amount) which would meet a 20 year demand with the planned 800 million cubic feet per day. A sufficient surplus will exist, compared with the current consumption of 90 million cubic feet per day.

(j) *Petroleum demand*

As for petroleum Bangladesh depends upon import. In 1967 Eastern Refinery Limited was established in Chittagong for the purpose of oil refinery of an annual amount of 1.5 million tons. The operational rate of the plant after the war stands as low as 50%. The estimated total demand of Bangladesh of 1.6 million tons in 1974 would consist of the supply of 840 thousand tons from the plant and the import of petroleum products from abroad.

The Five-Year-Plan estimates the demand in 1978 of 2.6 million tons, which corresponds to an annual increase of 10%.

Table 1-21 Petroleum Demand

	Unit: Thousand Tons					
	1969	1970	1971	1972	1973/74	1978
Crude Oil	965	894	795	820	841	
Products	913	818	746	732	733	
Total	1,878	1,712	1,541	1,552	1,574	2,590

Source: The First Five Year Plan.

1.5. Foreign trade.

The past Bangladesh trade had been in favorable balance but in 1968/69 the balance of trade turned to adverse and from then on the excess of imports over exports has been in the increase.

Bangladesh, which suffers from the lack of her natural resources is much behind other countries in the production of both capital and intermediate assets. Since the country must execute the various development programmes including her postwar reconstruction under these circumstances, a rapid increase of raw materials, capital and intermediate assets will directly occur.

Table 1-22 Historical Balance of Trade

Unit: Million US \$

Year	Exports			Imports			Balance		
	Foreign	Pakistan	Total	Foreign	Pakistan	Total	Foreign	Pakistan	Total
1965/66	318	119	437	279	205	484	39	86	-17
1966/67	331	140	471	329	215	544	2	-75	-73
1967/68	311	141	452	279	184	463	32	-43	-11
1968/69	324	156	480	389	211	600	65	-55	-120
1969/70	349	161	513	381	258	639	-32	-94	-126
1970/71	263	146	409	331	203	534	-68	-57	-125

Source: Bangladesh Economic Report 1972, by IBRD Mission.

Fundamental Survey of Bangladesh Economic Development Programmes, 1973,  
by International Development Center of Japan.

The trade with Pakistan was conducted both by air and sea, and the volume by air was much less than that by sea. The main export items by sea were tea, jute goods, paper, and matches, while cotton goods, raw cotton, tobacco, rape-seeds, mustard-oil, rice, machinery, cement, medicines were the main import items.

The export to Pakistan in 1968/69 made up 36% of the total exports in terms of quantity and import for the same period from Pakistan came to 43% of the total imports.

The trade with Pakistan has ceased and the trade with India which had ceased since 1965 has now been reopened. Therefore, the trade pattern based on the data up to now will change largely, but the description herein does not touch the above problem.

Tables 1-23 and 1-24 show the main imports by item in 1969/70 and 1977/78 and the main exports by item in the same years respectively. The figures in 1977/78, the target year of the Five-Year-Plan are estimated in the Five-Year-Plan, in which foodgrains are not tabulated because of the vision that a self-supply of foodgrains would be attained by the end of the Five-Year-Plan period. In this connection the import of the foodgrains in 1969/70 for example, amounted to 1.55 million tons, which is the largest quantity of a single item.

With scarce resources and undeveloped domestic industries Bangladesh must import important goods such as foodgrains and fundamental raw materials and living necessities: foodgrains, machinery, medicines, iron and steel, etc. in terms of currency and foodgrains, petroleum, cement, coal, fertilizer and iron and steel, etc. in terms of weight.

The trade to/from Bangladesh is made through the two ports of Chittagong and Chalna. Table 1-25 shows the fluctuation of the goods handled at the two ports. The quantities handled by either port have been in the increase. During the decade 1959/60-1969/70 an increase is recorded: 1.8 times for Chittagong and 2.3 for Chalna. Figure 1-4 shows the historical trend of imports and exports through the ports of Chittagong and Chalna.

However, it is characteristic that the ratio of imports over exports ranges from 1.3 to 3.5 with an annual increase of imports. This tendency will worsen the balance of the loading of the goods to and from the hinterland. Especially the goods movement to and from Chittagong shows a remarkable sign. For this reason the enlargement of the capacity of the Chalna port is under way. However, the Five-Year-Plan is likely to reduce the scope of the enlargement of said port because the depth of Port of Chalna is not sufficient for the ocean-goers, which would give rise to a great problem in the future.

The exports by item as shown in Table 1-26 include raw jute and jute goods with 64% of the total exports in 1968/69. Most of the tea, paper and match produced in East Pakistan were sent exclusively to West Pakistan.

Out of the exported raw jute and jute goods 85-90% thereof was to foreign countries other than West Pakistan and approximately 30% thereof was dispatched from Chalna Port.

With scarce resources and undeveloped domestic industries Bangladesh must import important goods such as foodgrains and fundamental raw materials and living necessities: foodgrains, machinery, medicines, iron and steel, etc. in terms of currency and foodgrains, petroleum, cement, coal, fertilizer and iron and steel, etc. in terms of weight.

Table 1-23 Main Item of Imports  
(Exclude Foodgrains)

Item	1969/70		1977/78	
	Unit (1,000 tons)	Value (Million Taka)	Unit (1,000 tons)	Value (Million Taka)
Edible Oil		265		385
Cement	439	81	790	170
Sugar	20	16	71	141
Raw Cotton	366	160	208	290
Cotton Cloth	91	104	56	80
Textile		242		16
Tobacco	27	103	28	79
Machinery		843		2,329
Iron & Steel		287	426	426
Coal		45	76	76
Other Metal & Metal Products	N.A.	N.A.		229
Transport Machinery		143		596
Medicines		478		204
Other Chemical Products				650
Oil Petroleum		86		538
TOTAL		2,853		6,209

Source: The First Five Year Plan.



Table 1-24 Main Items of Exports

Item	1969/70		1977/78	
	Unit (1,000 tons)	Value (Million Taka)	Unit (1,000 tons)	Value (Million Taka)
Raw Jute	626	1,280	892	1,930
Jute Products	572	1,450	694	2,250
Fishery Products	N.A.	30	N.A.	190
Hide & Skins Their Products	N.A.	90	N.A.	200
Tea		24	60 million lbs.	12
Others	N.A.	60	N.A.	60
TOTAL		3,690		5,290

Source: The First Five Year Plan.

Table 1-25 Import and Export by Port

				Unit: Thousand Tons			
Year	Import	Export	Total	Year	Import	Export	Total
1950-51	1,207	423	1,630	1950-51	8	69	77
1951-52	1,321	400	1,721	1951-52	192	210	402
1954-55	902	490	1,392	1954-55	88	392	480
1955-56	1,086	524	1,610	1955-56	78	478	556
1959-60	2,147	497	2,644	1959-60	259	627	886
1960-61	2,222	396	2,618	1960-61	374	480	854
1961-62	2,454	442	2,896	1961-62	325	677	1,002
1962-63	2,714	507	3,221	1962-63	799	709	1,508
1963-64	3,300	563	3,863	1963-64	861	800	1,661
1964-65	2,863	425	3,288	1964-65	293	707	1,000
1965-66	3,098	543	3,641	1965-66	618	872	1,490
1966-67	3,823	503	4,326	1966-67	988	863	1,851
1967-68	3,539	516	4,055	1967-68	710	970	1,680
1968-69	4,401	484	4,525	1968-69	1,080	947	2,027
1969-70	4,177	574	4,751	1969-70	1,039	1,004	2,043
1970-71	1,861	131	1,992	1970-71	433	361	794

Source: Statistical Digest of Bangladesh.

Note: Figure for 1970-71 indicates cargo handled between July and December.

Table I-26 Imports and Exports by Goods in 1968/69

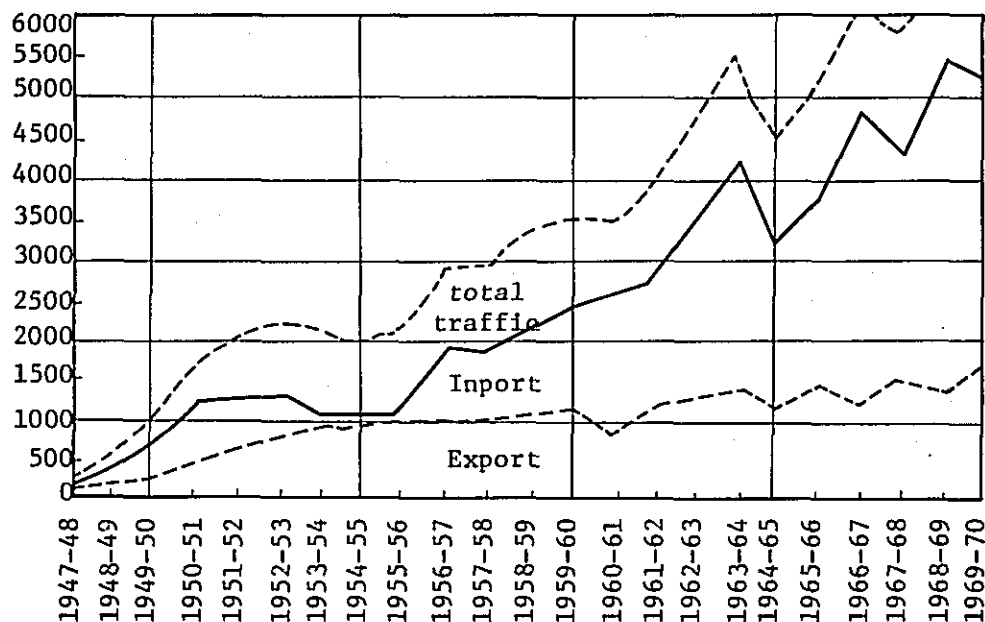
Item	- IMPORTS -				- EXPORTS -				
	Value of Imports (100 Thousand Rupee) (%)	Amount of Imports (Thousand Tons)		Item	Value of Exports (100 Thousand Rupee) (%)	Amount of Imports (Thousand Tons)		Total (%)	
		Chittagong (%)	Chalna (%)			Chittagong (%)	Chalna (%)		
Foodgrains									
Rice	1428(4.4)	722(17.9)	459(38.2)	1182(22.5)	Raw jute	7307(30.3)	110(22.7)	503(53.0)	614(42.9)
Wheat	3293(10.3)				Jute Products	8142(33.8)	149(30.7)	370(39.0)	519(36.2)
Oil (bulk)	78(0.2)	1276(31.6)		1276(24.3)	Tea	2571(10.7)	33(6.8)		33(2.3)
Oil (drum)		42(1.0)		42(0.8)	Paper	1096(4.5)	14(2.8)		14(1.0)
Cement	844(2.6)	552(13.7)	212(17.6)	765(14.6)	Iron & Steel		8		8
Coal	480(1.5)	267(6.6)	350(29.1)	617(11.8)	Match	427(1.8)	6(1.2)		6(0.4)
Fertilizer		175(4.3)	63(5.2)	238(4.5)	Hide & Skins	1048(4.3)		0	0
Iron & Steel	3506(10.9)	158(3.9)		158(3.0)	Fishery Products	149(0.6)			
Machinery	4938(15.4)		39(3.2)	39(0.7)					
Cotton	4362(13.6)	23(0.6)	3(0.1)	26(0.5)					
Total									
(Rate to total; %)	32087(59%)	4041(79%)	1203(93%)	5245(82%)	Total				
					(Rate to total; %)	24112(85%)	484(63%)	948(92%)	1432(83%)

Source: Statistical Digest of Bangladesh 1970/71.

Note : Figure includes imports and exports with Pakistan.

Figure 1-4 Historical Trend of Import and Export  
(handled by Chittagong and Chalna combined)

Thousand tons



## 2. Population.

### 2.1. Population data and its growth.

A population census was taken every year in Bangladesh (as shown in Fig. 1-1), but it was not conducted in 1971 because of the war and was taken in 1974. The population of the country has been estimated, using the latest data based on the 1974 census, for the years of 1983, 1993, 2003, 2010, 2020 and 2030.

The population of Bangladesh has been estimated according to the following procedure.

- 1) The present population of the country has been estimated, using the data contained in "Bangladesh Population Census of 1974" issued by the Ministry of Internal Affairs of Bangladesh.
- 2) The average annual growth rate of population for the years from 1961 to 1974 has been determined.
- 3) Assuming that the population would increase at the rate thus determined, the population based on the 1974 census has been estimated by administrative divisions for the years of 1983, 1993, 2003, 2010, 2020 and 2030.

- 4) Using the results obtained in step (3) above, the proportion of the population of each district to the total population of Bangladesh has been estimated for years mentioned above.
- 5) In the estimation of the future population of Bangladesh due consideration has been given the first five-year plan which aims to reduce the rate of population growth to zero in the 21st century. However, as it is obvious from the present rapid growth of population in this country that the government cannot possibly check population growth to such an extent as contemplated by its first five-year plan, an intermediate rate of population growth has been adopted, although a relatively high rate of growth has been applied to the years up to 1978. (See the graph of annual population growth in Bangladesh in Fig. 1-5)
- 6) The total population of Bangladesh has been broken down according to the proportion determined in step (4) above to estimate the population of each division for the years considered.

## 2.2. Distribution of the population.

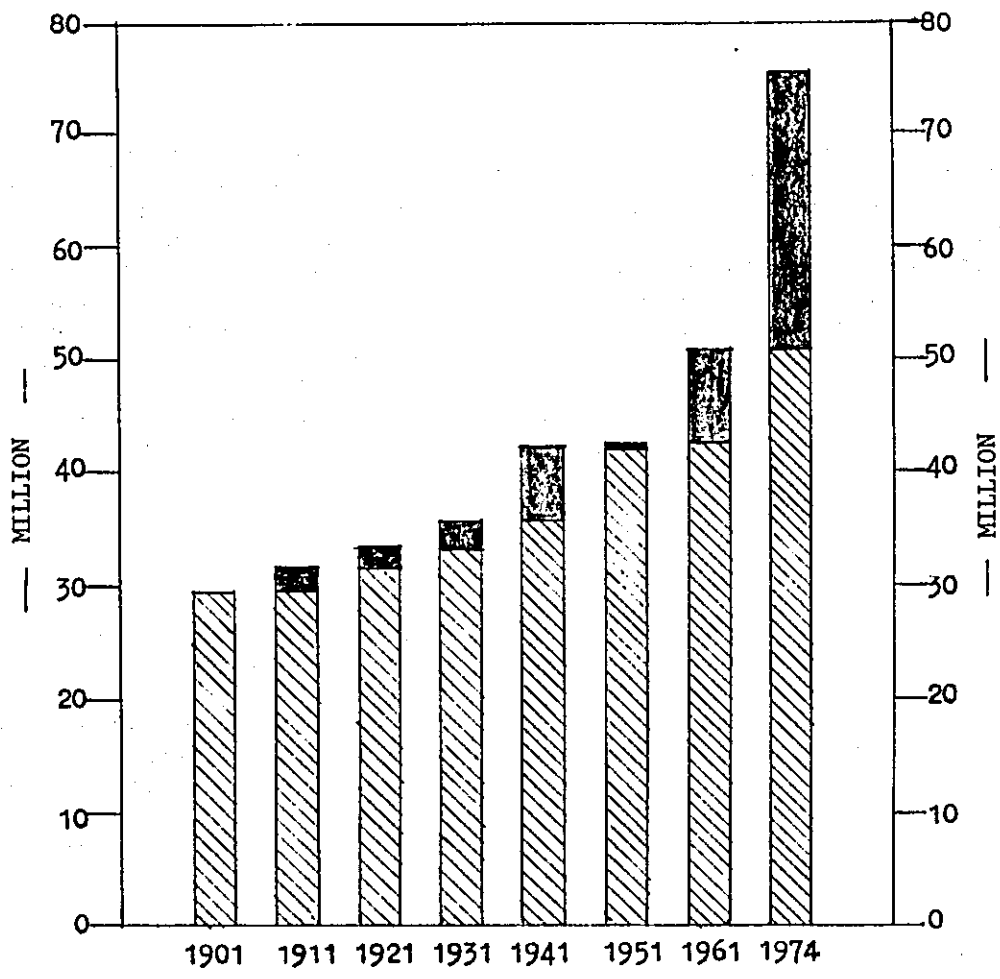
According to the "Bangladesh Population Census of 1974" the population of the country is distributed as shown in Table 1-4, when divided by the administrative division. The population density was obtained from the Statistical Digest of Bangladesh 1970-71," for the year 1961, and the population density for 1974 was calculated, using the area of each division and other figures derived from the Bangladesh Population Census of 1974 (see Tables 1-31 and 1-32).

The population density in Bangladesh in 1974 was about 530 persons per sq.km, indicating that the country is far more densely populated than other countries. The population density little differs from one division to the other, when the uninhabitable area like the forest is taken into consideration. The divisions which show a relatively higher density of population are Dacca (1,102 persons per sq.km), Comilla (919 persons per sq.km), Noakhali (651 persons per sq.km), Chittagong (640 persons per sq.km) and Tangail (640 persons per sq.km). Among others Dacca division shows a very high density of population which is nearly two-fold the density of 678 persons per sq.km in 1961. This is in large part because a high population growth rate of 16% was applied to Dacca Pourashave and Norayanganj Pourashave in the correction of population for 1974.

The very low density of 41 persons per sq.km in Chittagong division can be explained by the fact that more than 90% of its total area is covered by forests. If the forests are excluded, this division does not differ much in population density from other divisions.

From 1961 to 1974 the total population of Bangladesh grew at an average rate of 49.36%, and this average growth rate was outpaced by the following districts:

Figure 1-5 Graph of Annual Population Growth in Bangladesh



(Source: Bangladesh Population Census 1974)

Kushtia district	71.30%
Rajshahi district	60.98%
Jesson district	60.93
Dacca district	61.28
Dinajpur district	59.36

Except for Dacca district, the districts showing a rapid rate of population growth do not necessarily give a high population density, and there is no close relationship between population concentration and urbanization. The high rates of population growth in such big cities as Dacca, Chittagong and Khulna were taken into account in the correction of population estimates, but the population concentration in such big cities is not necessarily attributable to urbanization but to the unusual movement of population on the occasions of disaster like a flood.

Overall, it may be said that the tendency of population to move from rural districts to urban areas is not remarkable in Bangladesh.

### 2.3. Estimation of future population.

#### 1) Future growth rates of population

There are two official estimates of future population of Bangladesh: one is the growth rates of population estimated by the Census Commission of Bangladesh; and the other, the low estimate released by the IBRD. In this study the two estimates have been respected, and an intermediate estimate between the two has been adopted in consideration of the population control policy of the government of Bangladesh. For the years up to 1978, however, the estimate made by the Census Commission of Bangladesh was used in the estimation of population growth.

Table 1-27 Estimate of Growth Rates

Year	Growth Rate
1973	3.00
1978	3.01
1983	2.89
1988	2.53
1993	2.31
1998	2.19
2003	2.06
2008	1.90
2013	1.70
2018	1.50
2023	1.30
2028	1.20
2033	1.11
2038	1.00
2043	0.90
2048	0.80

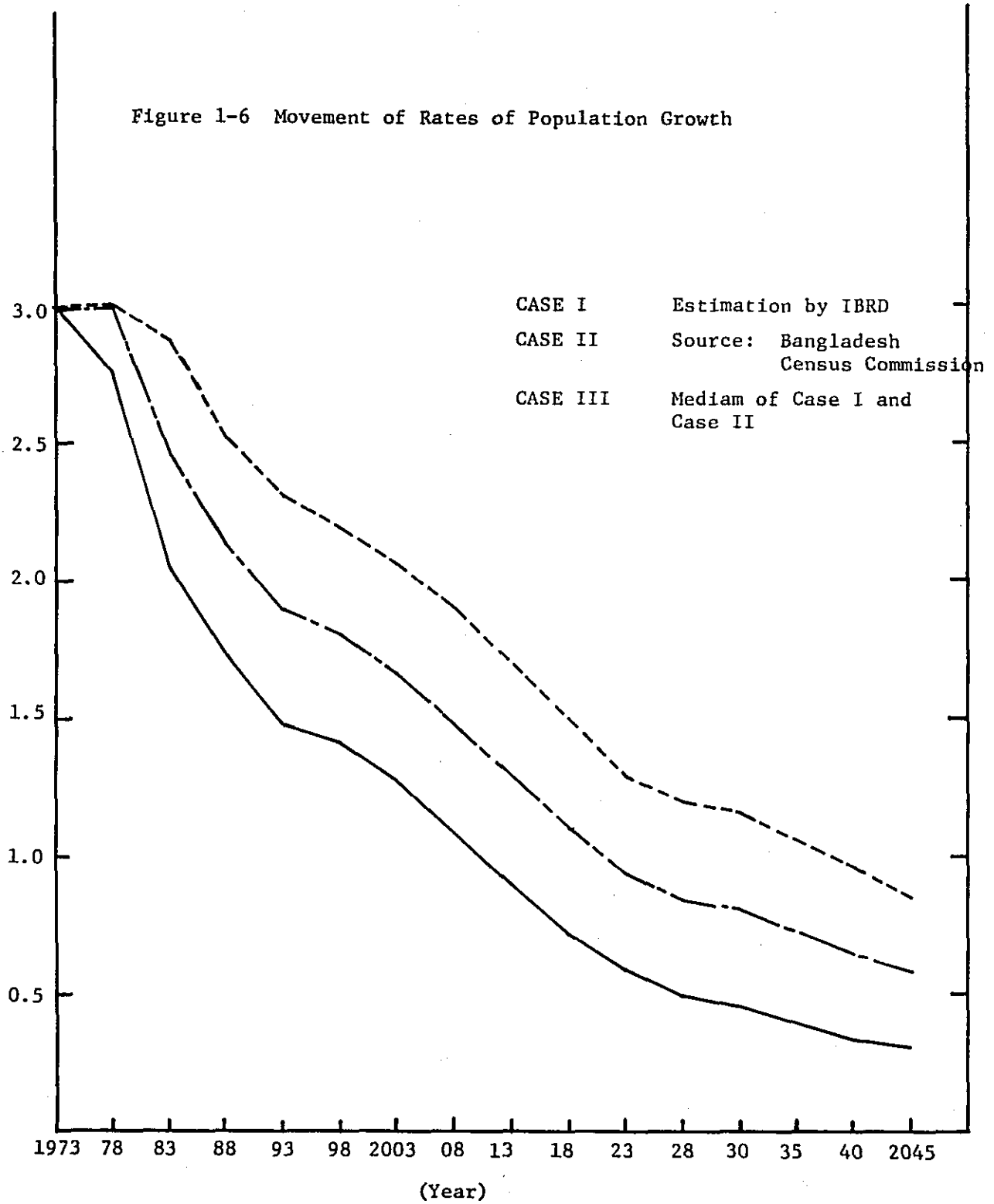
[Source: Census Commission of Bangladesh]

Table 1-28 Comparison of Rates of Population Growth

Year	Case I	Case II	Case III
1973	3.000 %	3.000 %	3.00 %
1978	2.770	3.010	2.89
1983	2.060	2.890	2.48
1988	1.740	2.530	2.14
1993	1.480	2.310	1.90
1998	1.420	2.190	1.81
2003	1.280	2.060	1.67
2004	1.240	2.028	1.63
2005	1.200	1.996	1.60
2006	1.160	1.964	1.56
2007	1.120	1.932	1.53
2008	1.080	1.900	1.49
2009	1.040	1.860	1.45
2010	1.000	1.820	1.41
2011	0.965	1.780	1.37
2012	0.930	1.740	1.34
2013	0.895	1.700	1.30
2014	0.860	1.660	1.26
2015	0.825	1.620	1.22
2016	0.790	1.580	1.19
2017	0.755	1.540	1.15
2018	0.720	1.500	1.11
2019	0.685	1.460	1.07
2020	0.650	1.420	1.04
2021	0.631	1.380	1.01
2022	0.612	1.340	0.98
2023	0.593	1.300	0.95
2024	0.574	1.280	0.93
2025	0.555	1.260	0.91
2026	0.536	1.240	0.89
2027	0.517	1.220	0.87
2028	0.498	1.200	0.85
2029	0.479	1.180	0.83
2030	0.460	1.160	0.81
2035	0.400	1.060	0.73
2040	0.340	0.960	0.65
2045	0.310	0.860	0.59

Note: Case I: IBRD  
Case II: Bogra Census Commission  
Case III:  $\frac{\text{Case I} + \text{Case II}}{2}$

Figure 1-6 Movement of Rates of Population Growth





## 2) Estimation of future population of Bangladesh

The annual rates of population growth in Paragraph 1) above were applied to the years considered, respectively, to estimate the population in each year (base: 1973/74 = 1.00). The results are shown in Table 1-29.

Table 1-29 Estimated Population of Bangladesh

Year	Population (000s)	Growth Rate
1973/74	76,002	1.00
1983	100,200	1.32
1993	123,800	1.63
2003	147,700	1.94
2010	164,200	2.16
2020	185,100	2.44
2030	202,500	2.66

As is clear from Table 1-29 it seems certain that the population of Bangladesh will nearly double by 2003 and will show further increases in the years beyond. In the light of the fact that the average annual GNP growth rate of Bangladesh for the past ten years did not exceed 4.4%, it is obvious that the growing population will exert considerable pressure on the nation's economy.

Using the total population estimated above, the population of each administrative division can be estimated by the procedure already described, as shown in Table 1-31. When the areas of the administrative divisions as of 1974 are used, the population densities of the divisions can be estimated, as shown in Table 1-32. Dacca division, for instance, will give a population density of as many as 3,353 persons per sq.km in 2020.

Table 1-30 Yearly Future Population Estimate

Year	Rate of Growth(%)	Ratio to 1973	Ratio to 2003	Population (1,000 persons)
1973	3.00	1,000		76,000
1978	2.89	1,158		88,000
1983	2.48	1,319		100,200
1988	2.14	1,476		112,200
(1993)	1.90	6,629		(123,800)
1998	1.81	1,785		135,700
2003	1.67	1,944	1,000	147,700
04	1.63	1,976	1,016	150,200
05	1.60	2,007	1,033	152,500
06	1.56	2,037	1,049	155,000
07	1.53	2,070	1,065	157,300
08	1.49	2,101	1,081	159,700
09	1.45	2,131	1,096	162,000
(2010)	1.41	2,161	1,112	(164,200)
11	1.37	2,191	1,127	166,500
12	1.34	2,220	1,142	168,700
13	1.30	2,249	1,157	170,900
14	1.26	2,277	1,171	173,000
15	1.22	2,305	1,186	175,200
16	1.19	2,333	1,200	177,300
17	1.15	2,359	1,214	179,300
18	1.11	2,386	1,227	181,300
19	1.07	2,411	1,240	183,200
(2020)	1.04	2,436	1,253	(185,100)
21	1.01	2,461	1,266	187,000
22	0.98	2,485	1,278	188,900
23	0.95	2,509	1,290	190,700
24	0.93	2,532	1,302	192,400
25	0.91	2,555	1,314	194,200
26	0.89	2,578	1,326	195,900
27	0.87	2,600	1,337	197,600
28	0.85	2,622	1,349	199,300
29	0.83	2,644	1,360	200,900
(2030)	0.81	2,665	1,311	(202,500)
2035	0.73	2,768		210,400
2040	0.65	2,864		217,700
2045	0.59	2,953		224,400

Table 1-31 Proportion of the Population of Each District

Unit of Population: Thousand Persons

	Population of Each District		Increase Rate		Future Population of Each District												
	1973/74		1974/1961		1983		1993		2003		2010		2020		2030		
	Popu- lation	%	Popu- lation	%	Popu- lation	%	Popu- lation	%	Popu- lation	%	Popu- lation	%	Popu- lation	%	Popu- lation	%	
Chittagong Division	10,140	19.97	14,751	19.40	45.47	19,028	18.99	22,965	18.55	26,748	18.11	29,217	17.79	32,074	17.33	35,094	17.33
Chittagong	2,983	5.87	4,616	6.07	54.74	6,222	6.21	7,849	6.34	9,533	6.45	10,720	6.53	12,256	6.62	13,405	6.62
Chittagong H.T.	385	0.76	539	0.71	40.00	671	0.67	780	0.63	881	0.60	939	0.57	993	0.54	1,094	0.54
Noakhali	2,383	4.69	3,428	4.51	43.85	4,359	4.35	5,187	4.19	5,945	4.03	6,418	3.91	6,924	3.74	7,574	3.74
Comilla	4,389	8.65	6,168	8.12	40.53	7,776	7.76	9,149	7.39	10,389	7.03	11,140	6.78	11,901	6.43	13,021	6.43
Dacca Division	15,605	30.70	23,486	30.90	50.50	31,072	31.01	38,489	31.09	46,006	31.15	51,188	31.17	57,724	31.17	63,119	31.17
Shylhet	3,490	6.87	5,045	6.64	44.56	6,483	6.47	7,787	6.29	9,009	6.10	9,792	5.96	10,666	5.76	11,664	5.76
Dacca	5,095	10.03	8,217	10.81	61.28	11,403	11.38	14,794	11.95	18,505	12.53	21,236	12.93	25,000	13.50	27,337	13.50
Mymensingh	5,533	10.88	8,021	10.55	44.97	10,300	10.28	12,368	9.99	14,323	9.70	15,567	9.48	16,956	9.15	18,529	9.15
Tangail	1,487	2.92	2,203	2.90	48.15	2,886	2.88	3,540	2.86	4,169	2.82	4,593	2.80	5,102	2.76	5,589	2.76
Khulna Division	13,246	26.04	19,394	25.52	46.41	25,240	25.19	30,913	24.97	36,620	24.79	40,579	24.79	45,664	24.68	49,977	24.68
Khulna	2,449	4.81	3,815	5.02	55.78	5,190	5.18	6,611	5.34	8,111	5.49	9,181	5.59	10,599	5.73	11,603	5.73
Patuakhali	1,193	2.34	1,589	2.09	33.19	1,904	1.90	2,141	1.73	2,311	1.56	2,396	1.46	2,437	1.32	2,673	1.32
Bekerganj	3,068	6.03	4,164	5.48	35.72	5,090	5.08	5,831	4.71	6,423	4.35	6,748	4.11	7,003	3.78	7,655	3.78
Faridpur	3,179	6.25	4,303	5.66	35.36	5,261	5.25	6,017	4.86	6,638	4.86	6,974	4.25	7,261	3.93	7,958	3.93
Jessore	2,191	4.31	3,526	4.64	60.93	4,390	4.88	6,351	5.13	7,941	5.38	9,112	5.55	10,727	5.80	11,745	5.80
Kushtia	1,166	2.30	1,997	2.63	71.30	2,905	2.90	3,962	3.20	5,196	3.52	6,168	3.76	7,617	4.12	8,343	4.12
Rajshahi Division	11,849	23.29	18,371	24.17	55.04	24,860	24.81	31,433	25.37	38,326	25.95	43,216	26.32	49,638	26.82	54,310	26.82
Rajshahi	2,811	5.52	4,525	5.95	60.98	6,283	6.27	8,146	6.58	10,189	6.90	11,692	7.12	13,764	7.44	15,086	7.44
Pabna	1,958	3.85	2,984	3.93	52.40	3,988	3.98	4,977	4.02	5,984	4.05	6,682	4.07	7,569	4.09	8,282	4.09
Bogra	1,574	3.09	2,365	3.11	50.25	3,126	3.12	3,875	3.13	4,608	3.12	5,112	3.11	5,733	3.10	6,278	3.10
Rangpur	3,796	7.46	5,774	7.60	52.11	7,716	7.70	9,619	7.77	11,583	7.84	12,934	7.88	14,650	7.91	16,017	7.91
Dinajpur	1,710	3.37	2,725	3.59	59.36	3,747	3.74	4,816	3.89	5,962	4.04	6,796	4.14	7,922	4.28	8,667	4.28
Bangladesh Total	50,840	100.00	76,002	100.00	49.36	100,200	100.00	123,800	100.00	147,700	100.00	164,200	100.00	185,100	100.00	202,500	100.00

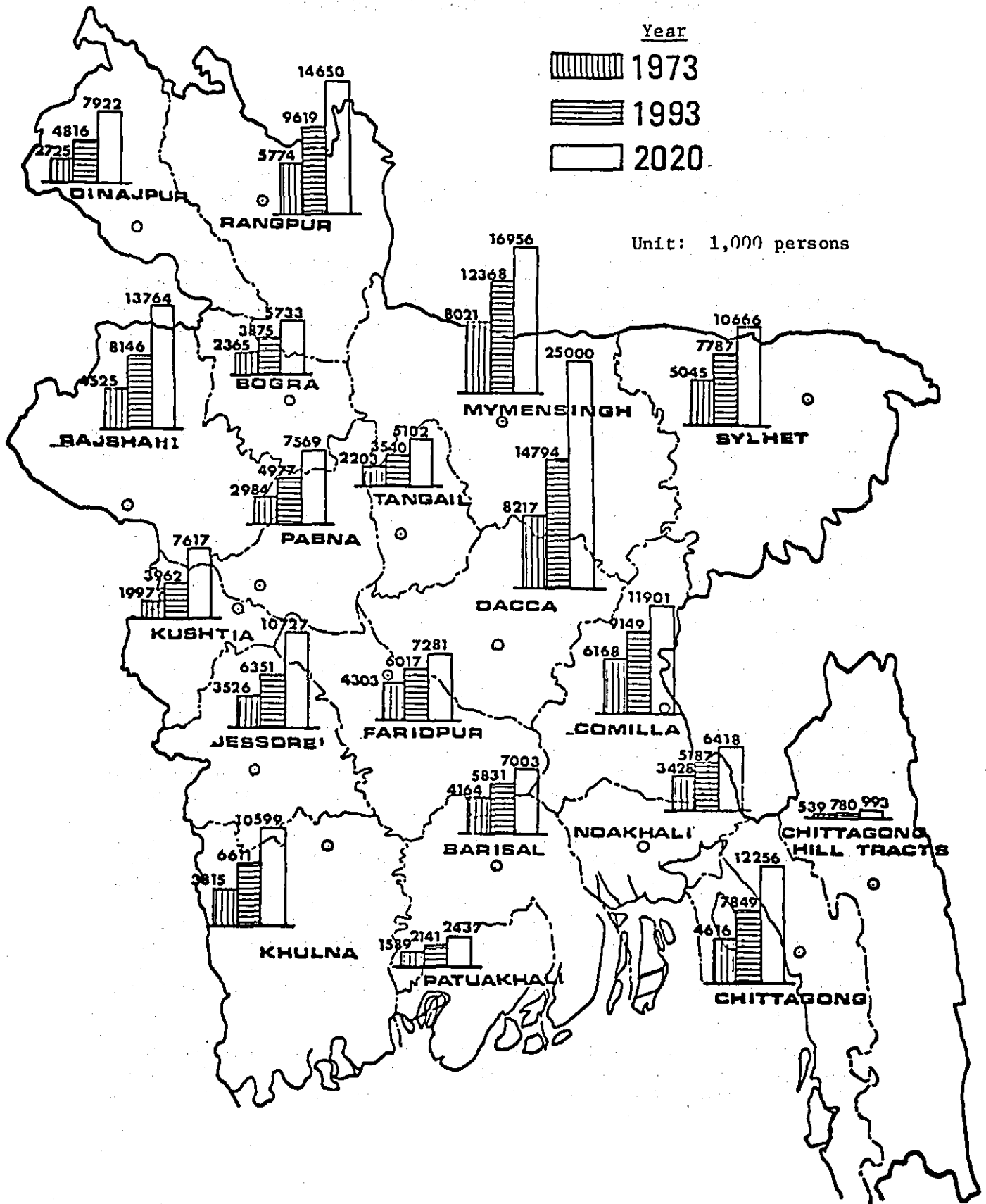
Table 1-32 Distribution of the Population and Population Density of Each District in Bangladesh

	1961		1974		1983		1993		2003		2010		2020		2030			
	Area (Km <sup>2</sup> )		Area (Km <sup>2</sup> )		Area (Km <sup>2</sup> )		Area (Km <sup>2</sup> )		Area (Km <sup>2</sup> )		Area (Km <sup>2</sup> )		Area (Km <sup>2</sup> )		Area (Km <sup>2</sup> )			
	I	II	I	II	I	II	I	II	I	II	I	II	I	II	I	II		
Chittagong Division	31,706	32,362	10,140	320	14,751	456	19,028	588	22,965	710	26,748	827	29,217	903	32,074	991	35,024	1,082
Chittagong	7,003	7,213	2,983	426	4,616	640	6,222	863	7,849	1,088	9,533	1,322	10,720	1,486	12,256	1,699	13,405	1,858
Chittagong H.T.	13,185	13,175	385	29	539	41	671	51	780	59	881	67	939	71	993	75	1,094	83
Noakhali	4,802	5,263	2,383	496	3,428	651	4,359	823	5,187	986	5,945	1,130	6,418	1,219	6,924	1,316	7,574	1,439
Comilla	6,716	6,711	4,389	654	6,168	919	7,776	1,159	9,149	1,363	10,389	1,548	11,140	1,660	11,901	1,773	13,021	1,940
Dacca Division	36,317	36,339	15,605	430	23,486	646	31,072	855	38,489	1,059	46,006	1,266	51,188	1,409	57,724	1,588	63,119	1,737
Sylhet	12,388	12,383	3,490	282	5,045	407	6,483	524	7,787	629	9,009	728	9,792	791	10,666	861	11,664	942
Dacca	7,461	7,456	5,095	678	8,217	1,102	11,403	1,529	14,794	1,984	18,505	2,482	21,236	2,848	25,000	3,353	27,337	3,666
Mymensingh	13,098	13,111	5,533	422	8,021	612	10,300	786	12,368	943	14,323	1,092	15,567	1,187	16,956	1,293	18,529	1,413
Tangail	3,370	3,389	1,487	441	2,203	650	2,886	852	3,540	1,045	4,169	1,230	4,593	1,355	5,102	1,505	5,589	1,649
Khulna Division	40,137	40,626	13,246	330	19,394	477	25,240	621	30,913	761	36,620	901	40,579	999	45,664	1,124	49,977	1,230
Khulna	12,043	11,987	2,449	203	3,815	318	5,190	433	6,611	552	8,111	677	9,181	766	10,599	884	11,603	968
Patuakhali	3,834	4,337	1,193	311	1,589	366	1,904	439	2,141	494	2,319	533	2,396	552	2,437	562	2,673	616
Bekerganj	7,143	7,228	3,068	430	4,164	576	5,090	704	5,831	807	6,423	889	6,748	934	7,003	969	7,655	1,039
Faridpur	6,974	6,910	3,179	456	4,303	623	5,261	761	6,017	871	6,638	961	6,974	1,009	7,281	1,054	7,958	1,152
Jessore	6,594	6,690	2,191	332	3,526	527	4,890	731	6,351	949	7,941	1,187	9,112	1,362	10,727	1,603	11,745	1,756
Kushtia	3,549	3,474	1,166	329	1,997	575	2,905	836	3,962	1,140	5,196	1,496	6,168	1,775	7,617	2,193	8,343	2,402
Rajshahi Division	34,548	34,616	11,849	343	18,371	531	24,860	718	31,433	908	38,326	1,107	43,216	1,248	49,638	1,434	54,310	1,569
Rajshahi	9,460	9,458	2,811	297	4,525	478	6,283	664	8,146	861	10,189	1,077	11,692	1,236	13,764	1,455	15,066	1,593
Pabna	4,858	4,935	1,958	403	2,984	605	3,988	808	4,977	1,009	5,984	1,213	6,682	1,354	7,569	1,534	8,282	1,618
Bogra	3,888	3,886	1,574	405	2,865	609	3,126	804	3,875	997	4,608	1,186	5,112	1,315	5,733	1,475	6,272	1,616
Rangpur	9,588	9,582	3,796	376	5,774	603	7,716	805	9,619	1,004	11,583	1,209	12,934	1,350	14,650	1,529	16,017	1,672
Dinajpur	6,754	6,755	1,710	253	2,725	403	3,747	555	4,816	713	5,962	883	6,796	1,006	7,922	1,173	8,667	1,283
Bangladesh Total	142,908	143,943	50,840	356	76,002	528	100,200	696	123,800	860	147,700	1,026	164,200	1,141	185,100	1,286	202,500	1,407

(Note): I: Number of Population (Thousand Persons).

II: Population Density (person/km<sup>2</sup>).

Figure 1-7 Distribution of the Future Population in Bangladesh



CHAPTER II  
PRESENT TRAFFIC CONDITIONS IN BANGLADESH

1. General.

1.1. Traffic networks.

The traffic networks of Bangladesh comprise railways, inland waterways, roads and airways. Of them the railways and inland waterways play a vital role, social and economic.

The natural conditions peculiar to Bangladesh have given her a network of inland waterways. There is a vast variety of waterways in Bangladesh, some providing small-scale traffic means for the community people in the respective regions and some serving as large-scale routes of passenger and freight traffic between regions. The people of Bangladesh where more than half her land is inundated during the rainy season have from of old used waterways in preference to road or rail, and inland water transport plays a very important role in the economy of Bangladesh. The total length of inland waterways is tremendous, and of them, those which are accessible to large vessels serving inter-region routes are operated by the Inland Water Transport Authority (IWTA).

The railways of Bangladesh were not built for the purpose of providing traffic means for the nation but were constructed mainly for the purpose of exporting the agricultural products to the suzerain state and distributing the imports from it. This historical background of Bangladesh railways explains the difference in railway gage between the eastern and western regions divided by the Jamuna River.

Furthermore, the two regions which extend from south to north have railway networks of a unique pattern starting from Calcutta and Chittagong, respectively. Unlike the inland waterways, the railway networks extending on both sides of the Jamuna River do not directly connect the three big load centers of Bangladesh, Dacca, Chittagong and Khulna. The difference in network pattern between railways and waterways is in part attributable to the geographic conditions of the country. As can be known from Figs. 2-1 and 2-2 overlapped one on top of the other. The railways are, comparatively speaking, concentrated in the northern region where waterways are not developed (and little wonder, because railways are less costly to build there), whereas the waterways spread from the middle to the southern region where little railways exist. This means that people of Bangladesh have no option for the means of transportation best suited to the commodities they want to move, but at least in the present stage of traffic development in this country the transport system of this type may be more effective than anything more complex.

The trunk roads, on the other hand, extend for a total length of about 1,200 miles, to connect all the divisions, but the road networks are also strongly effected by the natural conditions of the land. The

Figure 2-1 Network of Inland Waterways

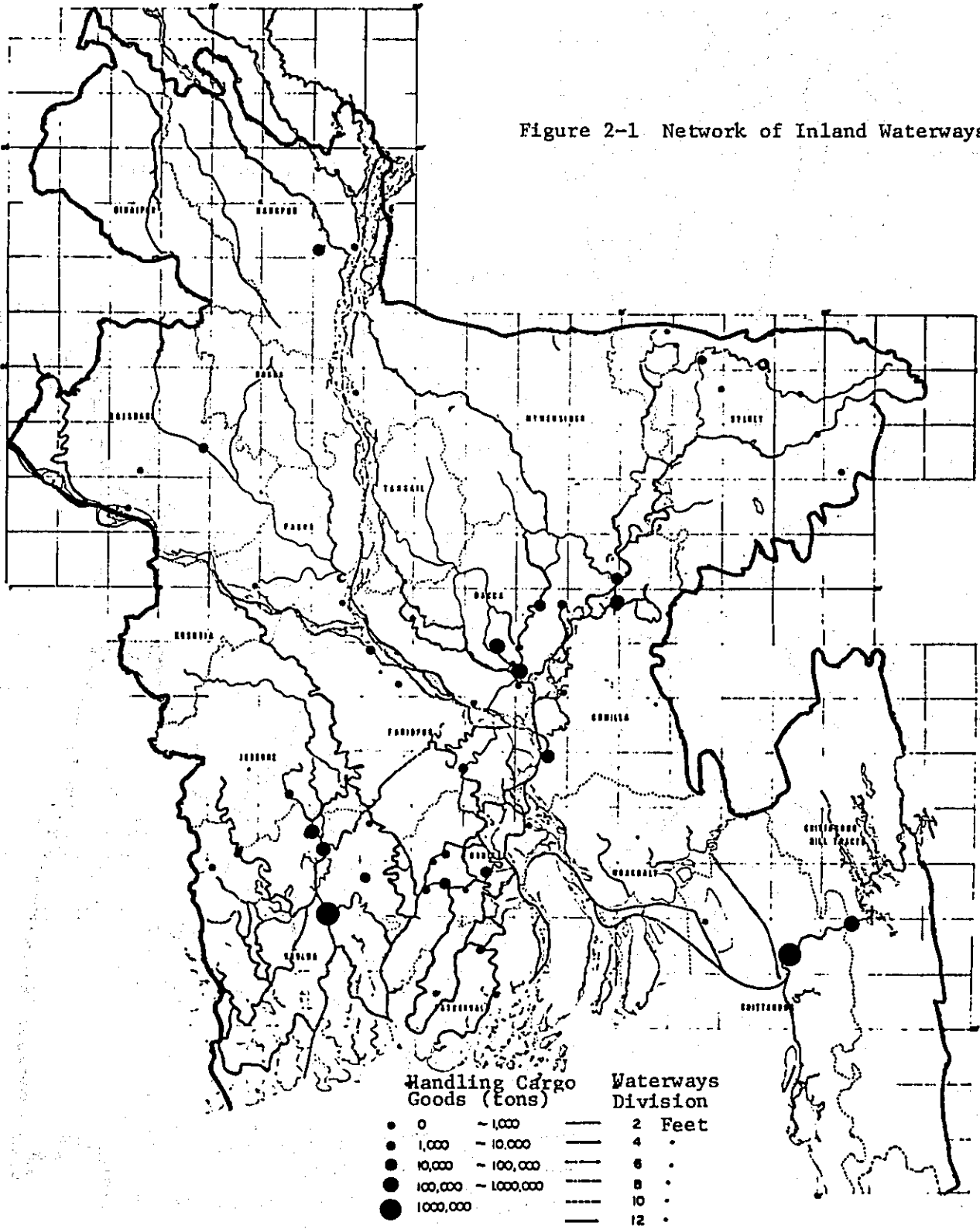


Figure 2-2 Railway Networks

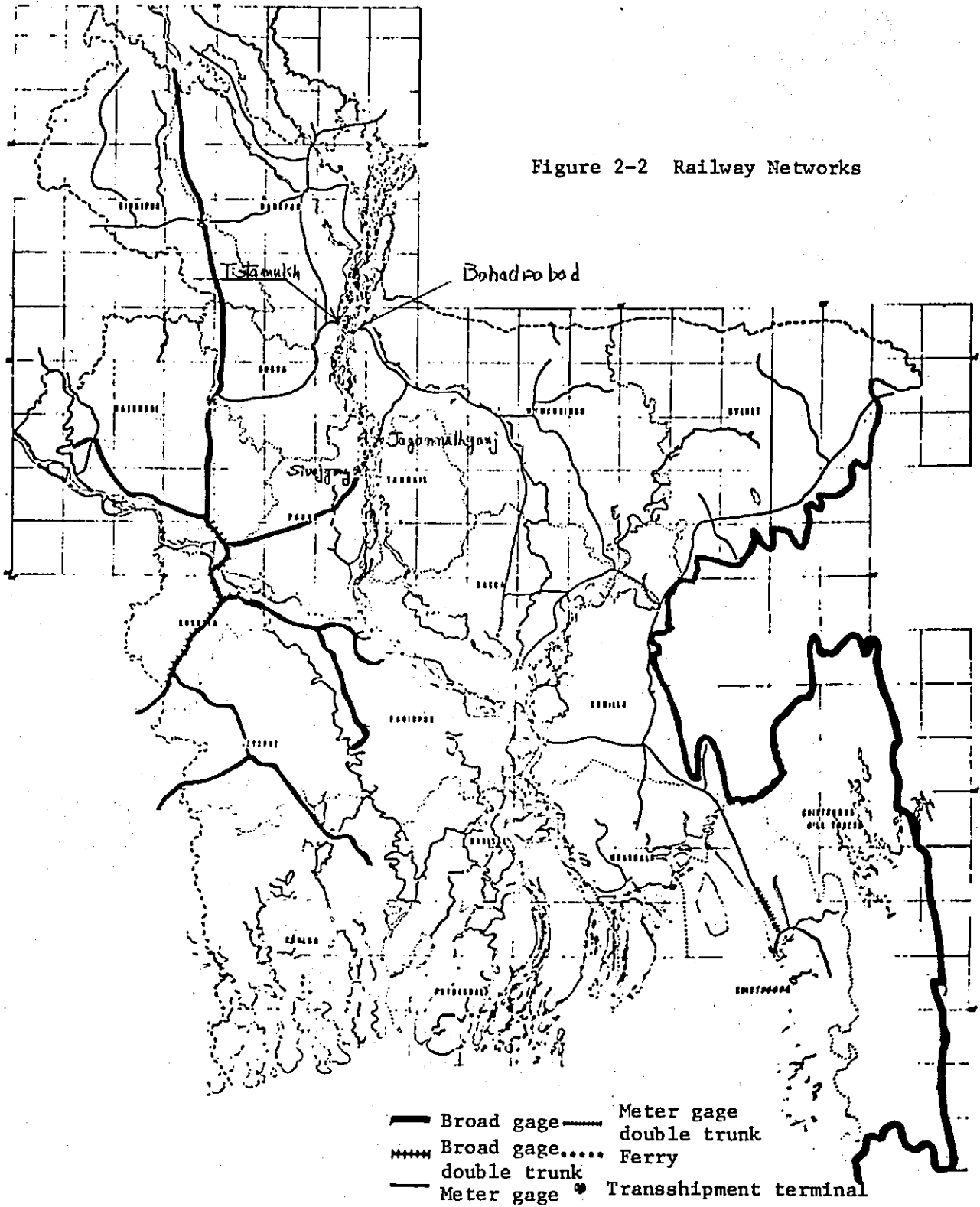
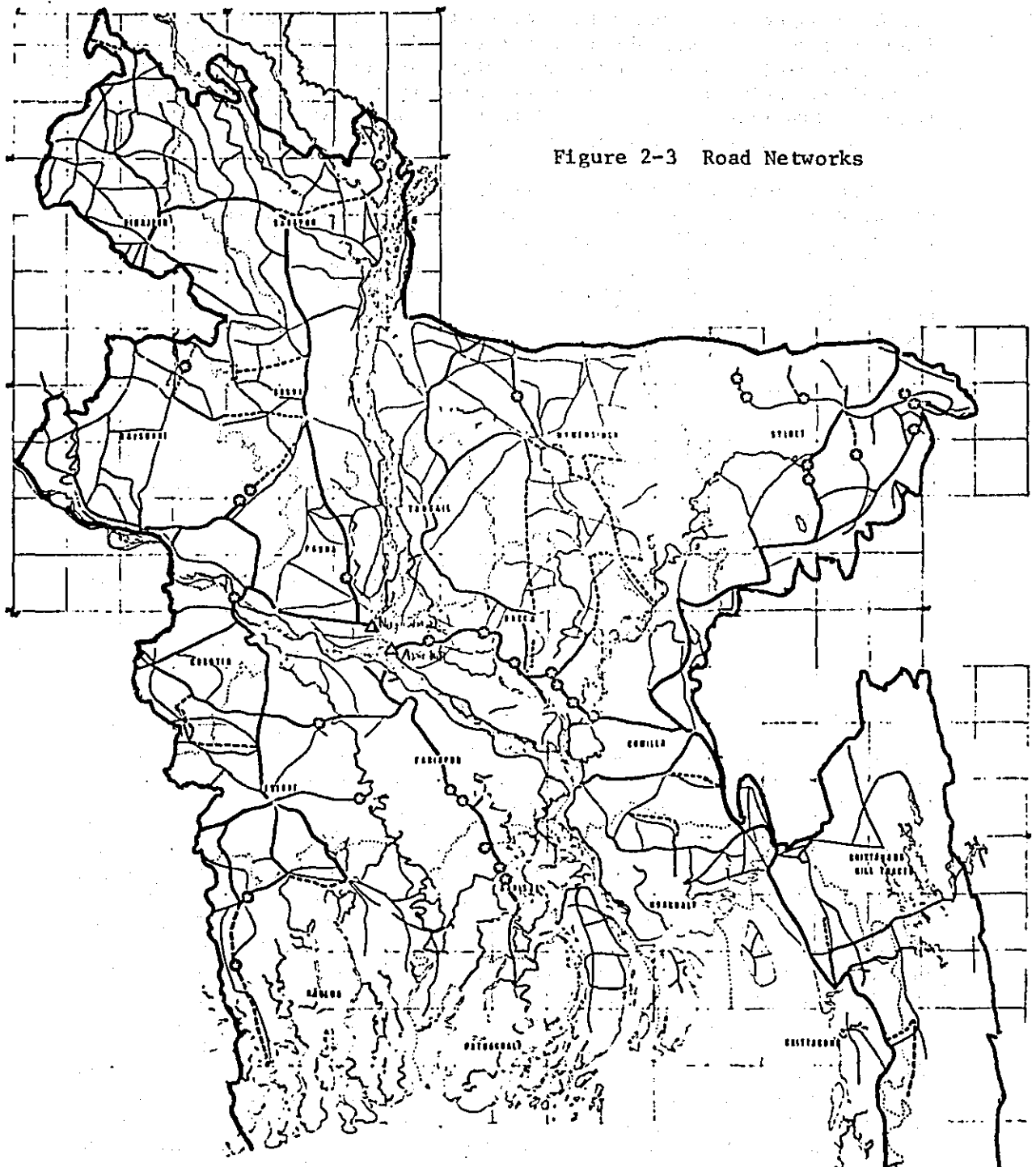




Figure 2-3 Road Networks



- TRUNK ROADS      — SHINGLE ROADS
- MAIN ROADS     — other road
- - - - under construction    ○ ferry
- ▲ Aricha ferry

trunk roads do not connect the seats of local governments and other load centers in a straight line but extend in a tortuous way. Rivers are responsible for the tortuous pattern of road networks. As a whole, connections between north and south are difficult. The obstacle to road construction is not limited to big rivers but includes many distributary ones in all the districts.

The railway and road networks in the eastern and western regions of the country are completely separated from each other by the Jamuna River, and all traffic is carried by ferry boats across the river. Especially in the case of railways, the difference in gauge between the two regions makes it necessary to tranship both freight and passengers at the ferry terminals, thus greatly reducing the efficiency of operation of the transport system.

#### 1.2. O-D Survey of passenger traffic across the Jamuna River.

Passenger traffic across the Jamuna River is divisible into railway traffic and road traffic. All the passenger traffic is carried by boat across the river, but no complete data on passenger traffic across the river was available. To make a more accurate estimate of this traffic, two surveys were taken for two days each, one in December 1973 and the other in June 1974. Both surveys were conducted by interviewing in order to collect information concerning the origin and destination of traffic as well as the traffic movement in the dry and rainy seasons.

##### 1.2.1. Railway passenger traffic survey.

The railway passenger traffic survey was conducted by interviewing all passengers who used the train ferry boat between Bahadurabad and Tistamuka and between Jagannathganj and Sirajganj on two days of December 1973 and June 1974, respectively. The train ferry boats made two round trips a day on both the ferry routes (which were operated according to the train schedule). The results of the survey will be discussed in detail later. To be short, the average railway passenger traffic between Bahadurabad and Tistamuka in the dry and rainy seasons was about 3,300 persons per day, and that between Jagannathganj and Sirajganj, about 2,600 persons per day. Between Bahadurabad and Tistamuka traffic between northwestern districts like Bogra, Rangpur and Dinajpur on one hand and Dacca and Mymensingh on the other was quite dense, accounting for about 85% of all traffic crossing the Jamuna River, whereas between Jagannathganj and Sirajganj traffic originating in or bound for Dacca and Mymensingh was heavy for the east side of the river but traffic originating in or bound for Jessore, Kushtia, Rajshahi and Pabna districts was overwhelming for the west side of the river. These patterns of traffic movement are only natural from the standpoint of the existing railway networks.

##### 1.2.2. Road Passenger Traffic Survey.

The road passenger traffic survey was conducted on two ferry routes: one between Aricha and Nagarbari and one between Aricha and Goalundo. Each route had a schedule of 4 round trips per day, but it

appeared that less trips were made depending on the day. It was shown by the survey that the average road passenger traffic on the ferry routes in both the dry and rainy seasons was about 2,200 persons per day, but the ferry traffic greatly varied with the season. The traffic in the rainy season was 1.4 times greater than in the dry season. Judging by the fact that the boats were more congested in the rainy season than in the dry season in spite of shorter intervals of service in the rainy season, it appeared that the ferry traffic congestion was not merely for a seasonal reason but ferry traffic itself increased in the span of time between the two surveys.

By O-D, traffic originating in or bound for Dacca was overwhelming, accounting for more than 90% of total traffic on each ferry route and indicating its close relations with Faridpur, Jessore, Pabna and Rajshahi districts. As for motor traffic, nearly 100% of both bus and passenger car traffic originated in or was bound for Dacca.

## 2. Traffic Volume.

### 2.1. Railway passenger movement.

The railway passenger movement had not varied greatly during the past 10 years from the annual passenger of 70 million as shown in Table 2-1. However, the average trip length made a slight increase of 10% in terms of man-mile. Tables 2-2 and 2-3 show the number of passengers and the average trip length by coach class respectively. The passengers of 3rd class accounted for more than 90%, those of 1st class and air-conditioned class totalled less than 1%. The average trip length was greater for the higher class passengers.

The number of railway users was greatest for Chittagong Station and Dacca Station with an annual passengers of over 2 million respectively. On the contrary in Khulna which has one of the key cities in Bangladesh there were no railway stations used by a great number of users. This might be because in Khulna areas IWT and vehicle transport networks were comparatively developed, while the rail system were poor. Stations of Mymensingh and Comilla handled more than 1 million passengers annually. The district capitals which have railway stations handled more than 500 thousand passengers and the stations which have railway junctions also handled more than 500 thousand passengers. The stations which connect to big IWT terminals such as Narayanganj and Chandpur did not handle so many railway passengers. Table 2-4 shows the number of stations classified by area and number of passengers. The areas which have a great number of railway passenger movement are Comilla, Mymensingh, Dacca and Chittagong, and the ones which have a comparative large number of passengers are Sylhet, Rajshahi and Dinajpur. Jessore and Khulna areas have few railway users.

Table 2-1 Railway Passenger Movement

Year	Persons (x1000)	Man-miles (x1000)	Average Trip Length (miles)
1959 - 60	70,091	1,816,381	25.9
1960 - 61	71,175	1,881,881	26.4
1961 - 62	72,799	1,916,555	26.3
1962 - 63	70,002	1,935,535	26.9
1963 - 64	73,145	2,003,397	27.4
1964 - 65	71,326	1,921,791	26.9
1965 - 66	67,191	1,787,490	26.6
1966 - 67	73,017	2,004,532	27.5
1967 - 68	70,806	2,078,707	29.4
1968 - 69	72,836	2,205,212	30.3
1969 - 70	72,885	2,061,084	28.3

Source: Bangladesh Railway Board Year Book 1970.

Table 2-2 Number of Railway Passengers by Class

Unit: Thousand Persons

Year	Class	Air-con- ditioned		1st		2nd		Inter- mediate		3rd		Total No.
		No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	
1959 - 60	--	--	--	58	0.08	342	0.49	3,892	5.55	65,799	93.9	70,091
1960 - 61	--	--	--	62	0.09	379	0.53	4,453	6.26	66,281	93.1	71,175
1961 - 62	--	--	--	61	0.08	420	0.58	4,956	6.81	67,362	92.5	72,799
1962 - 63	--	--	--	63	0.09	442	0.61	5,063	7.03	66,434	92.3	72,002
1963 - 64	--	--	--	68	0.09	479	0.65	5,433	7.43	67,165	91.8	73,145
1964 - 65	--	--	--	69	0.10	422	0.59	4,958	6.95	65,877	92.4	71,326
1965 - 66	--	--	--	71	0.11	347	0.52	4,660	6.94	62,113	92.4	67,191
1966 - 67	--	--	--	74	0.10	346	0.47	5,197	7.12	67,400	92.3	73,017
1967 - 68	29	0.04	384	0.54	5,424	7.66	--	--	--	64,969	91.8	70,806
1968 - 69	38	0.05	314	0.43	5,590	7.67	--	--	--	66,894	91.8	72,836
1969 - 70	42	0.06	334	0.45	5,714	7.84	--	--	--	66,795	91.6	72,885

Source: Bangladesh Railway Board Year Book 1970.

Table 2-3 Average Trip Length by Class

Unit: Miles

Year	Class	Air-con- ditioned	Class				Total
			1st	2nd	Inter- mediate	3rd	
1959 - 60		--	108.2	57.7	34.7	25.2	25.9
1960 - 61		--	108.9	57.2	25.7	25.6	26.4
1961 - 62		--	105.5	57.9	34.8	25.4	26.3
1962 - 63		--	107.1	57.8	36.8	35.9	26.9
1963 - 64		--	108.4	59.5	36.9	26.3	27.4
1964 - 65		--	107.1	59.5	40.3	25.6	26.9
1965 - 66		--	115.0	61.1	42.8	25.1	26.6
1966 - 67		--	118.0	62.9	43.4	25.9	27.5
1967 - 68		160.8	72.5	45.8	--	27.7	29.4
1968 - 69		138.2	83.3	49.8	--	28.3	30.3
1969 - 70		133.8	81.5	45.7	--	26.4	28.3

Source: Bangladesh Railway Board Year Book 1970.

Table 2-4 Number of Stations Classified by Area and Number of Passengers

Unit: Stations

Area	Annual users (10 Thousand persons)					
	200 -	100-200	50-100	30-50	10-30	1-10
Chittagong	1	0	3	5	11	17
Comilla	0	1	6	3	25	17
Sylhet	0	0	1	3	14	28
Dacca	1	0	1	4	13	7
Mymensingh	0	1	2	2	28	21
Khulna	0	0	0	2	4	6
Jessore	0	0	0	5	14	42
Rajshahi	0	0	3	3	18	21
Dinajpur	0	0	4	5	31	45

Table 2-5 Origin-Destination of Passenger Cars and Jeeps in 1968/69

D 0	Unit: Vehicles																			Total						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19							
	CHITTA GONG	CHITTAG ONG	CHITTAG H.T.	NOAKH ALI	COMIL LA	SYLHET DACCA	DACC SINGH	IL	TANGA	KHULNA	KHALI	AL	PATUA	BARIS	FARID	JESSO	KUSHT	IA	RAJSH	PABNA	BOGRA	DR	DINALJ PUR	*	**	
1 CHITTAGONG	72	8	6	13																					99	27
2 CHITTAGONG H.T.																										
3 NOAKHALI	6																								6	6
4 COMILLA	5		93	19																					117	24
5 SYLHET	1		1																						2	2
6 DACCA	8		19		1,041	6	15	14		1	4	3	1	2	3								1	1	1,119	78
7 MYMENSINGH						2																			2	2
8 TANGAIL						18																			18	18
9 KHULNA	1				8			185			2	83	6	1											286	101
10 PATUAKHALI																										
11 BARISAL					1						2														3	3
12 FARIDPUR					4			2			25														31	6
13 JESSORE					5			97			1	21	4												128	107
14 KUSHTIA					2			4				6													12	12
15 RAJSHAHI					3											12									15	15
16 PABNA					4										11	21							1		37	16
17 BOGRA					2										1		18	7					2		30	12
18 RANGPUR					1												7						17		25	25
19 DINAJPUR					1												2						48		51	3
*	93	8	119		1,124	6	15	302		1	34	113	11	15	36	27	8	69							1,981	
Total	21	8	26		83	6	15	117		1	9	92	11	15	15	9	8	21							457	

Source: Roads & Highways Directorate.

\* ; Includes intra-district traffic. \*\* : Excludes intra-district traffic.

Table 2-6 Origin-Destination of Bus Passengers in 1968/69

Unit: Vehicles

D	Origin-Destination																			Total			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19				
0	CHITTA GONG	CHITTAG ONG H.T. ALI	CHITTAG ONG H.T. ALI LA	CHITTAG ONG H.T. ALI LA	CHITTAG ONG H.T. ALI LA	CHITTAG ONG H.T. ALI LA	CHITTAG ONG H.T. ALI LA	CHITTAG ONG H.T. ALI LA	CHITTAG ONG H.T. ALI LA	CHITTAG ONG H.T. ALI LA	CHITTAG ONG H.T. ALI LA	CHITTAG ONG H.T. ALI LA	CHITTAG ONG H.T. ALI LA	CHITTAG ONG H.T. ALI LA	CHITTAG ONG H.T. ALI LA	CHITTAG ONG H.T. ALI LA	CHITTAG ONG H.T. ALI LA	CHITTAG ONG H.T. ALI LA	CHITTAG ONG H.T. ALI LA	CHITTAG ONG H.T. ALI LA			
1	CHITTAGONG	1,201	1,400	80																	2,681	1,480	
2	CHITTAGONG H.T.																						
3	NOAKHALI	1,570																				1,570	1,570
4	COMILLA			1,624	6	484																2,114	490
5	SYLHET																						
6	DACCA	1		462		19,707	422	1,242				11										21,845	2,138
7	MYMENSINGH					68																68	68
8	TANGAIL					1,987																1,987	1,987
9	KHULNA							1,221						2,070	2,156							5,447	4,226
10	PATUAKHALI																						
11	BARISAL																						
12	PARIDPUR														253							253	253
13	JESSORE							2,217					1,048	779								4,044	2,996
14	KUSHTIA							1,736					1,070									2,806	2,806
15	RAJSHAHI															459						459	459
16	PABNA															567	141	100				808	808
17	BOGRA															131	755					886	755
18	RANGPUR															795			916			1,711	1,711
19	DINAJPUR															44	965	2,767				3,776	1,009
*	Total	2,772	1,400	2,166	6	22,246	422	1,242	5,174			4,199	2,935	820	459	1,111	1,820	3,683	50,455				
**	Total	1,571	1,400	542	6	2,539	422	1,242	3,953			3,151	2,935	820	459	980	1,820	916	22,756				
	INDIA (CALCUTTA)																						

Source: Roads & Highways Directorate.

\* : Includes intra-district traffic.

\*\* : Excludes intra-district traffic.

Table 2-7 Passenger Movement by IWTA

(Unit: Million persons)

1959/60	60/61	61/62	62/63	63/64	64/65	65/66	66/67	67/68	68/69	69/70
14	16	20	21	22	22	23.6	25.4	24.7	25.6	26.4

### 2.2. Highway passengers movement.

From October 1968 through February 1969 the national highway traffic survey was conducted by Roads & Highways Directorate with 13 survey stations in the country. The fundamental trip pattern of passenger cars shows, like these of trucks and buses, more traffic around the adjacent areas of cities such as Chittagong, Dacca, Khulna, Jessore, etc.

Table 2-5 shows the O-D trips of passenger cars and jeeps, in which the number of intra-district trips were very great. The number of inter-regional trips in Khulna Division occupied approximately half of the whole number of interregional trips. The O-D shows the most trips between Khulna and Jessore. There were some trips that were for comparatively long distance such as between Dacca and Chittagong and between Dacca and Khulna.

The bus traffic was great on the routes that connected to large cities, Chittagong-Feni, Chittagong-Kaptai, routes to/from Dacca, Khulna-Jessore, etc. as noted in Table 2-6 which shows the O-D of bus passenger trips in 1968/69. The characteristics of the bus traffic was such that its O-Ds were limited to the traffic for very short distance: the traffic between Khulna and Jessore (including Kushtia) occupied approximately half of the total traffic, while no bus O-D traffic was found between the districts, Barisal, Patuakhali, Faridpur, etc. and the other districts, in Khulna Division.

### 2.3. Inland water passenger movement.

The passengers by inland water can be divided into the ones by Inland Water Transport Authority (IWTA) and the ones by country boat. The passengers by IWTA are shown in Table 2-7, the number of which, unlike railway, almost doubled during the decade 1959/60-69/70. However the number of passengers by IWTA in 1968/69 was only approximately 30% of the railway passengers in the same year. Land transport still played a greater role in passenger movement.

The man-miles by IWTA amounted to 649 million in 1968/68 and 702 million in 1968/69 respectively, both of which were equivalent to one third of the man-miles by railway. The average trip length of passengers by IWTA came to 26 miles in 1967/68 and 26.5 miles in 1968/69, which were a little shorter than that by rail.

Both in railway and IWTA the average trip length of passengers ranges from 25 to 30 miles which is much smaller than that of goods. Most of these modes of transport is supposed to be for such short distance trips as intra-district.



The average trip length of passengers by country boat that amounted to 17 miles is supposed to be for intra-district distance. According to the survey of passenger movement by country boat which was conducted by Dr. M.A. Rahman in 1963/64 based on 1003 samples boats, the volume amounted to 437 thousand passenger's and 7,435 thousand man-miles.

### 3. Goods Movement.

#### Data source and method of study

Reliable data and information concerning goods movement are very scarce and especially for the relation among modes of transport there is none that might be collectively comparable. The First Five-Year Plan puts an emphasis on the necessity to establish the transportation plan on the basis of a collective transport survey.

For this purpose the Bangladesh Transport Survey (B.T.S.) has been started since the year 1972 and now it is nearing its final stage. With the completed results of this survey, the transport sector of the five year plan will be revised.

The B.T.S. has already been completed in most of all the parts, some portions of which are to be incorporated into our survey as the newest, presentation of the status of transport after the war. Its results will not only have a strong, direct influence on the current five year plan but also produce important data for the Jamuna Bridge Survey.

Our survey selects the year 1968/69 as in its base year from the following points:-

- 1) The year 1973 does not present the normalized transport activities owing to the aftermath of the war: the regional economy has not fully recovered its production capacity, with innumerable destructions of transport systems, forming bottlenecks in many places.
- 2) At the present time the B.T.S. is under way and we avoid our survey being overlapped by their survey. Therefore, our field survey has been conducted for passengers and goods crossing the Jamuna with the intention to supplement the B.T.S.
- 3) The economic activities in 1968/69 was in a normal and the highest level.
- 4) The year 1968/69 is the only year that more detailed data is available about transportation of railway, highway and waterway.
- 5) The year 1968/69 is the year that more comprehensive data are available about the indices of the regional economy.

Among these data the following are used in this study especially about goods movement.

Railway: Interzonal Statistics, Bangladesh Railway Board, 1969

Highway: Traffic Survey Results, Roads & Highways Directorate, 1968.

Waterway: Annual Traffic Report, Inland Water Transport Authority, 1968/69.

The above data are adjusted and coordinated in some parts, e.g., as the weight of regional movement by rail in the above data covers only 50% of the actual total movement, considerable modification is made by item, and the goods for study by item as shown in Table 2-11 are limited to the main goods that were carried with an amount of over 100 thousand tons either in 1968/69 or 1972/73.

### 3.1. Factory survey.

The large-scale Bangladesh Transport Survey which is under way provides general information about the distribution of commodities in Bangladesh, but contains little information about the freight carried across the Jamuna River. To obtain specific information about the freight movement across the river, a series of surveys of freight movement were conducted, and this factory survey was part of this series.

The factory survey was taken between June and July 1974, using questionnaires distributed to the government-owned and private factories across the countries employing 10 employees or more. (The form of questionnaire is contained in the Appendix.) The survey design and results are summarized below.

- |   |                 |
|---|-----------------|
| 1) Number of questionnaires distributed   | 3,733           |
| 2) Returned questionnaires  | 1,479           |
| 3) Rate of recovery   | 39.6 %          |
| 4) Factories which used the Jamuna River<br>(% proportion of returned questionnaires)   | 528<br>(35.7 %) |
| 5) The annual freight movement in one year from July 1973 to June 1974 was surveyed.  |                 |
| 6) Only the questionnaires returned by the factories which used the Jamuna River for material and product transportation were used in the statistical analysis of freight movement across the Jamuna River (see Tables 2-8 and Fig. 2-4). |                 |

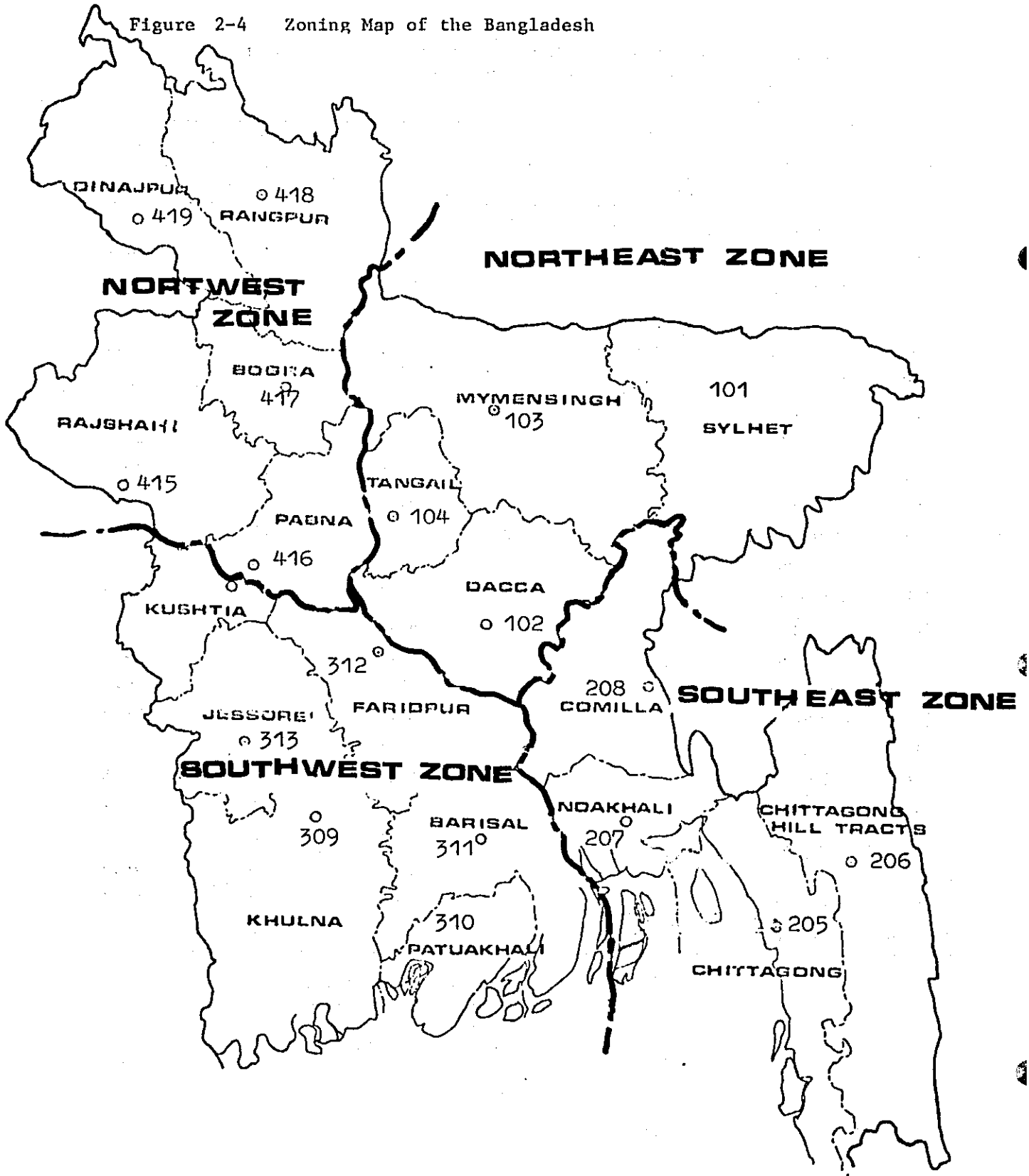
The survey information included the types of transport for the cargoes surveyed, origin and destination of cargoes (including quantity) and types of transport which the factories would use after completion of the Jamuna River Bridge.

Table 2-8 Number of the Factory Survey and the Rates of its Returned Questionnaires

Zone No.	District	No. of Questionnaires Distributed	Returned Questionnaires	Rate of Recovery (%)	No. of Factory using the Jamuna River	Rate of Crossing
101	Sylhet	166	79	47.6	1	1.3
102	Dacca	1,661	566	34.6	166	29.3
103	Mymensingh	48	8	16.7	3	37.5
104	Tangait	34	22	64.7	6	27.3
(NE)	Subtotal	1,909	675	35.4	176	26.1
205	Chittagong	748	350	46.8	70	20.0
206	Chittagong HT					
207	Noakhali	292	81	27.7	19	23.5
208	Comilla	126	34	36.9	10	29.4
(SE)	Subtotal	1,166	465	39.9	99	21.3
309	Khulna	84	31	36.9	13	41.9
310	Patuakhali	-	-	-	-	-
311	Barisal	43	31	72.1	1	3.2
312	Faridpur	33	16	48.5	8	50.0
313	Jessore	8	3	37.5	1	33.3
314	Kushtia	13	2	15.4	1	50.0
(JW)	Subtotal	181	83	45.9	24	28.9
415	Rajshahi	32	13	40.6	10	76.9
416	Pabna	299	165	55.2	158	95.8
417	Bogra	42	35	83.3	27	77.1
418	Rangpur	36	17	47.2	14	82.4
419	Dinajpur	68	26	38.2	20	76.9
(NW)	Subtotal	477	256	53.7	229	89.5
Bangladesh (Total)		3,733	1,479	39.6	528	35.7

NE ..... Northeast  
SE ..... Southeast  
SW ..... Southwest  
NW ..... Northwest

Figure 2-4 Zoning Map of the Bangladesh



101 - - - - Zone Number

Table 2-9 Inter-district O-D Movement of Cargoes in Bangladesh

																							Unit: Ton/year					
D	101	102	103	104	S. Tol	205	206	207	208	S. Tol	309	310	311	312	313	314	S. Tol	415	416	417	418	419	S. Tol	520	521	522	S. Tol	Total
0	Sylhet	Dacca	Mymensingh	Tangail		Chittagong	CTG. H.T	Noakhali	Comilla		Khulna	Patuakhali	Barisal	Faridpur	Jessore	Kushtia		Rajshahi	Pabna	Bogra	Rangpur	Dinajpur		Calcutta	Indistinct	Others		
101 Sylhet	0	40.2	11.6	0	51.8	103.0	0	130.6	86.0	319.6	0	0	0	0	0	0	0	7.5	0	0	89.1	14.9	111.5	0	0	0	0	482.9
102 Dacca		52,056.1	184.6	219.7	52,500.7	176,665.4	80.0	141.1	150,268.5	327,155.0	82,462.6	0	40.2	26.1	188.3	61.5	82,778.7	20,238.5	1,747.0	1,344.7	3,468.8	2,601.2	29,400.2	0	17,987.2	311,709.3	329,696.5	821,531.1
103 Mymensingh			0	27.5	223.6	227.0	0	0	46.6	273.6	16.4	0	0	0	0	0	16.4	7.5	15.0	679.0	5.3	0	706.8	0	0	0	1,220.4	
104 Tangail				0	247.2	0.8	0	0	0	0.8	0	0	0	0	0	0	0	0	2.1	0	53.0	0	55.1	0	0	0	303.1	
Sub total					53,023.3	176,996.2	80.0	271.7	150,401.1	327,749.0	82,479.0	0	40.2	26.1	188.3	61.5	82,795.1	20,253.5	1,769.1	2,023.7	3,616.2	2,616.1	30,273.6	0	17,987.2	311,709.3	329,696.5	823,537.5
205 Chittagong						4,127.7	1,561.9	7,966.1	400,794.3	414,450.1	5,889.8	0	0	2.7	0	51.0	5,943.5	1,611.1	938.8	2,167.0	2,264.5	338.1	7,319.5	0	90.0	5,026.0	5,116.0	609,825.1
206 CTG.GT						0	0	0	0	1,561.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,641.9
207 Noakhali						0	0	0	1,280.0	9,246.1	39.2	0	7.5	0	0	0	46.7	5.6	0	56.2	7.5	5.6	74.9	0	1,044.5	0	1,044.5	18,683.9
208 Comilla						0.1	402,074.4	42.9	29.8	827,332.5	5,971.9	29.8	14.9	0	0	0	87.6	44.8	0	0	222.9	0.1	267.8	0	0.2	0	0.2	552,831.2
Sub total						4,127.7	1,561.9	7,966.1	400,794.3	414,450.1	5,889.8	0	0	2.7	0	51.0	6,077.8	1,661.5	938.8	2,223.2	2,494.9	343.8	7,662.2	0	1,134.7	5,026.0	6,160.7	1,174,982.1
309 Khulna											4,481.0	0	83.0	5,101.1	6,834.0	166.0	16,665.1	17,768.0	3,139.8	537.2	761.4	2,742.2	24,948.6	54.5	2,428.0	35.7	2,518.2	132,582.8
310 Patuakhali											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	29.8
311 Barisal											0	0	0	0	0	0	83.0	0	0.4	0	0	0	0.4	0	0	0	0	145.9
312 Faridpur											0	0	0	0	0	0	5,101.1	0	0	0	0	0	0	0	7.5	0	7.5	5,137.4
313 Jessore											0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
314 Kushtia											0	0	0	0	0	10.2	6,844.2	0	0	13.0	0	0	13.0	1,646.7	0	0	1,646.7	8,692.2
3 Sub total											4,481.0	0	83.0	5,101.1	6,834.0	166.0	16,665.1	17,768.0	3,139.8	537.2	761.4	2,742.2	24,948.6	54.5	2,428.0	35.7	2,518.2	132,582.8
415 Rajshahi																	28,869.6	17,768.0	3,155.1	568.9	761.4	3,401.1	25,654.5	1,701.2	2,435.5	35.7	4,172.4	147,569.3
416 Pabna																	0	5.9	77.5	0	522.3	605.7	0	2,118.1	0	2,118.1	42,906.7	
417 Bogra																	0	136.0	7.1	11.2	0	160.2	0	13.9	0	13.9	0	6,032.1
418 Rangpur																	0	0	0	0	621.2	181.9	887.7	0	756.6	0	756.6	6,460.0
419 Dinajpur																	0	0	0	0	869.9	775.2	2,277.4	0	0	0	0	9,149.9
Sub total																	28,869.6	17,768.0	3,155.1	568.9	761.4	3,401.1	25,654.5	1,701.2	2,435.5	35.7	4,172.4	147,569.3
520 Calcutta																								0	0	0	0	1,701.3
521 Indistinct																								0	0	0	0	24,528.1
522 Others																								0	0	0	0	316,848.0
Sub total																								0	0	0	0	343,077.4
Total																												2,607,384.4

Sources: Results of Factory Survey only for factory which used Jamuna River.

Figure 2-5 Main Inter-district Cargo Movement in Bangladesh

This chart shows the inter-district movement of cargoes in excess of 5,000 tons. To simplify charting, the movement of cargoes between 5,000 and 10,000 tons is indicated by the same line as used to show the movement of cargoes of 10,000 tons.

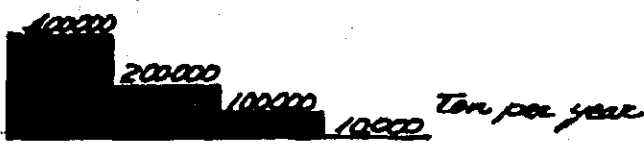
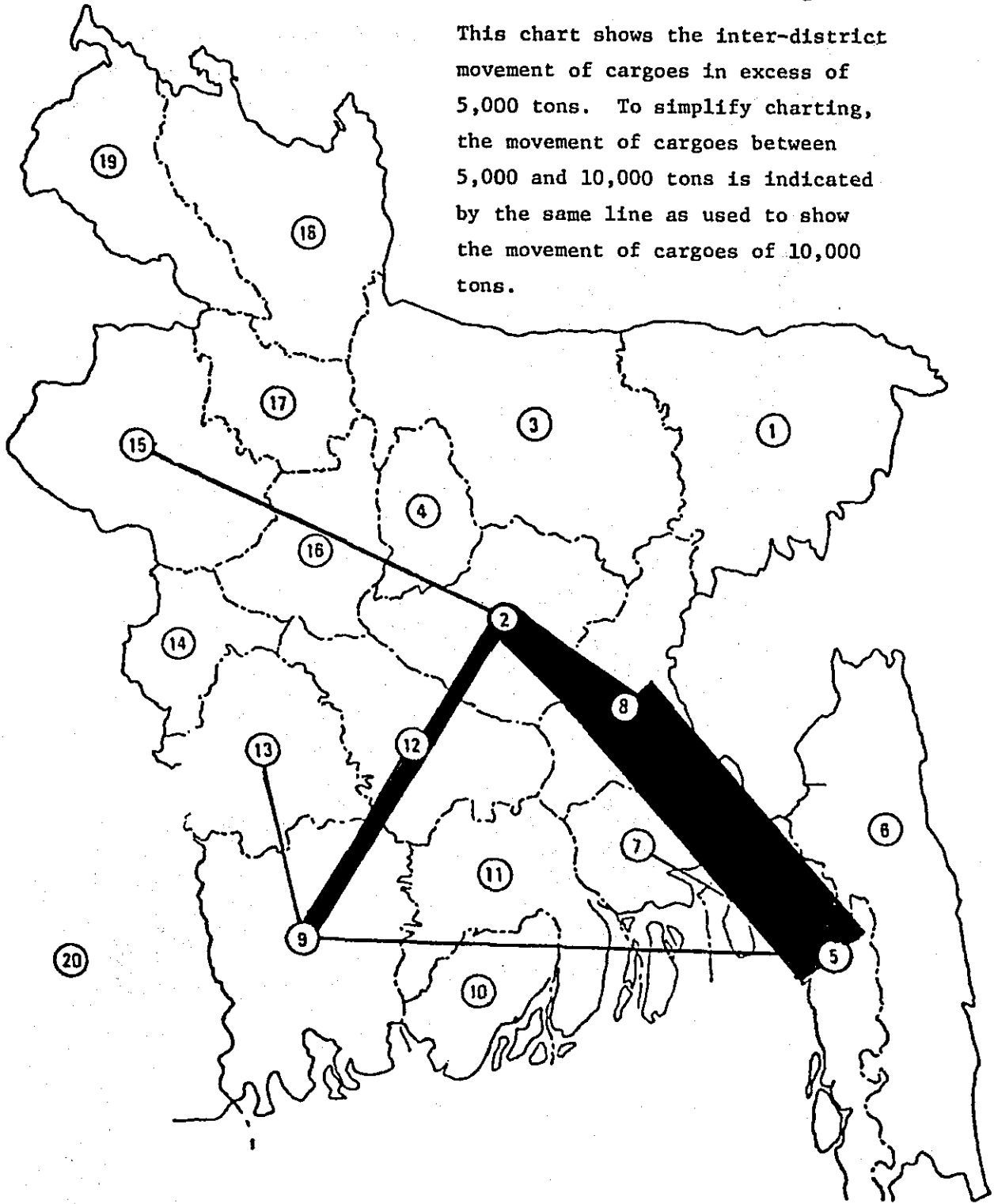
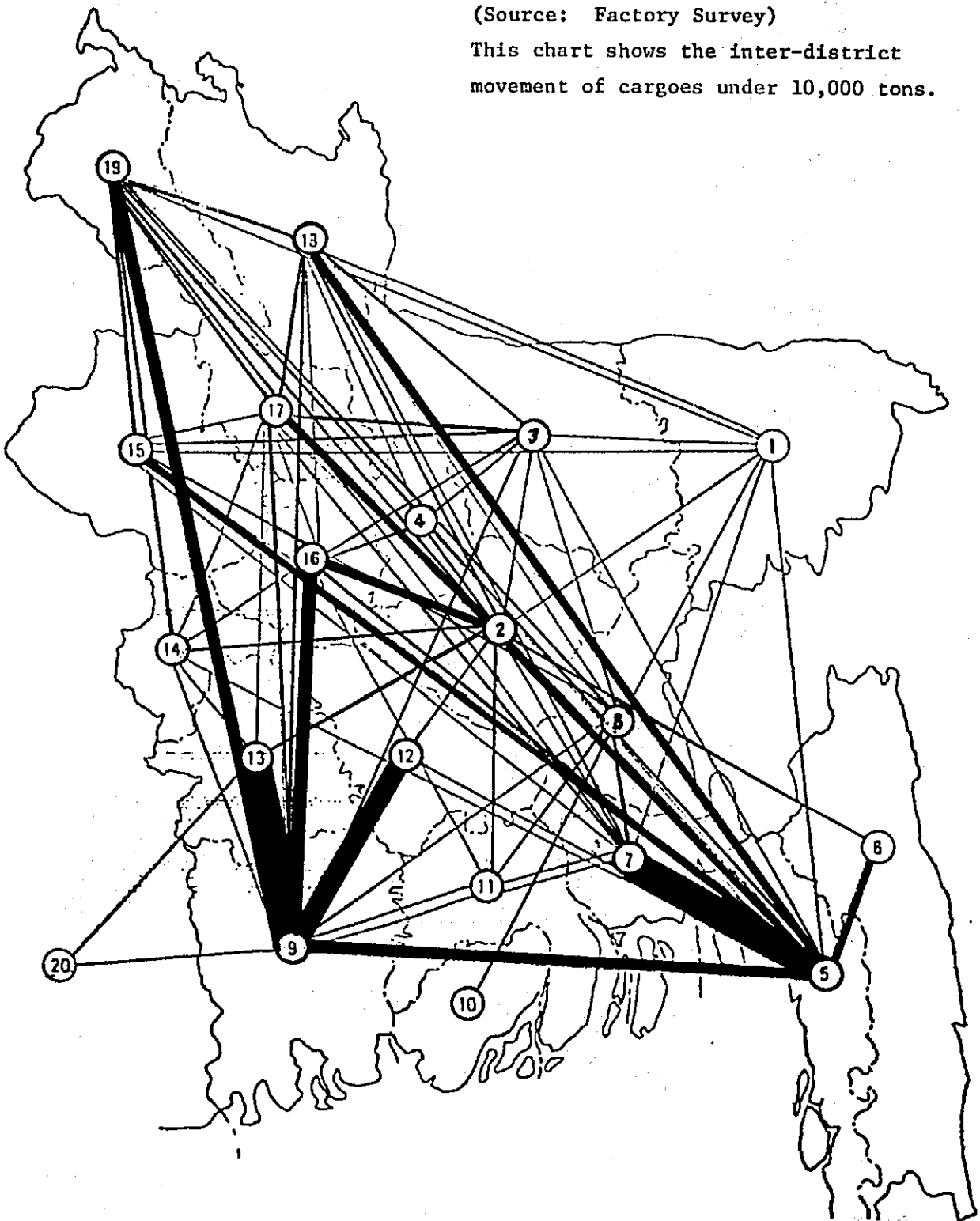


Figure 2-6 Main Inter-district Cargo Movement in Bangladesh

(Source: Factory Survey)

This chart shows the inter-district movement of cargoes under 10,000 tons.



Since the survey covered only 528 factories which used the Jamuna River, it does not furnish information about the nationwide cargo movement can be known from the data furnished by the survey, because the surveyed factories were distributed in each district in the much same proportion as all factories.

Table 2-9 shows the cargo volume generated by the surveyed factories in each district and inter-district cargo movement across the Jamuna River by O-D. Fig. 2-5 shows the inter-district movement of cargoes in excess of 5,000 tons, and Fig. 2-6, the inter-district movement of cargoes between 5,000 and 10,000 tons.

The data above shows that cargo traffic carried across the Jamuna River is dense between Chittagong and Comilla, between Chittagong and Dacca, between Dacca and Comilla, and between Dacca and Khulna. This tendency of cargo movement is in agreement with the existing data of the traffic surveys taken in Bangladesh in the past. When Figs. 2-5 and 2-6 are compared, it can be known that the cargoes which originate in or are bound for Chittagong and Khulna, main outlets of the country to the sea, are moved in large measure between Khulna and North Bengal and between Chittagong on one hand and Dacca and Comilla on the other and that this freight traffic accounts for much of the nationwide cargo movement in Bangladesh. In other words, it can be said that the data obtained by the factory survey faithfully reflects the real cargo movement across the country. The factory survey also revealed that little cargoes occurred between Bangladesh and India except between Jessore and Calcutta and between Khulna and Calcutta.

Mention will now be made of the industry distribution and scale of the surveyed factories.

#### Industry distribution and scale of the surveyed factories

The industry distribution and scale of the surveyed factories by zones are shown in Table 2-10. As is clear from the table, the textile factories account for about 37% of the total, and the average number of employees is 160 persons. There are only 19 jute factories (of the total of 528 factories covered by the survey), but the average number of employees of these factories is as large as 2,342 persons, indicating that the jute factories are operated on a relatively large scale. More than half of the jute factories are a state-run corporation. In the light of the fact that the jute industry is of prime importance in Bangladesh, the difference in type of management and scale between jute factories and others can be easily understood.

By zones nearly all factories are concentrated in Dacca in the northeast zone. In this zone there are such industries as jute, non-ferrous metals and mining which employ an average of 1,000 persons or more per factory. In the southeast zone Chittagong is the center of industrial activities, having such industries as metals, machinery and chemicals. It can therefore be readily known that the Chittagong district is the industrial center of Bangladesh. In the southwest zone the Khulna district is the industrial center where there are such industries as textiles, jute, paper, and printing. Although the number of



Table 2-10 The Industry Distribution and Scale of the Surveyed Factories and the Average Number of Employees (by zoning)

Item	Northeast		Southeast		Southwest		Northwest		Total	
	No. of Factory	Average No. of Employee	No. of Factory	Average No. of Employee	No. of Factory	Average No. of Employee	No. of Factory	Average No. of Employee	No. of Factory	Average No. of Employee
Food	9	157	14	49	3	354	40	190	66	165
Tobacco	4	121	1	262	0	0	4	152	9	154
Textile	30	136	11	538	4	1,932	148	89	193	160
Jute	12	3,312	1	2,248	2	1,078	4	91	19	2,342
Pulp & Paper Printing	12	84	8	17	2	1,076	8	95	30	135
Leather Products	11	53	3	29	0	0	1	56	15	49
Rubber	0	0	1	417	0	0	0	0	1	417
Chemical & Chemical Products	30	28	16	424	0	0	14	60	60	141
Nonferrous Metal & Mining	1	1,000	0	0	2	37	1	288	4	340
Metal	3	91	3	1,167	0	0	0	0	6	736
Metal Products & Machinery	29	68	18	148	2	550	2	59	51	116
Timber & Furniture	4	42	3	349	2	84	2	19	11	129
Daily Sundry Goods	24	137	16	23	6	12	3	105	49	81
Others	7	135	4	23	1	0	2	158	14	106
<b>Total</b>	<b>176</b>	<b>324</b>	<b>99</b>	<b>249</b>	<b>24</b>	<b>631</b>	<b>229</b>	<b>107</b>	<b>528</b>	<b>228</b>

factories is not large, factories are generally operated on a large scale. As is obvious from the discussion above, Dacca, Chittagong and Khulna are the three big cities of Bangladesh. The northwest zone is an important agricultural part of Bangladesh and therefore lacks industrial activities. Factories if any are all small in this zone.

The Chittagong, Dacca and Khulna districts are the centers of industrial activities in Bangladesh, as has been mentioned above, but from the standpoint of cargo distribution demand and supply is generally balanced across the country, though centering in the three load centers.

The types of transport will be discussed later in connection with the cargo movement across the Jamuna River.

### 3.2. Present goods movement by item.

#### 3.2.1. Total goods movement.

The main differences of goods movement between the periods before and after the war are: (1) a great decrease of goods movement by rail, (2) a great increase of foodgrains movement by Inland Water Transport (IWT) and (3) a remarkable decrease of the movement of cement, coal and petroleum.

Table 2-11 shows the total movement by the 13 main goods before and after the war. The reasons for the above tendencies are: for item (1) above, the drop of the rail transport capacity owing to for example the destroyed bridges by the war with the resulting transport time between Santahal and Chittagong taking approximately 30 days in 1972/73, while only 7 - 10 days in 1968/69, for item (2) above, similarly, the drop of the rail transport capacity, and for item (3) above, the industrial activities had not reached the prewar level.

Table 2-12 shows the ratio of modal transports to the total movement, in which the movements by country-boat and truck in 1972/73 occupy a considerable share and are not negligible. The transport pattern in 1968/69 is incomplete with the absence of the distribution of movements by either of the above two modes.

A comparison of inter-district movements in 1968/69 and 1972/73 shows some main tendencies. Movement among three districts, Dacca, Chittagong and Khulna, is remarkable both in 1968/69 and 1972/73. This is accounted by the fact that Dacca is the capital, and Chittagong and Khulna have foreign trade ports respectively.

Districts of Comilla, Sylhet, and Mymensingh have more movement and that their movement has not greatly decreased even in 1972/73.

Districts in North Bengal such as Rangpur and Bogra had a considerable movement in 1968/69 but their movement in 1972/73 showed a great decrease. Interregionally their movement with Chittagong showed a remarkable decrease, while the one with Dacca showed only a small decrease and the one with Khulna little decrease. This is due to the fact that the areas in North Bengal are subject to the direct influence of fall in efficiency over the railway system.

Such situations as in 1968/69 was maintained in 1972/73 that in Faridpur and Kushtia cargo was moved mainly by rail while in Barisal and Patuakhali mainly by inland water transport.

Table 2-11 Inter-District Movement of Main Goods by Mode, 1968/69 and 1972/73.

Unit : Thousand Tons

Item	Year Mode	1968/69				1972/73				
		Rail	IWT	Road	Total	Rail	IWT	Road	Country boat	Total
Raw Jute		605	268	NA	873	350	363	273	323	1,309
Jute goods		46	124	NA	170	24	176	0	0	200
Foodgrains		909	166	NA	1,075	697	1,491	571	473	3,232
Oil & Petroleum		365	376	NA	741	139	585	123	23	870
Cement		262	155	NA	417	44	194	71	16	325
Coal		191	193	NA	384	20	147	21	0	188
Fertilizer		92	25	NA	117	101	183	50	5	339
Iron & Steel		188	19	NA	207	13	49	62	0	124
Salt		123	16	NA	139	23	30	77	524	654
Sugar		92	1	NA	93	39	53	9	0	101
Hard rock		175	12	NA	187	108	135	2	159	404
Lumber		46	0	NA	46	5	18	42	114	179
Pulse		48	0	NA	48	15	93	44	111	263
<b>Total</b>		<b>3,142</b>	<b>1,355</b>	<b>(808)</b>	<b>4,497</b>	<b>1,578</b>	<b>3,517</b>	<b>1,345</b>	<b>1,748</b>	<b>8,183</b>
Other items		-	-	-	-	80	340	139	344	903
Movement with India		NE	NE	NE	NE	245	71	0	0	297

Note: 1) Excludes inter-district movement.

2) 808,000 tons of Inter-district movement was observed in the survey by Roads & Highways Directorate in 1968/69 although its data were not itemized as above.

Table 2-12 Share of Inter-District Movement by Mode of Transport

Mode	Year	Unit: %	
		1968/69	1972/73
Railway		58.1	24.1 1) 18.9 2)
Highway		15.0	20.6 16.0
Inland water		26.9	55.3 43.4
Country boat		NA	- 21.7
Total (1,000 tons)		5,395	6,574 9,091

Note: 1) Share in the absence of country boat.

2) Share in the presence of country boat.

### 3.2.2. Transit traffic of India.

Bangladesh is adjacent to India at most of her border line. The north part of Bangladesh borders on the state of Assam which is located far from Calcutta. Therefore, in the traffic with India the transit traffic of India -- Bangladesh -- India (Assam) will be an important factor. The past transit traffic is tabulated in Table 2-15.

There are three main routes in transit as shown in Figure 2-7.

- 1) Rail: Calcutta -- Darsana -- Santahar\* -- Kaunia -- New Gitaldaha -- Golakganj -- Pakiragram -- New Bongaigaon -- Gauhati (to Assam)
- 2) IWT : Calcutta -- Raimangal -- Chalna -- Barisal -- Chandpur -- Coalundo/Aricha -- Sirajganj -- Bahadurabad -- Chilmari -- Dhubri (to Assam)
- 3) IWT : Calcutta -- Rajmangal -- Barisal -- Chandpur -- Narayanganj -- Bhairab Bazar -- Azimiriganj -- Sherpur\*\* -- Penchuganj -- Zakiganj -- Karimganj (to Cachar/Tripura)

Note: \* indicates a transshipment station of broad to meter gauge.

\*\* indicates a transshipment station of vessels 6 feet draught to 2.5 - 2.75 feet in the lowest water season.

Table 2-13 Inter-District O-D Movement of Total Main Goods, 1973/73

Unit: Thousand Tons

D	1	2	3	4	5	6	7	9	9	10	11	12	13	14	15	16	17	18	19	Total		
	CHITTA	CHITTAG	NOAKH	COMIL	SYLHET	DACCA	MYHEN	TANGA	KHULNA	PATUA	BARIS	FARID	JESSO	KUSHT	RAJSH	PABNA	BOGRA	RANGP	DINAJ	*		
0	GONG	ONG H.T.	ALI	LA	LA		SINGH	IL		AL	AL	PUR	RE	IA	AHI		UR	UR	PUR	**		
1 CHITTAGONG	46	72	49	131	169	479	180	3	188	36	10	10	5	2	6	1	91	112	50	1219	1179	
2 CHITTAGONG H.T.																				871	825	
3 NOAKHALI	9		3		1																13	10
4 COMILLA	83		10	2	56	4	6	6	20								1			164	162	
5 SYLHET	95		29	17	65	21	20	7	1			6	3	3	2	13	13	3	3	290	30	225
6 DACCA	111	28	1	2	4	6	13	1	350			1				2	24			165	386	159
7 MYMENSINGH	104		9	9	1	112	20	1	1							2		2	2	260	2	240
8 TANGAIL						1														2		2
9 KHULNA	4		16		44			886	6	1	15	1	144	28	82	87	4	106	57	7	521	81
10 PATUAKHALI																						
11 BARISAL					2			2													4	4
12 PARIDPUR	3			1	1	1	2	44	8			12	6					1		10	68	56
13 JESSORE							1						4								5	1
14 KUSHITIA					5			19				5	1	6				1		37		31
15 RAJSHAHI	4			1	1	11		14				4	10	1				1		47		46
16 PABNA								2												2	2	2
17 BOGRA	11		1	3	41	8	8	43				17	7	14	6	3	11	7	1	173		162
18 RANGPUR	22		1	1	1	58	3	70	1			18	3	7	1		14	20	1	220		200
19 DINAJPUR	17		1	1	33	1	1	10				3	1	9	7		20	5	7	115		108
Total *	78	499	88	167	298	682	251	1665	1	52	1	220	52	139	110	8	262	238	72	3299		2297
Total **	32	459	85	165	233	676	231	579	1	52	1	208	48	133	109	8	251	218	65	3096		1359

INDIA (CALCUTTA)

Note: \* Includes interdistrict movement  
 \*\* Excludes interdistrict movement

Table 2-14 Inter-District O-D Movement of Total Main Goods, 1968/69

D	Unit: Thousand Tons																																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Total																				
O	CHITTA ONG H.T.	CHITTAG ONG H.T.	NOAKH ALI	COHIL LA	SYLHET	DACCA	MYREN SINGH	TANGA IL	KHULNA	FATUA KHALI	BARIS AL	FARID PUR	JESSO RE	KUSHT LA	RAJSH AHI	BOGRA UR	PABNA UR	RAJSH PUR	DINAJ PUR	*																				
1	324	67	15	5	174	51	223	159	31	176	50	76	39	7	1	492	1	3	37	43	5	1	2	13	6	1	5	832	582	508	515	2066	501	2064	391					
2	110	25			141	191	2			1376	144																													
3	7	5	7	3	2																																			
4	47	37	3	7	1	27	3	2	1																															
5	6	55	22	34	10																																			
6	5	28	34	5	49	19	7																																	
7	56		3	3	13	4																																		
8																																								
9	76		1	6	1	4																																		
10																																								
11																																								
12																																								
13																																								
14																																								
15																																								
16																																								
17																																								
18																																								
19																																								
Total	389	270	15	188	79	259	204	33	189	802	243	78	107	107	1	165	137	12	49	122	22	99	49	14	73	53	75	9	65	40	93	8	45	2393	1701	4642	2059			
**	65	203	15	181	79	232	201	33	179	173	223	67	105	107	1	165	137	12	49	122	22	99	49	8	72	42	70	8	64	12	87	4	37	1345	1578	3517	1748			
INDIA (CALCUTTA)	10																																							

Note: \* Includes interdistrict movement  
 \*\* Excludes interdistrict movement

Table 2-15 Transit Traffic in Two Ways

Unit: Thousand Tons

Rail		Inland Water		
Year	Calcutta -- Assam	Year	Calcutta -- Assam	Calcutta -- Tripura/Cachar*
1955/56	337	1956	666	106
1956/57	658	1957	743	104
1957/58	641	1958	741	98
1968/59	736	1959	614	99
1959/60	638	1960	594	87
1960/61	729	1961	625	89
1961/62	668	1962	515	78
1962/63	580	1963	554	93
1963/64	401	1964	494	90
1964/65	298	1965	301	56

Source: Bangladesh Railway Board and Indian River Utilization Committee.

\* indicates traffic mainly by IWT, but from Chandpur to Tripura by railway.

During the period 1965 - 1972 when India was unable to use the rail transit network in East Pakistan she tried to develop her domestic rail network connecting Calcutta to Assam and Tripura. As a result the broad gage railway which was connected to Sakrigari and Bhagalpur or the southern bank of the Ganges was extended as far as New Bongaigaon. The route saves a ferry facility, crossing the Ganges at Farakka, and including a branch line to the inland port of Gogighopa on the bank of the Brahmaputra.

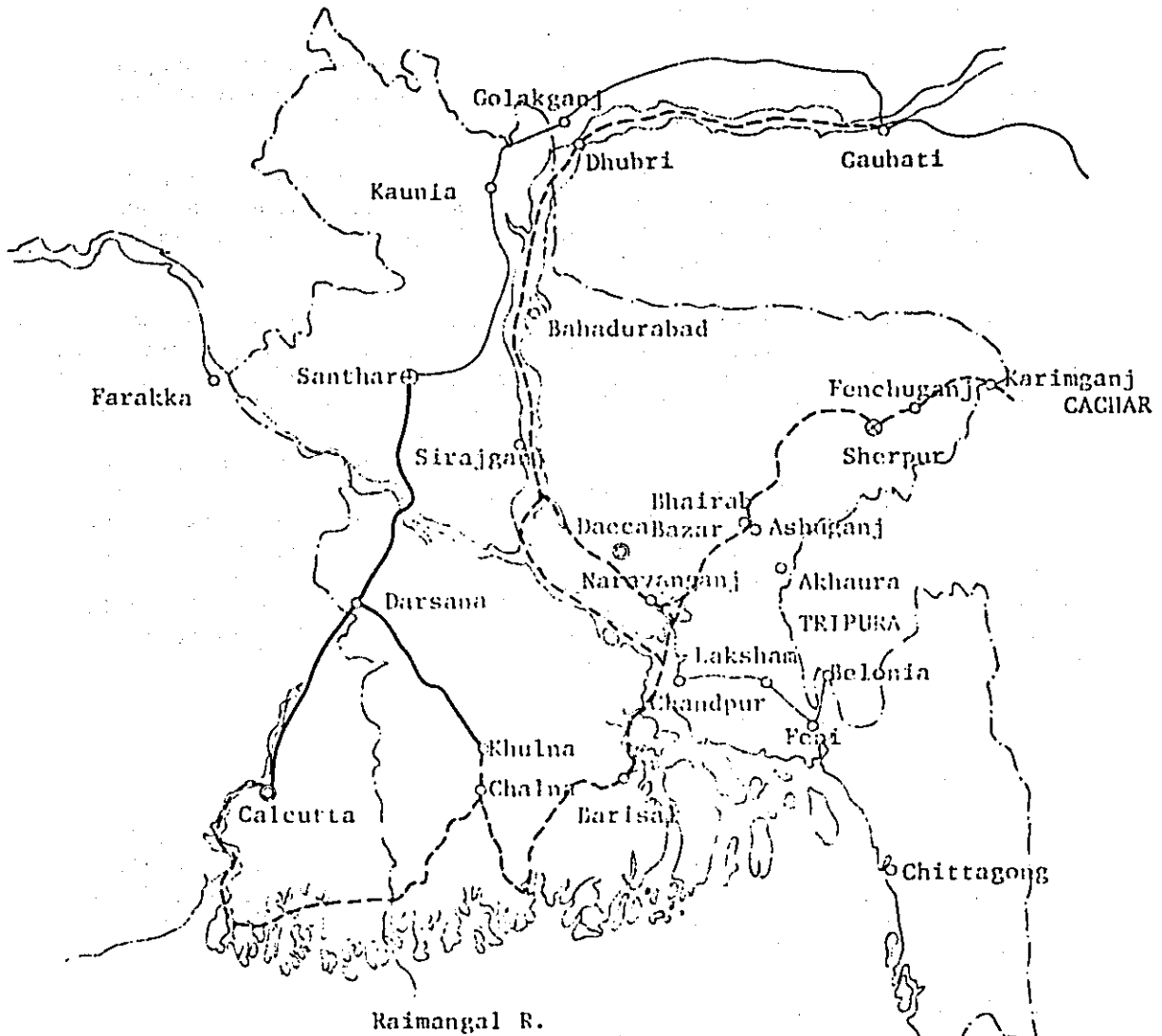
### 3.2.3. Transit traffic after 1972.

#### (1) Calcutta -- Assam

##### a. Railway

The Fifth Five-Year Plan (1974-79) schedules a rail extension of broad gage from New Bongaigaon/Gogighopa to Cauhati, the capital of Assam. With the completion of this railway line India will connect Calcutta with Gauhati with broad gage. For the use of the Bangladesh railway by the Indian for the trip up to Assam, two problems would arise: necessity of transshipment at Santahar from broad gage to meter, and border customs levy at two points. This route will have shorter in length for India than the route all through India territory: Calcutta - Farakka - Old Malda - Mukuria - New Jarpiguri - Raminagar - New Bongaigaon -

Figure 2-7 Main Transit Routes



Legend:

————— : Railway (broad gage)

————— : Railway (meter gage)

----- : Inland water way

⊕ : Transshipment terminal from broad gauge to meter gauge

⊗ : Transshipment terminal to shallow draught vessel



Bangladesh. The merit of a shorter length is to be offset by the above two demerits, and there would be no justification to enlarge railway systems for the traffic with India.

b. Inland water transport

On November 1, 1972 an agreement for inland water transport was signed between Bangladesh and India, and the Central Indian Water Transport Corporation reopened their operations.

In January 1972 the River Service Committee of India published the predicted traffic by IWT around Assam, which value was much larger than the actual traffic during the period November 1972 - December 1973 as shown in Table 2-16.

This may be for some reasons: during the 7 year cessation the movement of each item of goods settled down to rail transportation, it would take some time to recover the goods-holders' trust to the 1965 level, and there would be a limitation in the IWT capacity.

India has so high an interest in the above route together with the route of Calcutta - Cachar/Tripura that she would pay out 260 million rupee for the development of CIWTC in the Five-Year-Plan period. However, with the completion of the rail connection between Calcutta and Cauhati, the competition between railway and IWT would become keen. The CIWTC, taking into account the small amount of the actual traffic in 1973 and the timing of enlarging the IWT capacity has restudied the traffic projection as in Table 2-17.

(2) Calcutta -- Cachar/Tripura

a. Railway

During the period 1965-72 the freight movement to Cachar/Tripura was all by Indian railway. This route makes a very big detour, resulting in high operation cost. After the independence the reopening of the IWT traffic has recovered the use of the railway from the Chandpur to Cachar/Tripura.

b. Inland water transport

The trouble with the IWT is that at Sherpur transshipment is required from 6 feet draught boat to a 2.5 - 2.75 feet in the low water season. The capacity and operation of a light draught boat will determine the IWT capacity. The CIWTC which has not yet started its operation with the difficulty of increasing the IWT capacity schedules to reopen the operation in the succeeding highwater season (June and July 1974).

At the beginning of 1972 the River Service Committee predicted the traffic on this route as shown in Table 2-18, which is revised under various circumstances as in Table 2-19.

The only one transshipment terminal on this route is located at Chandpur, and the Indian Government has made two proposals as below for two terminals and approaches thereto both by

Table 2-16 Traffic between Calcutta and Assam

			Unit: Tons		
Item	Traffic to Assam		Item	Traffic to Calcutta	
	Predicted*	Actual**		Predicted	Actual
Food grain, pulse & sugar	10,000	497	Tea	40,000	4,735
Fertilizer	15,000	-	Jute	150,000	5,244
Iron, steel & machinery	30,000	368	Wax	30,000	-
Salt	2,000	-	Crude oil	30,000	-
Cement	100,000	-	Processed bamboo	1,000	-
Tea container	4,000	-	Seeds	2,000	-
Edible oil	1,000	-	Lumber	7,000	-
Stationary & pater	2,000	-	Match	-	54
Clothing	3,000	-	Others	8,000	-
Others	40,000	-	Total	268,000	10,033 <sup>2)</sup>

Source: The River Services Committee of India and CIWTC

\* indicates the average figure of the Fifth Five-Year Plan.

\*\* figures from November 1972 through December 1973.

1) all movement to Gauhati.

2) from Gauhati, Dhubri and Gogighopa.

Table 2-17 Revised Traffic Projection between Calcutta and Assam

		Unit: Thousand Tons	
From Calcutta to Assam		From Assam to Calcutta	
Cement	60	Tea and Jute	60
Iron & steel and general cargo	40	Millet, petroleum, coke, etc.	30
Total	100	Total	90

Table 2-18 Prediction of IWT Traffic between Calcutta and Cachar/Tripura

		Unit: Thousand Tons	
From Calcutta to Cachar/Tripura		From Cachar/Tripura to Calcutta	
Food grains, pulse and sugar	40	Tea	10
Fertilizer	5	Jute	15
Iron & Steel and machinery	5	Processed bamboo	3
Salt	8	Seeds	1
Cement	25	Lumber	1
Tea container	1	Others	2
Edible oil	2		
Stationary and paper	1	<b>Total</b>	<b>32</b>
Clothing	1		
Others	5		
<b>Total</b>	<b>93</b>		

Source: The River Service Committee, India, 1972.

Table 2-19 Revised Prediction of Traffic

		Unit: Thousand Tons	
From Calcutta to Cachar/Tripura		General cargo	40
From Cachar/Tripura to Calcutta		Tea, Jute and others	30

Source: ITWTC (India).

railway and highway to Bangladesh which are nearest to the state of Tripura (India).

i) Development of Ashuganj inland port

- Ashuganj river port which is to be dredge, provided with loading and unloading facilities and warehouse.
- Road between Akhaura and Agartala to be graded up.

ii) Railway line extension

- Railway between Akhaura and Agartala to be constructed.
- Railway between Belonia Station and Belonia Town to be constructed.

The completion of the above two projects would produce a great saving in transport cost compared with the route via Gauhati by Indian rail.

3.2.4. Lurking factors of transit traffic.

A. Industrial development programmes in indian side.

India has some industrial development programmes that would have a great influence on the transit traffic:

1) Cement manufacturing

- The annual production capacity of Cherrapunj cement factory in Meghalaya will be increased from 83,810 to 200,000 tons during the five year plan period.
- A new cement factory will be constructed at Bokjan in Assam. Cement will be moved from Calcutta to Assam and to Cachar/ Tripura until the above plants can gain enough production capacity to meet the local demand.

2) Industrial programmes of the Five Year Plan.

- Oil refinery at Bongaigaon: annual production of one million (metric) tons out of Assam crude oil moved through the existing pipe line.
- Chemical engineering industry at Bongaigaon: annual production of 30,000 tons.
- Cement manufacturing at Bokajan: annual production of 200,000 tons.
- Paper manufacturing: annual productions of 27,000 tons, 80,000 tons, and 80,000 tons at Gogighopa, Cachar and Nowgong, respectively.

- Urea fertilizer manufacturing: enlargement of the annual production capacity of Namrup factory from 45,000 to 90,000 tons.

The data with which comparison of transit cost is to be studied are not available. However, as the Indian Planning Committee has a full staff to make the economic study of various transport modes for the present and future transit traffic, the results will be utilized very soon.

#### B. Capacity limit of CIWTC.

The CIWTC is in charge of the transit traffic in Indian territory. As of December 1973 it has 11 tug boats and steamers and 32 flat-bottomed barges, and their capacity amounted to: 2,400 tons for mechanized boats or steamers, and 16,000 tons for unmechanized boats.

The annual transport capacity amounted to 150,000 tons in 1973 and the share of the main three routes were as follows:

Calcutta -----	Assam:	96,000 tons (63%)
Calcutta -----	Cachar/Tripur:	24,000 tons (16%)
Calcutta -----	Bangladesh:	33,000 tons (21%)

The greatest frequency of movement by CIWTC was between Calcutta and Bangladesh (especially Narayanganj). The trip duration between Calcutta and Narayanganj is about 18 days for a round trip, while the one between Calcutta and Dhubri about 34 days for a round trip.

The movement by CIWTC during the period from November 1972 through December 1973 is tabulated in Table 2-20. With the four steamers and 35 flat-bottomed boats out of operation at present, the transport capacity will amount to: 1,600 tons and 17,000 tons for mechanized freighters and unmechanized flat-bottomed boats, respectively. In addition the CIWTC would have an annual transport capacity of 23,000 tons with the existing repairable vessels.

The route from Calcutta to Cachar has a limit of light draught at Sherpur and the existing capacity is of as much as 2,000 tons per day (approximately 40,000 per year), while the revised projection of traffic is to be 70,000 tons annually. The maximum possible capacity of the CIWTC will be 230,000 tons, while their revised projection of traffic is estimated as 420,000 tons per year, for a 190,000 tons capacity shortage.

In order to supplement the capacity shortage the CIWTC will outlay 260 million rupee during the Fifth Five Year Plan period to increase the tonnage and to modernize their dock facilities. It is supposed that the shortage of the CIWTC capacity will last for a long period.

Table 2-20 Movement by CIWTC, November 1972 - December 1973

Unit: Tons

1. Calcutta → Bangladesh (mainly to Narayanganj, partly to Khulna)	
Coal:	69,544 <sup>1)</sup>
Iron and Steel:	949
Machinery:	699
Others:	5,890
Total	77,082
2. Bangladesh → Calcutta (mainly from Naraganganj)	
Jute:	16,323
Others:	146
Total	16,469
3. Calcutta → Assam	
(unknown)	865
4. Assam → Calcutta	
(unknown)	10,033
5. Assam → Bangladesh	
Lumber	2,511
Grand Total	106,960

Source: CIWTC (India).

Note: 1) 54,546 tons (78%) out of the amount was transported by the end of July 1973.

#### 4. Traffic across the Jamuna River.

At present all traffic between the eastern and western regions of Bangaladesh is carried by ferryboat across the Jamuna iver at three points, as shown in Figs. 2-2 and 2-3. At two of the three points railway ferries are operated, and at one point a road ferry is in operation, as shown below.

<u>Ferry Route</u>	<u>Mode</u>	<u>Load</u>
(1) Bahadurabad-Tistamuka	Railway	Passengers and freight*
(2) Sirajganj-Jagannathganj	Railway	Passengers
(3) Aricha-Nagarbari	Road	Passengers and freight

\* Passenger ferryboats (which also carry parcels and baggages) and freight ferryboats serve the Bahadurabad-Tistamuka route.

Little has been known about the passenger traffic across the Jamuna River, and no data is available concerning the railway passenger traffic across the river among other things except for the surveys taken by the survey team in 1973 and 1974. The Bangladesh Transport Survey is believed to contain an investigation into passenger traffic in Bangladesh, but its report has not been made available.

Information on freight movement across the Jamuna River is mainly derived from the data of types of transport described in Section 3.2. and supplemented by the inter-district cargo movement by O-D revealed by the factory survey.

When the data above is combined with the information obtained from the government of Bangladesh, the traffic across the Jamuna River may be summarized as shown in Table 2-21, and will be discussed in detail in the following pages.

Table 2-21 Traffic Across the Jamuna River (1968-1974)

		Year	1968/69	1971/72	1973	1974
Road Traffic	Passenger (persons/day)		2,089 <sup>1)</sup>	2,261	2,144 (1,977)	(2,538)
	Vehicles (units/day)		121 <sup>2)</sup>	143	157 (135)	(101)
	Freight (tons/day)		88 <sup>3)</sup>	173	N.A.	N.A.
Railway Traffic	Passengers (persons/day)		N.A.	N.A.	(5,669)	(6,137)
	Freight (tons/day)		1,611	526	N.A.	N.A.

(NOTES) 1) Source: B.I.W.T.

2) Source: B.I.W.T.

3) Source Transport Survey by Commodities described in Section 3.2.

4) Figures in parentheses are derived from the Traffic Survey. The numbers include all types of vehicles including buses and trucks.

#### 4.1. Number of traffic passengers.

##### 4.1.1. Highway traffic.

###### (1) Traffic crossing Jamuna River.

The number of the users of the Aricha Ferry in 1973/74 is estimated to amount to 730 thousand, as shown in Table 2-25. The two surveys in 1973 and 1974 which had a constraint of a two day survey period each reveal a greatly different result as shown in Table 2-22. This may be accounted for by the fact that the number of ferry boats was increased from 4 to 6 to cope with the increasing traffic. Compared with the survey results by the Roads and Highways Directorate in 1968, the increase in number of ferry users is remarkable. Judging from the crowded situation of vehicles waiting on the line, the potential demand would be tremendously great.

###### (2) Modes of transferred transport.

The number of ferry users who came to the ferry by bus and/or who left the ferry by bus and who crossed the river through bus was great among the modes, occupying more than half of the total ferry users, and followed by the ones by passenger car and taxi as shown in Table 2-23. Table 2-24 shows the average daily vehicular traffic crossing Jamuna River in two ways.

###### (3) Origin-destination.

More than 90% of the passenger movement crossing by the Aricha Ferry is for the movement of passengers departing from and destined for Dacca as shown in Table 2-25 which indicates the connections of Dacca-Khulna Divisions and Dacca-Rajshahi Divisions with 39% and 53% to the total respectively. District-wise the connections of Dacca-Faridpur and Jessore, and Dacca-Pabna and Rajshahi are stronger. The O-D flows by vehicle show that almost all the buses and passenger cars crossing by the Aricha Ferry have departed from and/or been destined for Dacca.

###### (4) Traffic in the Past Years.

According to the B.I.W.T., the traffic volume carried by the Aricha ferry across the Jamuna River in recent years is as shown in Tables 2-26 and 2-27. Table 2-26 shows the total traffic carried by the Aricha ferry. From 1965 to 1973 traffic at this point increased in a sharp curve, motor traffic increasing by about 7 times and passenger traffic by about 5 times.



Table 2-22 Number of Passengers Crossed by the Aricha Ferry

<u>Time of Survey</u>	<u>Duration</u>	<u>No. of Passengers (persons)</u>
December 1973	2 days	3,594
June 1974	2 days	5,076

Table 2-23 Number of Ferry Passengers by Mode of Transport

<u>Mode of Transport</u>	<u>Destined for the Ferry by</u>		<u>Left the Ferry by</u>	
	<u>(persons)</u>	<u>(percent)</u>	<u>(persons)</u>	<u>(percent)</u>
Passenger car, jeep, Station wagon, Micro-bus	303	8.4	229	6.3
Bus	2,138	59.3	2,159	58.9
Taxi	296	8.2	332	9.1
Rickshaw	126	3.5	125	3.4
Auto-rickshaw	22	0.6	10	0.3
Walk	301	8.4	396	10.8
Other	417	11.6	411	11.2
Total	3,603	100	3,662	100

Source: Survey result in December 1973 (2 days).

Table 2-24. Average Daily Vehicular Traffic Crossing by the Aricha Ferry by Two Ways.

<u>Ferry Terminals</u>	Unit: Vehicles								
	<u>Truck</u>			<u>Bus</u>			<u>Passenger car Jeep, Mini-bus</u>		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Aricha- Nagarbari	47	30	23	3	9	7	57	35	26
Aricha- Goalundo	22	36	24	2	10	7	27	15	14

Source: (1) Bangaldesh Transport Survey  
 (2) Jamuna Bridge Survey, December 1973  
 (3) Jamuna Bridge Survey, June 1974

Table 2-25 Road Passenger Movement Crossing by Aricha Ferry 1973/74 (AADT)

D O	Unit: Passengers																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
	CHITTA GONG	CHITTA GONGH	NOAKH ALI	COMEL LA	SYL HET	DACCA	MYMEN SINGH	TANGA IL	KHULNA	PATUA KHALI	BARIS AL	FARID PUR	JESSO RE	KUSHT IA	RAJSH AHI	PABNA	BOGRA	RANG PUR	DINAJ PUR	Total
1 CHITTAGONG									1			1	4	1	2	1	1			11
2 CHITTAGONG H.T.												1				1				2
3 NOAKHALI																				
4 COMILLA									1			1		2	2	2				6
5 SYLHET									1			1				1				3
6 DACCA									33	3	204	69	47	116	255	77	44	32		880
7 MYMENSINGH												8	2	9	1	1				21
8 TANGAIL												6	2		1	5	2			16
9 KHULNA																				51
10 PATUAKHALI																			1	1
11 BARISAL																				13
12 FARIDPUR																				296
13 JESSORE																				85
14 KUSHTIA																				33
15 RAJSHAHI																				152
16 PABNA																				288
17 BOGRA																				56
18 RANGPUR																				76
19 DINAJPUR																				19
Total	14		4	8	5	971	5	8	37	5	247	77	57	125	289	78	46	33	2009	

Table 2-26 Traffic Carried by the Aricha Ferry

	Vehicles		Passengers	
	Year	Daily Average	Year	Daily Average
1965	8,153	22	167,517	459
1966	17,975	49	273,566	749
1967	34,125	93	550,645	1,509
1968	43,072	118	717,270	1,965
1969	40,492	111	762,626	2,089
1970	40,771	112	817,779	2,240
1971	-	-	-	-
1972	47,877	131	825,582	2,261
1973	57,195	157	796,960	2,183
<del>1973</del> 1965	7.01		476	

- [NOTES] 1) There must have been non-sailing days, but the daily average computed counting the year as 365 days.
- 2) No data available for the year 1971 because of the war.

(Source: B.I.W.T.)

#### 4.1.2. Railway Traffic .

No data concerning railway passengers who crossed Jamuna River were available. The Jamuna Bridge Survey Team conducted the two interview surveys of the railway passengers who crossed Jamuna River by the Ferrys of Bahadurabad-Tistanukh and Jagannathganj-Sirajganj in December 1973 and June 1974 respectively.

##### (1) Traffic Crossing Jamuna River

Unlike the survey by the Aricha Ferry which was for the highway traffic, only a slight increase in the number of passenger was found at each of the ferries, as shown in Table 2-27. The number of the annual railway passengers who crossed Jamuna River is assumed to be 1,770 thousand by both ferries.

##### (2) Origin-Destination

Approximately 85% of the originating passengers by rail way are from Dacca and Mymensingh by each ferry, although their O-D patterns vary greatly with each ferry, as shown in Table 2-31 and 2-32.

In point of fact, however, the number of ferryboats increased as follows from 1965 to 1967:

1965	2 ferryboats
1966	3 ferryboats
1967 and after	5 ferryboats

This means that the sharp increase in traffic from 1965 to 1967 is attributable to the increase in the capacity of this ferry route. From 1967 to 1970 traffic did not increase remarkably, but in the post-war years of 1972 and 1973 motor traffic increased in a sharp curve, involving the use of a larger number of ferryboats. According to the field survey taken in 1974, about 70 trucks waited at the ferry terminals at all times depending on the route, and 5 to 7 days was necessary to carry all trucks across the Jamuna River by the ferryboats then in service. This fact suggests that there is a great deal of latent traffic across the Jamuna River.

##### Bahadurabad-Tistanukh Ferry

The passenger movements of Dacca-Bogra, -Dinajpur and -Rajshahi and Mymensingh-Bogra, -Dinajpur and -Rajshahi are greatest with 44% for the former and 42% for the latter to the total. Table 2-29 shows the major movements of these districts. Subdivision-wide the movements are scattered uniformly in the three districts in the northwest, while the movements in Dacca and Mymensingh Districts are concentrated in Dacca Subdivision, Mymensingh Subdivision and Jampur Subdivision. Among the three districts the movement from and to Rangpur occupies 65% of the total movement.

Table 2-27 Number of Passengers and Vehicles Crossed by the Aricha Ferry

Year	Item	Aricha to Nagarbari	Aricha to Goalundo	Total	Nagarbari to Aricha	Goalundo to Aricha	Total
1965	Passenger	36,006	40,031	76,037	31,003	60,477	91,480
	Vehicle	2,471	1,952	4,423	1,897	1,833	3,730
1966	Passenger	50,926	67,182	118,108	60,770	94,688	155,458
	Vehicle	5,383	4,061	9,444	4,471	4,060	8,531
1967	Passenger	120,501	129,617	250,118	124,084	176,443	300,527
	Vehicle	9,936	7,734	17,670	9,055	7,400	16,455
1968	Passenger	120,680	228,366	349,046	187,193	181,031	368,224
	Vehicle	13,203	8,950	22,153	12,408	8,511	20,919
1969	Passenger	164,776	204,085	368,861	180,840	212,925	393,765
	Vehicle	13,178	7,951	21,129	12,015	7,348	19,363
1970	Passenger	178,240	209,970	388,210	209,955	219,614	429,569
	Vehicle	13,331	7,536	20,917	12,630	7,224	19,854
1971	Passenger	-	-	-	-	-	-
	Vehicle	-	-	-	-	-	-
1972	Passenger	208,102	178,221	386,323	234,328	204,931	439,259
	Vehicle	14,190	9,540	23,730	15,012	9,135	24,147
1973	Passenger	223,236	188,569	411,805	211,461	173,694	385,155
	Vehicle	18,309	14,133	32,442	16,146	8,607	24,753

Data: I.W.T.

### Jagannathganj-Sirajganj Ferry

In the east the movements to and from Dacca and Mymensingh, like the Bahadurabad-Tistamukh Ferry, are greatest with 36% for the former and 48% for the latter to the total. Table 2-30 shows the major movements of the districts concerned. Likewise the movements to and from Dacca Subdivision, Mymensingh Subdivision and Jamurpur Subdivision are greatest. On the contrary the movement in the west makes a clear contrast to that by the Bahadurabad-Tistamukh Ferry with a considerable amount of the O-D movement to and from Khulna Division, in which the O-D between Jessore District and Kushtia District is predominant. Sub-divisionally the movement to and from Sirajganj Subdivision in Pabna District is remarkable.

Table 2-28 Number of Railway Passengers Crossed Jamuna River

<u>Time of Survey</u>	<u>Duration</u>	<u>Jagannathganj - Sirajganj</u>	<u>Bahadurabad - Tistamukh</u>	<u>Total</u>
December 1973	2 days	4,864	6,473	11,337
June 1974	2 days	5,505	6,769	12,274

Table 2-29 Major Passenger O-D by Bahadurabad-Tistamukh Ferry

	Unit: Persons (average daily)		
	<u>Bogra</u>	<u>Rangpur</u>	<u>Dinajpur</u>
Dacca	175	762	253
Mymensingh	120	782	230

Table 2-30 Major Passenger O-D by Jagannathganj-Sirajganj Ferry

	Unit: Persons (average daily)			
	<u>Jessore</u>	<u>Kushtia</u>	<u>Rajshahi</u>	<u>Pabna</u>
Dacca	77	97	182	292
Mymensingh	60	56	98	731

Table 2-31 Railway Passenger Movement Crossing by Bahadurabad-Tistamukh Ferry 1973-74 (AADI)

Origin	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Unit: Passengers		
																				RANG PUR	DINAJ PUR	Total
Destination	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19			
CHITTA GONG	CHITTA GONG	CHITTA GONG	NOAKH ALI	COMIL LA	SYL HET	DACCA	MYMEN SINGH IL	TANGA KHULNA	PATUA KHALI	BARIS AL	FARID PUR	JESSO RE	KUSHT IA	RAJSH AHI	PABNA	BOGRA						
1 CHITTAGONG									1								13	31	5	50		
2 CHITTAGONG H.T.																						
3 NOAKHALI																	2	33	12	47		
4 COMILLA												2					8	26	9	45		
5 SYLHET																	4	6	4	14		
6 DACCA												2		14	2	4	83	377	94	572		
7 MYMENSINGH													1	2	4	58	358	118	541			
8 TANGAIL																		16	2	18		
9 KHULNA																						
10 PATUAKHALI																						
11 BARISAL																						
12 FARIDPUR																						
13 JESSORE	2																			2		
14 KUSHTIA																						
15 RAJSHAHI	1					6	4													11		
16 PABNA																						
17 BOGRA	3	2	9	2	92	62														170		
18 RANGPUR	30	16	37	13	385	424	6				1									912		
19 DINAJPUR	10	7	20	3	159	112	2													313		
Total	46	25	66	18	642	602	8	1	1	18	6	168	847	244	2,695							

Table 2-32 Railway Passenger Movement Crossing by Jagannathganj-Sirajganj Ferry 1973-74 (AADT)

Unit: Passengers

Station	Unit: Passengers																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
Origin	CHITTA GONG	CHITTA GONG	CHITTA GONG	CHITTA GONG	CHITTA GONG	CHITTA GONG	CHITTA GONG	CHITTA GONG	CHITTA GONG	CHITTA GONG	CHITTA GONG	CHITTA GONG	CHITTA GONG	CHITTA GONG	CHITTA GONG	CHITTA GONG	CHITTA GONG	CHITTA GONG	CHITTA GONG	
Total	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
1 CHITTAGONG									1				2	2	18	12			2	37
2 CHITTAGONG H.T.																				
3 NOAKHALI								1				2	1	7	4		2			17
4 COMILLA								1				7	2	4	13	1	12			40
5 SYLHET								7				2	4	5	11					29
6 DACCA							2	29				44	72	103	155	10	25	8		448
7 MYWENSINGH							1	9			1	31	38	50	374	2	31	2		539
8 TANGAIL												1	4	2	8	1	1			17
9 KHULNA	2		1	2	5	20	15	1												46
10 PATUAKHALI																			1	1
11 BARISAL																				
12 FARIDPUR												2								2
13 JESSORE	6		2	4	6	33	29	4												84
14 KUSHIA	2		5	3	3	25	18	7												63
15 RAJSHAHI	14		2	7	2	79	48	5												157
16 PABNA	20		6	20	10	137	357	16												566
17 BOGRA							5	5												10
18 RNAGPUR	3		1	2	4	12	10	1												33
19 DINAJPUR	1		1	2	1	7	2	1												15
Total	48	18	40	31	320	484	38	48	1	89	123	190	577	14	71	12	2104			



## 4.2. Goods Flow.

### 4.2.1. Traffic Volume.

Goods traffic across Jamuna River composes the following movements:

- 1) All movements between Rajshahi Division and the east part of Jamuna;
- 2) Railway movement between Khulna Division and the east part of Jamuna; and
- 3) Traffic with India between Calcutta and the east part of Jamuna.

Highway, railway and inland water are the available modes of transport. However, there are only two ferry connections catering to goods traffic; one is the railway ferry in Bahadurabad-Tistamukh and the other is the road ferry in Aricha-Nagarbari, -- (Sirajganj Ferry is for railway passengers only).

Table 2-30 and 2-31 show the total tonnage of goods crossing the river. Traffic between Rajshahi Division and Divisions of Dacca and Chittagong relates directly to the proposed bridge over Jamuna River and inland water traffic will be affected by the construction of the bridge.

The tables show that 620,000 tons of goods excluding traffic by country boat and 612,000 tons of goods including 198,000 tons traffic by country boat crossed Jamuna River in 1968/69 and 1972/73 respectively. Considering that the figures for 1968/69 are composed of only major goods, additional 10-20% will be added. Thus the total tonnage for 1968/69 that crossed Jamuna River is estimated to be as much as 700,000-800,000 tons. Of the total tonnage of 612,000 tons in 1972/73, railway traffic was only 192,000 tons. The considerable difference between the two years was caused by damage to the railways. This can be accounted for by the fact that the number of freight wagons handled in 1972/73 at the Bahadurabad ferry decreased to as little as one fourth of that in 1968/69.

Other changes and characteristics of goods traffic between Rajshahi Division and the east part of Jamuna River in the pre- and post-war days are as follows:

- 1) Cross river traffic has decreased by 40-50%, mainly because of damage to railway facilities;
- 2) Although railways were a main method of transportation between east and west, the share of traffic by road and inland water has become larger;
- 3) In 1968/69 oil, salt, cement, sugar, fertilizer, iron and steel, coal, etc. other than the two major goods of raw jute and food-grains were also carried. However, in 1972/73 there was little movement of cement, oil, coal, fertilizer, iron, etc. but pulse and timber were included in the amount; and

- 4) There has been a significant decrease of traffic between Chittagong Division and Rajshahi Division. This occurred mainly because of the traffic decrease between Chittagong District and the districts of Bogra and Rangpur. The main goods were foodgrain, cement, oil, salt, etc.

The following two movements other than movement between Rajshahi Division and the east of Jamuna River are to be noted in studying the future cross river traffic:

- 1) Movement by railway or highway between Khulna Division and the east:

The movement by road by the Aricha-Goalundo ferry amounted to approximately 10,000 tons in 1968/69. If the bridge should be constructed near the ferry terminal, the movement by road would be transferred to the one by railway. The movement by railway, in spite of its long detour, is composed of goods suitable for railway transportation, and the total tonnage in 1968/69 amounted to 47,000 tons including 11,000 tons of sugar, 11,000 tons of fertilizer, 10,000 tons of cement, 4,000 tons of salt, 1,000 tons of raw jute, etc. With the location of the bridge, these movements will have a merit of shorter distance and result in a great increase of transportation demand.

- 2) Movement by inland water transport (IWT) between Khulna Division and the east:

The IWT movement will play a major role having amounted to 573,000 tons in 1968/69 and to 1,522,000 tons in 1972/73 when the overland transport facilities were not restored completely. However, the location of the bridge would produce a considerable saving of the interregional distances compared with the route distance by IWT.

#### 4.2.2. Characteristics of Goods Traffic Crossing Jamuna River.

- 1) Jute and Jute Products

Jute is mostly exported and its main destinations are Chittagong, Khulna and Dacca as is seen in Table 2-35. Roughly 250,000 tons was shipped from Rajshahi Division, mostly by railway. Although the table shows some diversification of the traffic from Chittagong and Dacca to Khulna, it is difficult to say that the tendency will continue, because of the damage to the railway facilities during the Liberation War.

However, it should be noticed that the jute traffic crossing Jamuna River will not increase much in future. Even considering the development of port facilities and increased industrial functions in Khulna and the reduction of railway route mileage between the Dacca-Chittagong area and Rajshahi Division, the production of raw jute will not be greatly effected in the case of the bridge construction.

Table 2-33 Inter-District Goods Movement Across Jamuna River  
(1968/69)

Unit: Thousand Tons

Division		Rail	Road	IWT	C.B.	Total
Origin	Destination					
Rajshahi	Chittagong	63	0	0	N.A.	63
Chittagong	Rajshahi	261	3	0	N.A.	264
Rajshahi	Dacca	157	3	0	N.A.	160
Dacca	Rajshahi	<u>61</u>	<u>16</u>	<u>0</u>	<u>N.A.</u>	<u>77</u>
Sub-total		542	22	0	N.A.	564
Khulna	Chittagong	3	0	26	N.A.	29
Chittagong	Khulna	20	1	146	N.A.	167
Khulna	Dacca	8	5	52	N.A.	65
Dacca	Khulna	<u>15</u>	<u>4</u>	<u>349</u>	<u>N.A.</u>	<u>368</u>
Total		588	32	573	N.A.	1,193

Note: Tonnage by rail and inland water is limited to that of main goods only.

Table 2-34 Inter-District Goods Movement Across Jamuna River  
(1972/73)

Unit: Thousand Tons

Division		Rail	Road	IWT	C.B.	Total
Origin	Destination					
Rajshahi	Chittagong	25	0	30	10	65
Chittagong	Rajshahi	13	2	65	38	118
Rajshahi	Dacca	80	42	35	114	271
Dacca	Rajshahi	<u>66</u>	<u>15</u>	<u>29</u>	<u>36</u>	<u>146</u>
Sub-total		184	59	159	198	600
Khulna	Chittagong	1	0	128	72	201
Chittagong	Khulna	0	0	615	135	750
Khulna	Dacca	7	3	285	258	553
Dacca	Khulna	<u>0</u>	<u>1</u>	<u>495</u>	<u>52</u>	<u>547</u>
Total		192	63	1,681	751	2,651
India	Chittagong	0	0	10	0	10
India	Dacca	0	0	42	1,164	1,206

Note: Tonnage by rail and inland water is limited to that of main goods only.

Movement of jute manufactured products crossing Jamuna River is negligible. However, 300,000 to 400,000 tons of raw jute and jute products by IWT, mostly from Dacca to Khulna is not to be ignored. In the case of bridge construction in Nagarbari, possible diversion of traffic from IWT to rail will occur with considerable reduction of mileage by railway.

Table 2-35 Jute Movement from Rajshahi Division

Unit: Thousand Tons

Destination (District)	1968/69			1972/73		
	Road	Rail	IW	Road	Rail	IW
Chittagong	NA	46	0	0	20	5
Dacca	NA	89	0	7	45	3 (61)
Khulna	NA	111	2	19	94	0 (3)

Note: ( ) indicates tonnage by country boat.

Table 2-36 Inter-District Movement of Raw Jute Crossing Jamuna River

Unit: Thousand Tons

Division		Rail		Road		IWT		Total	
Origin	Destination	68/69	72/73	68/69	72/73	68/69	72/73	68/69	72/73
Rajshahi	Chittagong	46	20	N.A.	0	0	5	46	25
Chittagong	Rajshahi	0	0	N.A.	0	0	0 <sup>1)</sup>	0	0
Rajshahi	Dacca	89	45	N.A.	7	0	8(69)	89	60(69)
Dacca	Rajshahi	0	0	N.A.	0	0	0	0	0
Sub-total		135	65	N.A.	7	0	13(69)	135	85(69)
Khulna	Chittagong	0	0	N.A.	0	3	1(10)	3	1(10)
Chittagong	Khulna	0	0	N.A.	0	8	14	8	14
Khulna	Dacca	0	0	N.A.	0	3	1(53)	3	1(53)
Dacca	Khulna	1	0	N.A.	0	248	245	249	245
Total		136	65	N.A.	7	262	274(132)	398	346(132)

Note: 1) Figure in ( ) indicates tonnage by country boat.

2) Tonnage by country boat in 1968-69 is not available.

Table 2-37 Inter-District Movement of Jute Products Crossing  
Jamuna River

Unit: Thousand Tons

Division		Rail		Road		IWT		Total	
Origin	Destination	68/69	72/73	68/69	72/73	68/69	72/73	68/69	72/73
Rajshahi	Chittagong	0	0	NA	0	0	0	0	0
Chittagong	Rajshahi	1	0	NA	0	0	0	1	0
Rajshahi	Dacca	0	0	NA	0	0	0	0	0
Dacca	Rajshahi	0	0	NA	0	0	0	0	0
Sub-total		1	0	NA	0	0	0	1	0
Khulna	Chittagong	0	0	NA	0	0	0	0	0
Chittagong	Khulna	0	0	NA	0	13	9	13	9
Khulna	Dacca	0	0	NA	0	0	0	0	0
Dacca	Khulna	0	0	NA	0	88	154	88	154
Total		1	0	NA	0	101	163	102	163

## 2) Foodgrains

The foodgrains movement to and from Rajshahi Division was as shown in Tables 2-38 and 2-39. Rajshahi Division as a whole was an area of deficit in foodgrains both in 1968/69 and 1972/73. The tables also show that considerable amount of foodgrains moving in both directions. This is because there is a disparity of supply/demand balance by district, and foodgrains is handled by both the private and public sector. The government sector handles mostly imported foodgrains and distributes it to the low-income-level people who are scattered throughout the country.

Foodgrains to Rajshahi Division is mostly imported and is supplied by Chittagong, Khulna and Dacca. On the other hand, foodgrains from Rajshahi Division is transported mainly to Khulna Division rather than to Dacca.

It is expected that Rajshahi Division will be a surplus area in the future resulting in a decrease in the traffic to Rajshahi Division and an increase in the traffic from Rajshahi, most probably directed to Khulna Division.

Table 2-38 Foodgrains Movement to Rajshahi Division

Unit: Thousand Tons

Origin (District)	1968/69			1972/73		
	Road	Rail	IW	Road	Rail	IW
Chittagong	NA	56	0	2	4	13
Comilla	NA	0	0	0	0	48
Dacca	NA	2	0	0	52	24 (10)
Khulna	NA	103	0	0	113	9 (0)

Note: ( ) indicates tonnage by country boat.

Table 2-39 Foodgrains Movement from Rajshahi Division

Unit: Thousand Tons

Destination (District)	1968/69			1972/73		
	Road	Rail	IW	Road	Rail	IW
Dacca	NA	32	0	14	15	18
Khulna	NA	20	0	19	56	2
Faridpur	NA	35	0	0	15	2
Jessore	NA	11	0	0	7	0
Kushtia	NA	26	0	10	18	0

Table 2-40 Inter-District Movement of Foodgrains Crossing  
Jamuna River

Unit: Thousand Tons

Division		Rail		Road		IWT		Total	
Origin	Destination	68/69	72/73	68/69	72/73	68/69	72/73	68/69	72/73
Rajshahi	Chittagong	6	3	NA	0	0	0	6	3
Chittagong	Rajshahi	56	4	NA	2	0	61	56	67
Rajshahi	Dacca	37	15	NA	14	0	0(18)	37	29(18)
Dacca	Rajshahi	6	52	NA	0	0	24(10)	6	76(10)
Sub-Total		105	74	NA	16	0	85(28)1	105	175(28)
Khulna	Chittagong	0	1	NA	0	5	26	5	27
Chittagong	Khulna	1	0	NA	0	21	215	22	215
Khulna	Dacca	0	2	NA	0	22	14(74)	22	16(74)
Dacca	Khulna	1	0	NA	0	2	13(17)	3	13(17)
Total		107	77	NA	16	50	353(119)	157	446(119)

Note: 1) Figure in ( ) indicates tonnage by country boat.

2) Tonnage by country boat in 1968-69 is not available.

### 3) Cement

There is no cement production in Rajshahi Division. It is either imported or supplied from Sylhet District. Table 2-41 shows the cement movement to Rajshahi Division. Although cement was transported mainly from Chittagong and Khulna in 1968/69, Khulna was the only cement supplier in 1972/73.

### 4) Oil

Oil consumption is expected to increase significantly in the future. Oil is totally imported through the Chittagong port, but the origins of oil supply are not only Chittagong but are also Comilla, Khulna and Dacca, because oil is distributed through main depots in these districts. Table 2-43 shows the oil movement to Rajshahi Division.

In estimating the future movement of oil, two main routes are to be noticed; one is from Chittagong to Rajshahi Division, and the other from Chittagong to Khulna by IWT and then to Rajshahi Division by railway. The movement from Chittagong to Rajshahi by railway will benefit from the bridge.

Table 2-41 Cement Movement to Rajshahi Division

Unit: Thousand Tons

Origin (District)	1968/69			1972/73		
	Road	Rail	IWT	Road	Rail	IWT
Chittagong	NA	45	0	0	0	0
Sylhet	NA	3	0	0	0	0
Khulna	NA	30	0	15	13	0

Table 2-42 Inter-District Movement of Cement Crossing Jamuna River

Unit: Thousand Tons

Division		Rail		Road		IWT		Total	
Origin	Destination	68/69	72/73	68/69	72/73	68/69	72/73	68/69	72/73
Rajshahi	Chittagong	0	0	NA	0	0	0	0	0
Chittagong		45	0	NA	0	0	0	45	0
Rajshahi	Dacca	0	0	NA	0	0	0	0	0
Dacca	Rajshahi	3	0	NA	0	0	0	3	0
Sub-total		48	0	NA	0	0	0	48	0
Khulna	Chittagong	0	0	NA	0	0	0	0	0
Chittagong	Khulna	10	0	NA	0	16	0(10)	26	0(10)
Khulna	Dacca	0	0	NA	0	1	55	1	55
Dacca	Khulna	0	0	NA	0	0	0	0	0
Total		58	0	NA	0	17	55(10)	75	55(10)

Note: 1) Figure in ( ) indicates tonnage by country boat.

2) Tonnage by country boat in 1968/69 is not available.



Table 2-43 Oil Movement to Rajshahi Division

Unit: Thousand Tons

Origin (District)	1968/69			1972/73		
	Road	Rail	IWT	Road	Rail	IWT
Chittagong	NA	69	0	0	9	0
Comilla	NA	0	0	0	0	4 (3)
Dacca	NA	1	0	3	0	0 (2)
Khulna	NA	54	0	8	22	0

Table 2-44 Inter-District Movement of Oil Crossing Jamuna River

Unit: Thousand Tons

Division		Rail		Road		IWT		Total	
Origin	Destination	68/69	72/73	68/69	72/73	68/69	72/73	68/69	72/73
Rajshahi	Chittagong	0	0	NA	0	0	0	0	0
Chittagong	Rajshahi	69	9	NA	0	0	4(3)	69	13(3)
Rajshahi	Dacca	0	0	NA	0	0	0	0	0
Dacca	Rajshahi	1	0	NA	3	0	0(2)	1	3(2)
Sub-Total		70	9	NA	3	0	4(5)	70	16(5)
Khulna	Chittagong	0	0	NA	0	0	0	0	0
Chittagong	Khulna	0	0	NA	0	163	262(8)	163	262(8)
Khulna	Dacca	0	0	NA	0	0	0	0	0
Dacca	Khulna	0	0	NA	0	0	4(2)	0	4(2)
Total		70	9	NA	3	163	270(15)	233	282(15)

Note: 1) Figure in ( ) indicates tonnage by country boat.

2) Tonnage by country boat in 1968/69 is not available.

5) Coal

Coal had been imported mostly from India until 1965 when it was suspended. Since being suspended, coal was transported from Dacca and Khulna by railway, as seen in Table 2-44. The last Liberation War opened the Indian Channel again, thus changing the coal movement pattern completely. Now coal is being imported directly by railway from Calcutta to Rajshahi Division as shown in Table 2-46. Dacca and Chittagong are the greatest consumers of coal. The movement from Calcutta directly to Dacca and Chittagong by railway will benefit from the provision of the bridge.

6) Fertilizer

There is no fertilizer production in Rajshahi Division. The tonnage of fertilizer carried across Jamuna River was respectively 39,000 tons and 5,000 tons in 1968/69 and 1972/73. The significant change of the distribution pattern had undoubtedly resulted from the war. Considering that the major fertilizer factories are located in Dacca Division, the 1968/69 pattern was a normal one. The movement from Dacca and Sylhet was of domestic production, but Khulna remains as an important supplier of imported fertilizer.

Table 2-45 Coal Movement to Rajshahi Division

Unit: Thousand Tons

Origin (District)	1968/69			1972/73		
	Road	Rail	IWT	Road	Rail	IWT
Dacca	NA	21	0	0	0	0
Khulna	NA	70	0	0	0	0

Table 2-46 Inter-District Movement of Coal Crossing Jamuna River

Unit: Thousand Tons

Division		Rail		Road		IWT		Total	
Origin	Destination	68/69	72/73	68/69	72/73	68/69	72/73	68/69	72/73
Rajshahi	Chittagong	0	0	NA	0	0	0	0	0
Chittagong	Rajshahi	0	0	NA	0	0	0	0	0
Rajshahi	Dacca	0	0	NA	0	0	0	0	0
Dacca	Rajshahi	21	0	NA	0	0	0	21	0
Sub-Total		21	0	NA	0	0	0	21	0
Khulna	Chittagong	0	0	NA	0	18	77	18	77
Chittagong	Khulna	0	0	NA	0	4	0	4	0
Khulna	Dacca	0	0	NA	0	23	54	23	54
Dacca	Khulna	0	0	NA	0	0	0	0	0
Total		0	0	NA	0	45	131	66	131
India	Chittagong						10		10
	(Calcutta)								
India	Dacca						42		83
	(Calcutta)								

Table 2-47 Movement of Imported Coal from Calcutta in 1972/73

Unit: Thousand Tons

Destination (District)	Inland Water	Rail Direct	Rail to Khulna then IWT	Total
Chittagong	10	-	75	85
Dacca	42	-	50	92
Khulna	-	41	-	41
Pabna	-	10	-	10
Bogra	-	5	-	5
Bangpur/Dinajpur	-	17	-	17
Total	52	73	125	250

Table 2-48 Fertilizer Movement to Rajshahi Division

Unit: Thousand Tons

Origin (District)	1968/69			1972/73		
	Road	Rail	IWT	Road	Rail	IWT
Chittagong	NA	2	0	0	0	0
Sylhet	NA	26	0	0	0	0
Dacca	NA	0	0	0	3	0
Khulna	NA	3	0	0	39	0

Table 2-49 Inter-District Movement of Fertilizer Crossing Jamuna River

Unit: Thousand Tons

Division		Rail		Road		IWT		Total	
Origin	Destination	68/69	72/73	68/69	72/73	68/69	72/73	68/69	72/73
Rajshahi	Chittagong	0	0	NA	0	0	0	0	0
Chittagong	Rajshahi	2	0	NA	0	0	0	2	0
Rajshahi	Dacca	0	0	NA	0	0	0	0	0
Dacca	Rajshahi	26	3	NA	0	0	2	26	5
Sub-Total		28	3	NA	0	0	2	28	5
Khulna	Chittagong	0	0	NA	0	0	0	0	0
Chittagong	Khulna	0	0	NA	0	9	35	9	35
Khulna	Dacca	0	0	NA	0	3	0	3	0
Dacca	Khulna	11	0	NA	0	0	76	11	76
Total		39	3	NA	0	12	113	51	116

7) Salt

Salt is mainly produced in Chittagong District and refined in the districts of Comilla, Barisal, etc. Table 2-50 shows the salt movement to Rajshahi Division. Chittagong was the single major origin in 1968/69, while in 1972/73 Comilla and Dacca were supplying areas. However, in both years the salt movement was a traffic across Jamuna River and it is expected that this basic pattern will not change much in the future.

8) Sugar

Rajshahi Division is a supplying area of sugar, and as shown in Table 2-51 destinations of the sugar movement are spread widely but mainly in the east part of Jamuna. Dacca and Chittagong were the two major destinations in 1968/69 and Dacca was the sole destination in 1972/73. The total tonnage carried decreased from 530,000 tons in 1968/69 to 20,000 tons in 1972/74, because of a reduction in production.

It is to be noticed that there is another movement by railway from Khulna to Dacca and Chittagong as far as the cross river traffic across Jamuna River is concerned.

Table 2-50 Salt Movement to Rajshahi Division

Unit: Thousand Tons

Origin (District)	1968/69			1972/73		
	Road	Rail	IWT	Road	Rail	IWT
Chittagong	NA	67	0	0	0	0
Comilla	NA	0	0	0	0	0(35)
Dacca	NA	0	0	0	11	14(1)

Note: Figure in ( ) indicates tonnage by country boat.

Table 2-51 Inter-District Movement of Salt Crossing Jamuna River

Unit: Thousand Tons

Division		Rail		Road		IWT		Total	
Origin	Destination	68/69	72/73	68/69	72/73	68/69	72/73	68/69	72/73
Rajshahi	Chittagong	0	0	NA	0	0	0	0	0
Chittagong	Rajshahi	67	0	NA	0	0	0(35)	67	0(35)
Rajshahi	Dacca	0	0	NA	0	0	0	0	0
Dacca	Rajshahi	0	11	NA	0	0	3(12)	0	14(12)
Sub-Total		67	11	NA	0	0	3(47)	67	14(47)
Khulna	Chittagong	0	0	NA	0	0	0	0	0
Chittagong	Khulna	4	0	NA	0	3	3(82)	7	13(82)
Khulna	Dacca	0	0	NA	0	0	0	0	0
Dacca	Khulna	0	0	NA	0	0	0	0	0
Total		71	11	NA	0	3	16(129)	74	27(129)

Note: 1) Figure in ( ) indicates tonnage by country boat

2) Tonnage by country boat in 1968/69 is not available

Table 2-52 Movement of Sugar from Rajshahi Division

Unit: Thousand Tons

Destination (District)	1968/69			1972/73		
	Road	Rail	IWT	Road	Rail	IWT
Chittagong	NA	8	0	0	2	0
Noakhali	NA	0	0	0	0	0
Comilla	NA	3	0	0	0	0
Sylhet	NA	1	0	0	2	0
Dacca	NA	28	0	2	12	0
Mymensingh	NA	2	0	0	2	0
Khulna	NA	9	0	0	3	0
Faridpur	NA	4	0	0	2	0
Jessore	NA	0	0	0	1	0

Table 2-53 Inter-District Movement of Sugar Crossing Jamuna River

Unit: Thousand Tons

Division		Rail		Road		IWT		Total	
Origin	Destination	68/69	72/73	68/69	72/73	68/69	72/73	68/69	72/73
Rajshahi	Chittagong	11	2	NA	0	0	0	11	2
Chittagong	Rajshahi	0	0	NA	0	0	0	0	0
Rajshahi	Dacca	31	16	NA	2	0	0	31	18
Dacca	Rajshahi	0	0	NA	0	0	0	0	0
Sub-Total		42	18	NA	2	0	0	42	20
Khulna	Chittagong	3	0	NA	0	0	0	3	0
Chittagong	Khulna	0		NA	0	0	14	0	14
Khulna	Dacca	8	0	NA		0	0	8	0
Dacca	Khulna	0	0	NA	0	0	1	0	1
Total		53	18	NA	2	0	15	53	35

## 9) Pulse

Pulse is one of the few products that has moved after the war. The main production area of pulse in Rajshahi Division is Pabna District, and pulse is transported to Comilla and Dacca mainly by inland water.

Table 2-54 Pulse Movement from Rajshahi Division

Unit: Thousand Tons

Destination (District)	1968/69			1972/73		
	Road	Rail	IWT	Road	Rail	IWT
Comilla	NA	0	0	0	0	24(5)
Dacca	NA	0	0	0	0	15(5)
Mymensingh	NA	0	0	0	1	1
Khulna	NA	0	0	2	1	0

Note: Figure in ( ) indicates tonnage by country boat.

Table 2-55 Inter-District Movement of Pulse Crossing Jamuna River

Unit: Thousand Tons

Division		Rail		Road		IWT		Total	
Origin	Destination	68/69	72/73	68/69	72/73	68/69	72/73	68/69	72/73
Rajshahi	Chittagong	0	0	NA	0	0	24(5)	0	24(5)
Chittagong	Rajshahi	0	0	NA	0	0	0	0	0
Rajshahi	Dacca	0	1	NA	0	0	16(5)	0	17(5)
Dacca	Rajshahi	0	0	NA	2	0	0	0	2
Sub-Total		0	1	NA	2	0	40(10)	0	43(10)
Khulna	Chittagong	0	0	NA	0	0	7(30)	0	7(30)
Chittagong	Khulna	0	0	NA	0	0	9	0	9
Khulna	Dacca	0	0	NA	1	0	7(29)	0	8(29)
Dacca	Khulna	0	0	NA	0	0	1	0	1
Total		0	1	NA	3	0	64(69)	0	68(69)

Note: 1) Figure in ( ) indicates tonnage by country boat.

2) Tonnage by country boat in 1968/69 is not available.

### 3) Estimation of Traffic across the Jamuna River from the Factory Survey

In June 1974 questionnaires were distributed to factories in all districts of Bangladesh, asking how much freight they moved across the Jamuna River in one year. This survey was taken in order to estimate the volume of traffic across the Jamuna River. The result of this survey is:

Number of questionnaires distributed	3,733
Number of returned questionnaires	1,479
Rate of recovery	39.6%
Number of factories which used in Jamuna River	528

The factories which used the Jamuna River are referred to those which answered that their cargoes were carried across the Jamuna River.

Table 2-56 shows an estimate of the present traffic across the Jamuna River based on the Factory Survey. It should be noted, however, that the survey included only 528 factories and that the questionnaire asked about the cargo movement in one year between July 1973 and June 1974. Table 2-52 shows the cargo movement across the Jamuna and Padma



rivers between the eastern and western regions of Bangladesh. This cargo traffic amounts to about 126,000 tons a year. The cargo traffic across the Jamuna River can be obtained by subtracting the cargo traffic volume between zones II and III from the cargo traffic volume between the eastern and western regions of the country. Between zones II and III about 95% of total freight is carried by ship. Between these zones the greater part of freight is water-borne, but very little freight is carried across the Jamuna River.

As a result, the freight which is carried across the Jamuna River in one year can be placed at about 120,000 tons. When the coefficient of multiplication (that is, the rate of questionnaire recovery of the Factory Survey) is taken into consideration, the total cargo traffic across the Jamuna River in all Bangladesh can be given as follows:

$$120,000 \text{ tons} \times 0.4 = 300,000 \text{ tons/year}$$

where, 0.4 = coefficient of multiplication

In actuality, however, the figure arrived at above does not represent the total cargo traffic across the Jamuna River, because it does not include the cargoes (mainly grains) other than the factory-related freight. The existing data of grain traffic show that 178,000 tons of grains were carried across the Jamuna River in one year from 1972 to 1973. If this figure applied to 1974, the total cargo traffic across the Jamuna River in 1974 can be estimated to be about 478,000 tons. However, the total freight carried across the Jamuna River in 1972/73 is said to be 612,000 tons. This discrepancy can be explained as follows. In the Factory Survey about 70% of surveyed factories answered the questionnaire. When the non-respondents are taken into account, the total freight carried across the Jamuna River in one year can be placed at about 600,000 tons. Accordingly, it can be said that there is little discrepancy between the estimates based on the existing data and the Factory Survey.

#### Cargo Traffic by Modes of Transport.

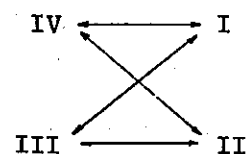
The freight traffic across the Jamuna River by modes of transport estimated from the Factory Survey is shown below. The proportion of freight carried by inland water transport (including country boats) is about 74%, which is higher than the figure derived from the existing data.

#### Cargo Traffic Across the Jamuna River by Modes of Transport

	(Factory Survey)	(Existing Data)
Railway transport	18.4 %	26.5 %
Road transport	7.8 %	10.8 %
Inland water transport	73.8 %	62.7 %

Overall, however, there is little difference in transport mode distribution of the freight carried across the Jamuna River from 1972 to 1974 between the estimates based on the existing data and the Factory Survey.

Table 2-56 Cargo Movement Across the Jamuna and Padma Rivers



Unit: Ton/year

D 0	Mode	III South West Zone		IV North West Zone		Total	
			*		*		*
I  North-east Zone	Railway	1,114.6	13%	9,758.2	32.2%	10,872.8	9.6%
	Truck	374.2	0.5	3,587.4	11.8	3,961.6	3.5
	Steamer	73,771.1	89.7	101.7	0.4	73,872.8	65.3
	Railway Truck	1,487.2	1.8	2,689.8	8.9	4,177.0	3.7
	Country-boat	0	0	215.6	0.7	215.6	2.2
	Bus	0	0	15.0	0.1	15.0	-
	Others	5,600.0	6.9	11,002.1	36.3	16,602.1	14.7
	N.A.	448.0	0.5	2,904.0	9.6	3,352.0	5.0
TOTAL	82,795.1	100.0	30,273.8	100.0	113,068.9	100.0	
II  South-east Zone	Railway	133.1	2.2	4,785.0	62.5	4,918.1	35.8
	Truck	152.3	2.5	1,006.0	13.1	1,158.3	8.4
	Steamer	5,740.0	94.4	32.6	0.4	5,772.6	42.0
	Railway Truck	44.8	0.7	1,241.8	16.2	1,286.6	9.4
	Country-boat	7.8	0.1	0	0	7.8	0.1
	Bus	0	0	0.1	-	0.1	0
	Others	0	0	0	0	0	0
	N.A.	0	0	595.8	7.8	595.8	4.3
TOTAL	6,078.0	100.0	6,661.3	100.0	13,739.3	100.0	

\* Proportion of Transport.

## CHAPTER III

### FORECAST OF FUTURE TRAFFIC ACROSS THE JAMUNA RIVER

#### 1. Methods and Assumptions.

##### 1.1. Passenger Traffic.

The methods and assumptions for estimation of future passenger traffic across the Jamuna River are as follows:

- 1) Future passenger traffic across the Jamuna River was estimated for the years of 1993 and 2020, and the estimate for 1990 (when the Jamuna River Bridge is expected to come into service) and other years was made by a simplified method.
- 2) To estimate future passenger traffic across the Jamuna River, the O-D distribution of passenger traffic by districts was established, and the nationwide passenger traffic expected to occur was distributed across the country according to the future railway and road networks. An estimated of future passenger traffic by modes of transport was also made.
- 3) The gravity model was not used in the establishment of the O-D distribution of passenger traffic by districts in step (2) above.

The statistical work done in the estimation of future passenger traffic across the Jamuna River will be discussed in detail in Section 3.1.

##### 1.2. Cargo Traffic.

Future cargo traffic across the Jamuna River was estimated on the basis of the data obtained by the 1974 survey. The methods and assumptions for estimation of future cargo traffic across the Jamuna River are as follows:

- 1) Future cargo traffic across the Jamuna River was estimated in due consideration of the first five year plan of the government of Bangladesh.
- 2) Future cargo movement was estimated on the basis of the O-D distribution of freight established in the previous study.
- 3) Future cargo traffic was estimated for the years of 1993 and 2020, and for 1993 the O-D distribution of nationwide cargo traffic was established to estimate the cargo movement across the Jamuna River.
- 4) In the previous study 1983 was selected as the base year, and cargo traffic for 1993 and subsequent years was estimated in consideration of the annual growth rates of GNP and other economic indicators, whereas 1993 was selected as the base year in this study.

- 5) As a result, future traffic in such commodities as food grains, salt, and sugar newly estimated on the basis of estimated population in 1993.
- 6) Future traffic in other commodities was estimated on the basis of the previous estimate based on the first five-year plan (base year: 1883), taking into account general economic and social conditions of the country such as growth rates of agricultural production and population.
- 7) The assumption was made in the estimation of future traffic in mining products in the Bgra district that the production of lime, cement and coal would have been started by 1993.
- 8) The current growth rate of about 4.4% in GNP was used in the estimation of cargo traffic growth in 1993 and after in stead of the rate of 5.5% which is aimed at by the first five year plan, because it seems too high in the light of the present rate of economic expansion in Bangladesh. In the estimation of future cargo traffic the annual growth rates in railway and road traffic were placed at 4% and 4.5%, respectively, on the assumption that road transport will outweigh railway transport in the future.

## 2. Estimated Traffic at Four Proposed Sites of Bridge Construction.

In the previous study future traffic across the Jamuna River was estimated for four proposed sites of bridge construction, whereas in the present study only the traffic on the Sirajganj route was estimated, as the survey team and the government of Bangladesh agreed on this route as the most suitable site of bridge construction. Accordingly, future traffic on other routes was not estimated in this study, and the estimates made in the previous study were used as approximate data (because the conditions of traffic estimation are not the same for both studies).

Table 3-1 shows an estimate of traffic at the four proposed sites of bridge construction in 1993. Traffic progressively increases, proceeding from north to south, and the traffic across the Jamuna River is thickest on the Nagarbari route. This tendency is only natural, when the traffic networks of Bangladesh are taken into consideration. Traffic does not differ greatly from one route to the other, and the average traffic of all routes is placed at 46 to 48 trains/day (including both passenger and freight cars) and 2,500 to 3,500 vehicles/day. This estimate is based on the assumption that the projects of coal and cement production in the Bogra district will be afoot by 1993.

## 3. Traffic across the Jamuna River at Sirajganj.

### 3.1. Passenger Traffic.

To estimate future passenger traffic across the Jamuna River at Sirajganj it is necessary to establish the O-D distribution of passenger traffic across the country.

Table 3-1 Approximate Estimate of Traffic Across the Jamuna River at the Four Proposed Sites of Bridge Construction

Proposed Site	Traffic by Modes of Transport	Mode of Transport	Year 1993			
			Railways		Vehicles	
			Annual	Daily Average	Annual	Daily Average
(I) Bahadurabad	Passengers	Passenger Cars	146	40	7,928	2,172
		Buses			694	190
Gabargaon	Freight Trains (Trucks)		22	6	665	182
		<b>Total</b>	<b>168</b>	<b>46</b>	<b>9,287</b>	<b>2,544</b>
(III) Sirajganj	Passengers	Passenger Cars	146	40	8,731	2,392
		Buses			767	210
Sirajganj	Freight Trains (Trucks)		22	6	687	188
		<b>Total</b>	<b>168</b>	<b>46</b>	<b>10,185</b>	<b>2,790</b>
(IV) Nagarbari	Passengers	Passenger Cars	153	42	10,089	2,764
		Buses			883	242
Nagarbari	Freight Trains (Trucks)		22	6	792	202
		<b>Total</b>	<b>175</b>	<b>48</b>	<b>11,764</b>	<b>3,208</b>

### 3.1.1. Estimation of Future Trip Generation.

In the previous study the basic rate of inter-district trip generation in Bangladesh was determined on the basis of inter-district trip generation in Japan. In this study the basic rate of inter-district trip generation was also established as follows:

Basic rate of future inter-district trip generation  
= 0.0077/person/day

When this basic rate is used, nationwide trip generation in 1993 and 2020 can be estimated as follows, although trip generation will differ from 1993 to 2020.

1993	288 million trips/year
2020	429 million trips/year

Using these figures as the control total, passenger trip generation in each district was estimated. The trip generation in each district was computed by dividing the control total according to the district distribution of total population of Bangladesh. The results are shown in Table 3-2.

### 3.1.2. Distribution of Future Passenger Traffic.

The O-D distribution of inter-district passenger trips was established, processing the data by the gravity model and convergence calculation. Preliminary to the establishment of the O-D distribution of inter-district passenger trips, the forecast of future road and railway networks and estimation of the time-distance between districts were carried out, as will be explained below.

#### (1) Road and Railway Networks

Not only the existing road and railway networks but also the plans of expansion were taken into account with reference to the Bangladesh Transport Survey report and the time table of the railways.

#### (2) Time-distance

The time-distance between districts was estimated, dividing the surface transports into railway and road networks, determining the shortest route between zones (A) and (B), and placing the average traveling speed at 30 km/h for vehicles and 40 km/h for trains (based on the working Time Table of the Bangladesh Railways). (In the case of ferry routes, the time-distance was converted to the route distance, when determining the shortest route.)

#### (3) Time-distance O-D

The time-distance O-D which was used as an input to the gravity model was established, using the average inter-district time-distance estimated from the forecast of future road and railway networks. (See Table 3-3).

Table 3-2 Number of Inter-District Future Passenger Generation Trips

	1 9 9 3		2 0 2 0	
	Passenger Trips	%	Passenger Trips	%
Dacca Division	8,955	31.09	13,372	31.17
1. Sylhet	1,812	6.29	2,471	5.76
2. Dacca	3,442	11.95	5,792	13.50
3. Mymensingh	2,877	9.99	3,925	9.15
4. Tangail	824	2.86	1,184	2.76
Chittagong Division	5,342	18.55	7,434	17.33
5. Chittagong	1,826	6.34	2,840	6.62
6. Chittagong HT	181	0.63	232	0.54
7. Noakhali	1,207	4.19	1,604	3.74
8. Comilla	2,128	7.39	2,758	6.43
Khulna Division	7,191	24.97	10,588	24.68
9. Khulna	1,538	5.34	2,458	5.73
10. Patuakhali	498	1.73	567	1.32
11. Barisal	1,356	4.71	1,622	3.78
12. Faridpur	1,400	4.86	1,686	3.93
13. Jessore	1,477	5.13	2,488	5.80
14. Kushtia	922	3.20	1,767	4.12
Rajshahi Division	7,312	25.39	11,506	26.82
15. Rajshahi	1,895	6.58	3,192	7.44
16. Pabna	1,158	4.02	1,755	4.09
17. Bogra	901	3.13	1,330	3.10
18. Rangpur	2,238	7.77	3,393	7.91
19. Dinajpur	1,120	3.89	1,836	4.28
Bangladesh Total	28,800	100.00	42,900	100.00

Note: Passenger Trips Unit: 10 thousand trips.

Table 3-3 Average Inter-District Time-Distance 0-D  
(Average of the Road and the Railway Networks)

Districts	Unit: Hour																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1 Sylhet	8	10	10	12	15	10	8	20	22	20	16	18	16	16	15	15	18	18	18
2 Dacca		4	3	8	11	5	4	12	14	13	9	11	9	10	8	8	11	11	11
3 Mymensingh			4	11	14	9	7	13	17	15	12	12	9	9	8	8	11	11	11
4 Tangail				11	14	8	7	11	14	13	9	9	6	7	5	6	9	9	9
5 Chittagong					4	5	6	20	22	21	16	19	17	18	15	16	18	19	19
6 Chittagong HT						9	8	23	24	23	20	22	19	20	18	19	22	22	22
7 Noakhali							3	18	17	17	14	16	13	14	12	13	15	15	15
8 Comilla								16	17	16	13	15	12	13	11	12	14	14	14
9 Khulna									6	4	6	3	5	9	7	10	13	13	13
10 Patuakhali										2	6	7	9	13	11	14	17	17	17
11 Barisal											4	6	8	11	9	12	15	16	16
12 Faridpur												6	4	7	6	9	12	12	12
13 Jessore													4	7	5	8	11	12	12
14 Kushtia															4	3	5	9	9
15 Rajshahi																4	4	7	8
16 Pabna																	5	8	8
17 Bogra																		4	5
18 Rangpur																			3
19 Dinajpur																			3



Table 3-4 0-D of Future Passenger Trips (1993)

Unit: 10 thousand persons

Districts	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Total	
1	0	388	305	47	224	10	88	214	39	12	49	58	38	28	81	42	33	114	40	1,812	
2		0	806	200	321	11	233	606	66	17	65	113	63	47	128	79	70	168	60	3,441	
3			0	242	212	9	86	225	69	14	60	79	65	57	189	95	85	203	72	2,875	
4				0	32	2	17	34	14	3	12	21	17	14	47	38	23	45	14	824	
5					0	111	198	317	33	10	31	48	32	20	60	30	27	85	30	1,827	
6					0		6	12	2	1	2	2	2	1	3	2	1	4	1	182	
7							0	420	12	4	14	7	11	8	24	13	11	33	12	1,207	
8							0		22	6	25	37	22	15	44	24	21	60	21	2,127	
9								0	0	47	234	140	539	58	87	57	25	69	24	1,537	
10									0	0	252	46	28	9	14	8	5	16	5	499	
11										0	232	129	129	37	67	40	20	60	21	1,356	
12											0	113	140	138	140	77	31	79	28	1,399	
13											0	112	114	112	114	63	31	75	23	1,477	
14												0	117	153	29	57	29	57	20	920	
15												0	254	138	305	83	138	305	83	1,895	
16												0	56	95	34	1,160					
17												0	218	77	901						
18												0	552	2,238							
19												0	1,119								
Total																					28,796

Table 3-5 0-D of Future Passenger Trips (2020)

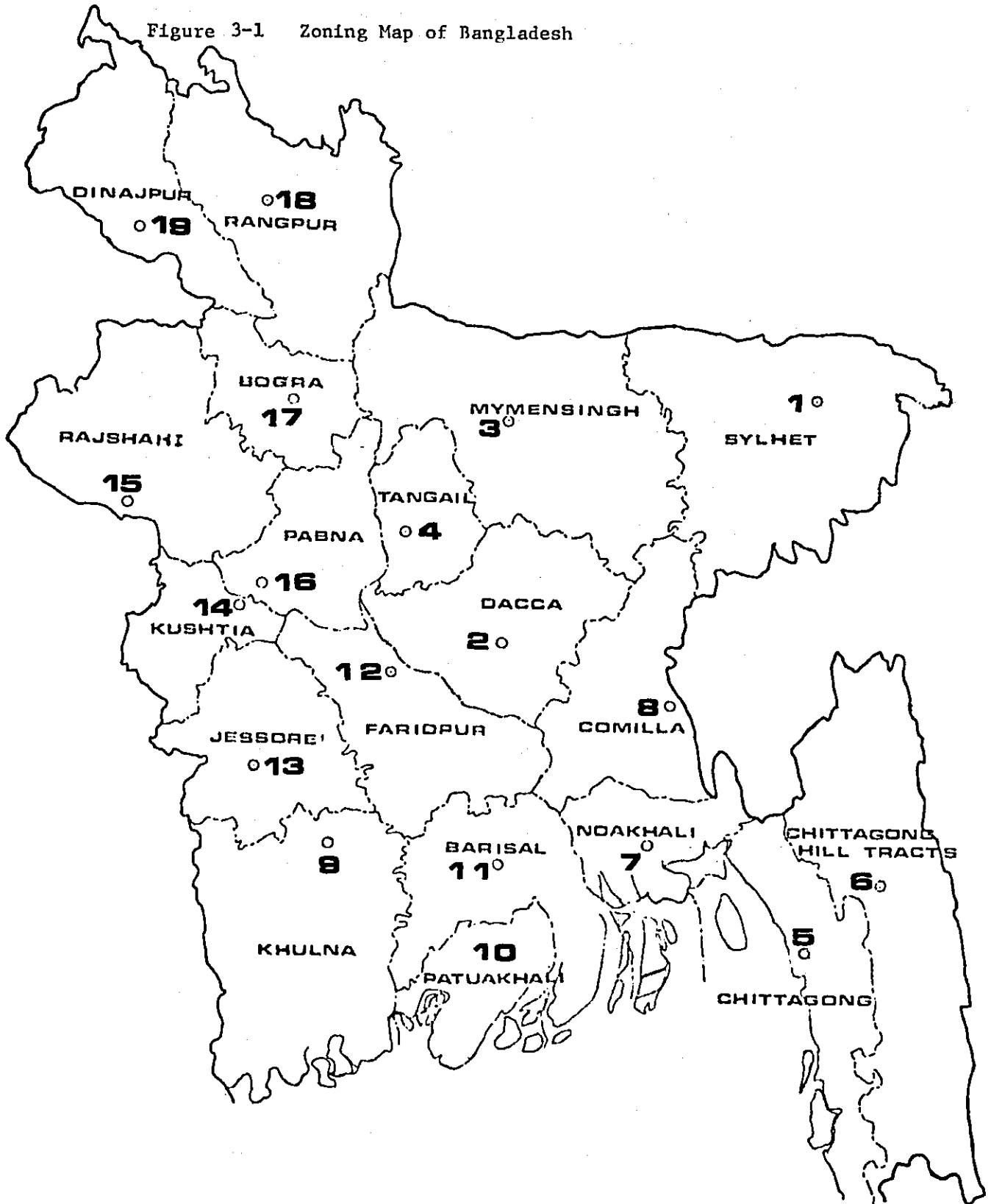
Unit: 10 thousand persons

Districts	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Total
1	0	634	362	60	327	11	108	246	57	14	55	62	57	48	124	54	42	151	60	2,472
2		0	1,277	345	628	17	380	923	128	25	97	161	126	111	263	138	122	298	119	5,792
3			0	302	299	10	102	249	97	17	65	82	94	97	280	120	107	261	104	3,925
4				0	30	2	21	41	22	4	14	23	27	26	76	52	31	63	25	1,184
5					0	148	290	431	56	13	50	61	57	43	110	47	42	135	54	2,841
6					0		7	12	2	1	2	2	2	2	5	2	2	5	2	234
7							0	480	18	4	16	18	16	15	37	17	15	44	18	1,606
8								0	29	7	26	36	31	25	62	29	26	74	30	2,757
9								0	82	308	175	175	949	121	157	87	39	107	43	2,457
10								0	260	45	38	45	38	14	20	10	5	19	8	566
11									0	225	176	176	176	60	95	47	24	73	29	1,622
12									0	146	211	187	187	87	87	87	35	91	36	1,683
13									0	241	214	214	214	100	100	50	50	122	41	2,487
14									0	258	287	287	287	54	108	287	54	108	43	1,764
15									0	414	227	508	508	156	156	156	156	156	156	3,193
16									0	77	134	134	134	53	53	53	53	53	53	1,755
17									0	308	122	1,328	1,328	122	122	122	122	122	122	1,328
18									0	893	3,321	3,321	3,321	893	893	893	893	893	893	3,321
19									0	1,836	1,836	1,836	1,836	1,836	1,836	1,836	1,836	1,836	1,836	1,836
Total																				42,896

Table 3-6 : Zoning Table of Bangladesh

No.	District	No.	District
1	Sylhet	11	Barisal
2	Dacca	12	Faridpur
3	Mymensingh	13	Jessore
4	Tangail	14	Kushtia
5	Chittagong	15	Rajshahi
6	Chittagong Hill Tracts	16	Pabna
7	Noakhali	17	Bogra
8	Comilla	18	Rangpur
9	Khulna	19	Dinajpur
10	Patuakhali		

Figure 3-1 Zoning Map of Bangladesh



The O-D of future passenger trips which was established by the gravity model based on various data mentioned above is shown in Tables 3-4 and 3-5. Table 3-6 shows a zoning table of Bangladesh, and Fig. 3-1, a zoning map of Bangladesh.

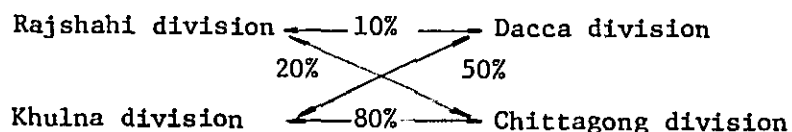
### 3.1.3. Distribution of Future Road and Railway Passenger Traffic.

The O-D distribution of future inter-district passenger traffic which has been discussed in Paragraph 3.1.2. above was further divided according to mode of transport (roads and railways).

#### (1) Inter-district Passenger Traffic by Modes of Transport

The vast majority of passengers travel by road, railway or waterway in Bangladesh. At present, however, little data is available concerning the transport mode distribution of total passenger traffic in this country. Concerning the passenger traffic across the Jamuna River no data is available either except for the survey taken by the survey team (for two days in 1973 and 1974). For lack of information on the distribution ratio of the three transport modes, the future inter-district passenger traffic by modes of transport was estimated in the following way.

- a) Water-borne passenger traffic was subtracted from the O-D table of passengers. In this case the assumption was made that the ratio of water-borne passengers to total inter-zone passenger traffic was as shown below.



- b) The ratio of passenger traffic by rail to passenger traffic by road was estimated by the time-ratio of road to railway which was computed on the basis of time-distance of each inter-district route (base: railway distance = 1). The proportion of rail-borne passenger traffic which was estimated in this way is shown in Table 3-7 (This ratio was also applied to the estimates for 1993 and 2020).
- c) The O-D distribution of rail-borne passenger traffic was established by subtracting water-borne passenger traffic from the O-D table of passengers and multiplying it by the ratio of rail-borne passenger traffic.
- d) The O-D distribution of road passenger traffic was established by subtracting water- and rail-borne passenger traffic from the O-D table of passengers.

As a result, the O-D distribution of future road and railway passenger traffic was estimated as shown in Tables 3-8 through 3-11.

Table 3-7 Proportion of Rail-Born Passenger Traffic 1993/2020

Unit: Percent

Districts	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1 Sylhet	0	50	54	58	66	62	66	62	66	58	54	54	66	62	66	58	50	54	58
2 Dacca		0	50	50	62	54	62	42	66	50	50	50	58	62	70	54	42	50	50
3 Mymensingh			0	42	58	58	54	50	66	56	62	62	62	54	62	54	38	50	50
4 Tangail				0	62	54	50	46	62	70	70	74	62	66	74	62	34	46	46
5 Chittagong					0	42	50	58	66	58	54	54	62	66	70	62	54	54	58
6 Chittagong HT						0	46	50	62	54	54	54	62	62	66	58	46	50	58
7 Noakhali							0	38	62	62	54	54	62	66	70	62	46	54	54
8 Comilla								0	62	50	50	46	58	62	70	54	42	50	50
9 Khulna									0	34	34	34	58	58	54	50	54	62	66
10 Patuakhali										0	22	58	42	54	62	54	58	58	62
11 Barisal											0	50	38	54	62	62	62	62	66
12 Faridpur												0	34	62	74	58	54	62	74
13 Jessore													0	42	50	50	50	58	62
14 Kushtia														0	50	38	50	54	62
15 Rajshahi															0	62	50	50	54
16 Pabna																0	62	54	62
17 Bogra																	0	50	42
18 Rangpur																		0	50
19 Dinajpur																			0

Table 3-8 The 0-D distribution of Future Road Passenger Traffic (year 1993)

Districts	Unit: 10 thousand persons/year																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Total
1 Sylhet	0	194	140	20	76	4	30	82	10	4	18	22	10	9	19	16	14	17	15	700
2 Dacca		0	403	100	122	5	89	351	18	6	26	45	21	14	36	34	37	76	27	1,604
3 Mymensingh			0	140	89	4	40	112	18	6	18	24	20	21	65	40	48	91	32	1,311
4 Tangail				0	12	1	8	8	4	1	3	4	5	4	11	13	14	22	8	378
5 Chittagong					0	64	99	133	2	1	3	4	2	1	9	6	6	20	7	656
6 Chittagong HT					0		3	6	0	0	0	0	0	0	1	1	1	1	0	91
7 Noakhali							0	260	1	0	1	1	1	1	4	3	3	8	3	555
8 Comilla								0	2	1	2	4	2	1	7	6	6	15	6	1,004
9 Khulna								0	31	154	59	334	29	40	28	11	26	8		775
10 Patuakhali									0	197	19	16	4	5	4	2	7	2		306
11 Barisal										0	116	80	17	25	15	8	23	7		713
12 Faridpur											0	80	52	36	32	14	30	7		549
13 Jessore												0	65	57	31	15	31	9		779
14 Kushtia													0	58	95	14	26	8		419
15 Rajshahi														0	97	69	152	38		729
16 Pabna															0	21	44	13		499
17 Bogra																0	109	45		437
18 Rangpur																	0	276		974
19 Dinajpur																		0		511
Total																				12,990

Table 3-9 The 0-D Distribution of Future Road Passenger Traffic (Year 2020)

Unit: 10 Thousand persons/year

Districts	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Total
1 Sylhet	0	317	167	29	111	4	37	93	15	5	20	23	15	14	38	30	19	71	23	1,031
2 Dacca		0	638	172	239	8	144	535	35	10	67	64	42	78	71	57	64	134	53	2,728
3 Mymensingh			0	175	126	4	47	124	26	6	20	20	29	36	95	50	59	117	47	1,806
4 Tangail				0	29	1	10	22	6	1	3	5	8	7	18	18	18	31	12	565
5 Chittagong				0	86	145	181	4	1	4	6	4	3	17	9	10	31	12	12	1,018
6 Chittagong HT				0	4	6	0	0	0	0	0	0	0	1	1	1	1	1	1	118
7 Noakhali					0	298	1	0	1	1	1	1	1	1	6	3	4	10	4	717
8 Comilla					0	2	1	3	3	3	3	3	2	10	7	8	15	8	15	1,321
9 Khulna					0	41	203	73	854	60	72	43	18	41	15	1,509				
10 Patuakhali						0	213	19	22	6	8	5	2	8	3	351				
11 Barisal							0	112	109	28	36	18	9	28	10	884				
12 Faridpur								0	96	80	49	37	16	35	9	648				
13 Jessore									0	140	107	50	25	51	16	1,572				
14 Kushtia										0	129	178	27	50	16	855				
15 Rajshahi											0	157	113	254	72	1,253				
16 Pabna												0	29	62	20	774				
17 Bogra													0	154	71	647				
18 Rangpur														0	446	1,539				
19 Dinajpur															0	838				
Total																				20,174



Table 3-10 The 0-D Distribution of Future Railway Passenger Traffic (Year 1993)

Districts	Unit: 10 thousand persons/year																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Total
1 Sylhet	0	194	165	27	148	6	58	134	21	6	21	25	20	14	48	22	15	56	21	1001
2 Dacca		0	403	100	199	6	144	255	35	7	27	46	30	23	81	39	26	76	27	1718
3 Mymensingh			0	102	123	5	46	113	37	7	30	39	32	25	105	46	29	92	32	1431
4 Tangail				0	20	1	9	16	7	2	6	13	9	7	32	22	7	19	6	405
5 Chittagong					0	47	99	184	4	1	4	5	4	3	21	10	8	23	9	912
6 Chittagong HT						0	3	6	0	0	0	0	0	0	1	1	0	1	1	78
7 Noakhali							0	160	1	0	2	1	1	1	9	4	3	9	3	553
8 Comilla								0	3	1	3	3	3	2	16	7	5	15	5	931
9 Khulna									0	16	80	81	205	29	47	29	14	43	16	668
10 Patuakhali										0	55	27	12	5	9	4	3	9	3	167
11 Barisal											0	116	49	20	42	25	12	37	14	543
12 Faridpur												0	33	86	104	45	17	49	21	711
13 Jessore													0	47	57	32	16	44	14	608
14 Kushtia														0	59	58	15	31	12	437
15 Rajshahi															0	157	69	153	45	1055
16 Pabna																35	51	21		608
17 Bogra																0	109	32		415
18 Rangpur																		0	276	1093
19 Dinajpur																			0	558
Total																				13892

Table 3-11 The O-D Distribution of Future Railway Passenger Traffic (Year 2020)

Districts	Unit: 10 thousand persons/year																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Total
1 Sylhet	0	317	195	35	216	7	71	153	30	6	24	26	30	20	74	28	19	74	33	1358
2 Dacca		0	639	173	339	9	236	388	67	10	38	65	58	55	166	67	46	134	54	2911
3 Mymensingh			0	127	173	6	55	125	51	8	32	41	46	42	157	58	37	118	47	1957
4 Tangail				0	31	1	11	19	11	2	8	14	14	14	50	29	10	26	11	586
5 Chittagong					0	62	145	250	7	2	6	7	7	6	39	15	12	37	16	1420
6 Chittagong HT						0	3	6	0	0	0	0	0	0	2	1	1	2	1	101
7 Noakhali							0	182	2	0	2	2	2	2	13	6	4	12	5	753
8 Comilla							0	4	1	3	3	4	3	22	8	6	19	8		1204
9 Khulna							0	21	105	102	95	61	85	44	21	66	28			800
10 Patuakhali								0	57	26	16	8	12	5	3	11	5			193
11 Barisal									0	113	67	32	59	29	15	45	19			654
12 Faridpur										0	50	131	138	50	19	56	27			870
13 Jessore											0	101	107	50	25	71	25			768
14 Kushtia												0	129	109	27	58	27			825
15 Rajshahi													0	257	114	254	84			1762
16 Pabna														0	48	72	33			909
17 Bogra															0	154	51			612
18 Rangpur																0	447			1656
19 Dinajpur																	0			921
Total																				20260

### 3.1.4. Future Passenger Traffic across the Jamuna River (at Sirajganj).

When the O-D road and railway passenger traffic was distributed in the future road and railway networks in the above-mentioned proportion, the road and railway passenger traffic crossing the Jamuna Bridge was estimated as shown in Table 3-12. According to this estimate, 12,390,000 passengers are expected to cross the Jamuna Bridge by rail and 8,840,000 passengers, by road in 1993. In 2020, 19,160,000 passengers are expected to cross the Jamuna Bridge by rail, and 14,030,000 passengers, by road.

Table 3-12 Passenger Traffic Crossing the Jamuna Bridge  
(at Sirajganj)

Unit: Million persons/year

Mode of Transport \ Year	1993	2020
Railway	1,239	1,916
Road	884	1,403
Total	2,123	3,319

### 3.2. Cargo Traffic.

Future cargo traffic across the Jamuna River was estimated on the basis of the data obtained by the 1974 survey. The methods and assumptions for estimation are as follows:

- 1) Future cargo traffic across the Jamuna River was estimated in due consideration of The First Five-Year Plan of the government of Bangladesh.
- 2) Future cargo traffic was estimated for the years of 1993 and 2020, and for 1993 the O-D distribution of nationwide cargo traffic was established to estimate the cargo movement across the Jamuna River.
- 3) Future traffic in such commodities as food grains, salt, and sugar newly estimated on the basis of estimated population in 1993.
- 4) The movement of other commodities such as Jute, Jute product, cement, coal, petroleum steel fertilizer and stone was estimated mentioning the following conditions.
  - a) The estimate for 1982/83 was made on the basis of The First Five-Year Plan of Bangladesh.
  - b) This estimate was extended to 1992/93, and the estimate for subsequent years was made on the assumption that cargo traffic would grow after 1982/83 at about half the average annual growth rate till 1982/83. The reason is that the cargo traffic growth after 1982/83 may be overestimated, if the same growth rate is applied to the years before and after 1982/83, since the unstable

political situation of Bangladesh is expected to bring about a considerable delay in the execution of The First Five Year Plan.

- c) The estimate of traffic in each commodity till 1982/83 will be described in the Feasibility Study Report. In Table 3-13 are shown the estimated average annual growth rates before and after 1982/83.

Table 3-13 Average Annual Growth Rates of Cargo Traffic by Commodities

<u>Commodity</u>	<u>Before 1982/83</u>	<u>After 1982/83</u>	<u>(Through 1993)</u>
Cement	8 %	4 %	(1.48)
Coal	5 %	3 %	(1.34)
Petroleum	5 %	3 %	(1.34)
Steel	10 %	3 %	(1.34)
Fertilizer	12.5 %	7 %	(1.97)
Stone	8 %	4 %	(1.48)

Note: 1. The growth rates of steel traffic were estimated in consideration of the growth of other industrial products.

2. Concerning the annual growth rate of Raw Jute and Jute products on the target year (1982/83, 1992/93 and 2020) is not included in this Table because it can be estimated in setting up of the future development plan.

- d) The estimate for 1993 was made by multiplying the estimate for 1982/83 by the average annual growth rates shown above.
- 5) The assumption was made in the estimation of future traffic in mining products in the Bogra district that the production of lime, cement and coal would have been started by 1993.
- 6) The current growth rate of about 4.4 % in GNP was used in the estimation of cargo traffic growth in 1993 and after instead of the rate of 5.5 % which is aimed at by The First Five-Year Plan, because it seems too high in the light of the present rate of economic expansion in Bangladesh. In the estimation of future cargo traffic the annual growth rates in railway and road traffic the annual growth rates in railway and road traffic will be placed at 4 % and 4.5 %, respectively, on the assumption that road transport will out-weight railway transport in the future.

### 3.2.1. Estimation of Future Cargo Traffic across the Jamuna River.

Of the nationwide inter-district cargo traffic, the portion of traffic which originates in either the eastern or the western half of the country divided by the Jamuna and Padma Rivers may cross the Jamuna River, when moved from one district to the other. To be concrete, the cargo traffic which originates in the following divisions may cross the Jamuna Bridge when it is built.

Inter-Division Cargo Traffic which May Cross the Jamuna River

Rajshahi division ←-----→ Dacca division

Khulna division <-----> Chittagong division

The possible interdivision cargo traffic crossing the Jamuna River is estimated in Table 3-14. When this traffic is divided according to modes of transport, the cargo traffic which will cross the Jamuna Bridge (by road and rail) can be estimated.

### 3.3. Traffic across the Jamuna Bridge by Modes of Transport.

Future passenger and cargo traffic crossing the Jamuna Bridge has been estimated in Sections 3.1. and 3.2. respectively. In this section the traffic volume will be broken down according to modes of transport and will be expressed in numbers of vehicles and trains. Furthermore, estimates for all years between 1990 and 2020 will also be made by a simplified method on the basis of the estimates for 1993 and 2020.

The traffic growth in 1993 and 2020 will be divided into natural and incidental increases.

#### 3.3.1. Passenger Traffic by Modes of Transport.

##### (1) Railways

The estimation of railway passenger traffic in terms of trains is based on the following conditions:

* Passengers per car	70
* Cars per train	20
* Passengers per train	1,400 (= 70 x 20)
* Yearly operating days	365 days

The conditions above were established at the meeting of the survey team and officials of Bangladesh.

##### (2) Vehicles

Vehicles are divided into passenger cars and buses. No official statistical data is available concerning the traffic of passenger

Table 3-14 The 0-D Inter-District Future Cargo Traffic Across the Jamuna River, 1993

		Unit: Thousand tons											
0	D	Raw Jute	Jute Goods	Food- Grain	Cement	Coal	Petro- leum	Iron Steel	Ferti- lizer	Salt	Sugar	Hard Rock	Total
Rajshahi	Chittagong	60	0	0	0	373	0	0	0	0	5	0	438
Chittagong	Rajshahi	0	0	0	0	0	0	34	520	145	0	0	699
Rajshahi	Dacca	169	0	0	374	504	0	0	0	0	73	178	1,298
Dacca	Rajshahi	0	0	0	0	0	0	0	264	0	0	0	264
	Subtotal	229	0	0	374	877	0	34	784	145	78	178	2,699
Khulna	Chittagong	60	0	54	0	0	0	0	0	0	0	0	119
Chittagong	Khulna	50	0	0	0	0	58	0	191	161	0	0	460
Khulna	Dacca	50	0	0	98	0	230	0	0	5	0	0	383
Dacca	Khulna	320	200	0	0	0	0	0	185	0	0	0	705
	Subtotal	480	200	54	98	0	288	0	376	166	0	0	1,667
	Total	709	200	54	472	877	288	34	1,160	311	83	178	4,366

Table 3-15 Cargo Traffic by Mode of Transport Across the Jamuna River (1993)  
(at point of Shirajganj)

		Unit: Thousand tons				
O	D	Railway	Road	IWT	Country boat	Total
Rajshahi	Chittagong	423	2	13	0	438
Chittagong	Rajshahi	557	0	87	55	699
Rajshahi	Dacca	978	244	13	63	1,298
Dacca	Rajshahi	242	0	17	5	264
	Sub-total	2,200	246	130	123	2,699
Khulna	Chittagong	2	0	57	60	119
Chittagong	Khulna	0	0	323	137	460
Khulna	Dacca	98	0	233	52	383
Dacca	Khulna	204	0	457	44	705
Total		2,504	246	1,200	416	4,366

cars and buses crossing the Jamuna River, and the vehicle traffic across the Jamuna River was estimated on the basis of the survey taken by the survey team. According to this survey, passengers are carried by passenger cars and buses across the Jamuna River in the proportion shown below.

Proportion of Passenger Car Traffic to Bus Traffic  
across the Jamuna River

Year	Bus	Passenger Car
1973	70 %	30 %
1974	76 %	24 %

At present buses outweigh passenger cars in passenger traffic in Bangladesh, but passenger cars will acquire increasing importance as various programs are carried out to improve the infrastructure including the roads. With this consideration in mind, the proportion of passenger cars to buses was placed at 50:50 in the estimation of future passenger traffic crossing the Jamuna Bridge. The number of passengers per car and bus were determined as follows according to the present riding passenger index.

* Passengers per car	3.5
* Passengers per bus	40.0

As a result, future passenger traffic crossing the Jamuna Bridge was estimated in terms of numbers of trains, passenger cars and buses, as shown in Table 3-16.

Table 3-16 Passenger Traffic Crossing the Jamuna Bridge

Mode of Transport	Year	1993		2020	
		Annual	Daily Average	Annual	Daily Average
Road Traffic	Passenger Cars	1,262,900	3,460	2,005,700	5,495
	Buses	110,600	303	175,200	480
	Total	1,373,500	3,763	2,180,900	5,975
Railway Traffic (Trains)		876,000	24	1,387,000	38

### 3.3.2. Cargo Traffic by Modes of Transport.

The cargo traffic crossing the Jamuna Bridge shown in Table 3-17 was broken down according to modes of transport.



## Conditions of Conversion

### (1) Railways

The assumption was made that the following conditions would apply to the railway cargo transport.

*Capacity of freight car	20 tons
*Freight cars per train	60
*Loading rate	80 %
*Yearly operating days	365 days

### (2) Trucks

The assumption was made that the following conditions would apply to the truck cargo transport.

* Capacity of truck	5 tons
* Loading rate	80 %
* Yearly operating days	365 days

According to the conditions established above, future cargo traffic crossing the Jamuna Bridge was converted to numbers of trains and trucks, as shown in Table 3-17.

Table 3-17 Cargo Traffic Crossing the Jamuna Bridge

Mode of Transport	1993		2020	
	Annual	Daily Average	Annual	Daily Average
Truck	61,700	169	201,500	552
Freight Trains	255,500	7	766,500	21

Future passenger and cargo traffic across the Jamuna Bridge by modes of transport is shown together in Table 3-18.

### 3.3.3. Annual Average Daily Traffic Crossing the Jamuna Bridge.

Annual average daily traffic crossing the Jamuna Bridge was estimated by a simplified (direct) method for all years between 1990 and 2020. The years before 1990 were excluded from the estimation, because the completion of the Jamuna Bridge is set for 1990.

Table 3-18 Future Passenger and Cargo Traffic Across the Jamuna Bridge.

Mode of Transport		1993		2020	
		per year	per day	per year	per day
Road	Passenger Car	1,262,900	3,460	2,005,700	5,495
	Bus	110,600	303	175,200	480
	Truck	61,700	169	201,500	552
	Total	1,435,200	3,932	2,382,400	6,527
Railway	Passenger Train	8,760	24	13,870	38
	Cargo	2,555	7	7,665	21
	Total	11,315	31	21,535	59

Table 3-19 Annual Average Daily Traffic Across the Jamuna Bridge by Modes of Transport

Year	Cars (Veh./day)				Trains (Trains/day)		
	Passenger Cars	Buses	Trucks	Total	Passenger Trains	Freight Trains	Total
1990	3,234	283	126	3,643	23	6	29
1991	3,309	290	141	3,740	23	6	29
1992	3,385	296	155	3,836	24	7	31
1993	3,460	303	169	3,932	24	7	31
1994	3,535	310	183	4,028	25	8	33
1995	3,611	316	197	4,124	25	8	33
1996	3,686	323	212	4,221	26	9	35
1997	3,761	329	226	4,316	26	9	35
1998	3,837	336	240	4,413	27	10	37
1999	3,912	342	254	4,508	27	10	37
2000	3,988	349	268	4,605	28	11	39
2001	4,063	355	283	4,701	28	11	39
2002	4,138	362	297	4,797	29	12	41
2003	4,214	369	311	4,894	29	12	41
2004	4,289	375	325	4,989	30	13	43
2005	4,364	382	339	5,085	30	13	43
2006	4,440	388	353	5,181	31	14	45
2007	4,515	395	368	5,278	31	14	45
2008	4,591	401	382	5,374	32	15	47
2009	4,666	408	396	5,470	32	15	47
2010	4,741	415	410	5,566	33	16	49
2011	4,817	421	424	5,662	33	16	49
2012	4,892	428	439	5,759	34	17	51
2013	4,967	434	453	5,854	34	17	51
2014	5,043	441	467	5,951	35	18	53
2015	5,118	447	481	6,046	35	18	53
2016	5,194	454	495	6,143	36	19	55
2017	5,269	460	510	6,239	36	19	55
2018	5,344	467	524	6,335	37	20	57
2019	5,420	474	538	6,432	37	20	57
2020	5,495	480	552	6,527	38	21	59

Passenger traffic across the Jamuna Bridge in 1993/2020 is calculated by modal such as rail and road, and also divided into the normal traffic, diverted traffic and induced traffic. The result of estimation is shown Table 3-20, using the ratio of modal split which is shown before.

Table 3-20 The Result of Estimation of Annual Passenger Volume by Modes of Transport (x 1,000)

[1993]

	Rail	Road	Total
Normal Traffic	2,940	2,100	5,040
Diverted Traffic	7,830	5,580	13,410
Developed Traffic	1,620	1,160	2,780
<b>Total</b>	<b>12,390</b>	<b>8,840</b>	<b>21,230</b>

[2020]

	Rail	Road	Total
Normal Traffic	6,133	4,480	10,613
Diverted Traffic	10,517	7,710	18,227
Developed Traffic	2,510	1,840	4,350
<b>Total</b>	<b>19,160</b>	<b>14,030</b>	<b>33,190</b>

These passenger traffic is estimated by modes of transport according to the same procedure as in the estimation of Section 3.3. Then concerning the cargo traffic, induced traffic which generated by the Jamuna Bridge is not considered because of goods movement forecast under the development plan. As has already been mentioned above, traffic by modes of transport was broken down in the following tables.

Table 3-21 Passenger and Cargo Traffic Across the Jamuna Bridge by the  
Composition of Traffic Generation

Mode of Traffic Generation	Year				Total	Induced Traffic	Diverted Traffic	Induced Traffic	Total
	1993		2020						
	Normal Traffic	Diverted Traffic	Induced Traffic	Total	Normal Traffic	Diverted Traffic	Induced Traffic	Total	
Road									
(Passenger Car)	823	2,183	454	3,460	1,761	3,013	721	5,495	
(Bus)	72	191	40	303	153	264	63	480	
(Truck)	-	169	-	169	-	552	-	552	
Total	895	2,543	494	3,932	1,914	3,829	784	6,527	
Railway									
(Passenger Train)	8,051	21,456	4,438	33,945	16,784	28,822	6,877	52,493	
(Cargo Train)	0	6,860	-	6,860	0	19,758	-	19,758	

## CHAPTER IV

### BENEFITS OF THE JAMUNA BRIDGE

#### 1. Concept of Benefits.

The benefits which are expected to result from the construction of a bridge across the Jamuna River are roughly divisible into two categories: direct and indirect benefits. The direct benefits will be represented by the savings in transportation cost and time which will be effected when the Jamuna Bridge is offered for free public use, and the direct benefits can be estimated according to mode of transportation (road and railway).

The indirect benefits includes all but direct benefits, but it is impossible to enumerate all such indirect effects of the bridge construction. In this study, therefore, the indirect benefits will be limited to such obvious returns to the investment as savings in river-crossing facilities (ferry and its related facilities), savings in cost of ferry operation and maintenance, and utilization of the base camps after completion of the bridge.

The basic conditions for evaluation of benefits of bridge construction are as follows:

- 1) The benefits of bridge construction are assumed to be the best, and the benefits of ferry improvement, the second best. The benefits which are expected to result from the construction of the Jamuna Bridge will be evaluated on the basis of this assumption.
- 2) Traffic growth which is expected to result from the construction of the Jamuna Bridge is divided into natural and incidental increases, and the benefits of incidental traffic growth will be decreased by half in value, when evaluating the overall benefits of traffic growth.

#### 2. Direct Benefits.

The direct benefits which are expected to result from the construction of the Jamuna Bridge are the savings which the transports can effect by the use of the bridge, and the savings will be afforded in two ways.

- 1) Savings in transportation cost
- 2) Savings in transportation time

The savings in cost and time will now be estimated according to modes of transportation.

##### 2.1. Savings in Transportation Cost

In the estimation of savings in transportation cost the differences in inter-district distance before and after bridge construction were calculated and multiplied by the transportation cost (or freight) per unit dis-

Table 4-1 (1) The Savings in Inter-District Road Distance

Unit: km

Districts	9	10	11	12	13	14	15	16	17	18	19
1. Sylhet						46	25	46	144	144	144
2. Dacca						30	69	30	144	144	144
3. Mymensingh	112				106	144	144	144	144	144	144
4. Tangail	44	23	23	9	144	144	144	144	144	144	144
5. Chittagong						30	69	30	144	144	144
6. Chittagong MT						30	69	30	144	144	144
7. Noakhali						30	69	30	144	144	144
8. Comilla						30	69	30	144	144	144

Table 4-1 (2) The Savings in Inter-District Railway Distance

Districts	9	10	11	12	13	14	15	16	17	18	19
1. Sylhet	95				149	123	171	123	125	79	141
2. Dacca	95				149	123	171	123	171	125	171
3. Mymensingh	156	58	58	58	194	184	194	184	34		58
4. Tangail	194	139	139	139	194	194	194	194	194	194	194
5. Chittagong	95				149	123	171	123	158	112	171
6. Chittagong MT	95				149	123	171	123	158	112	171
7. Noakhali	95				149	123	171	123	158	112	171
8. Comilla	95				149	123	171	123	125	79	151

Zone No.

- |                |              |              |
|----------------|--------------|--------------|
| 9. Khulna      | 13. Jessore  | 17. Bogra    |
| 10. Patuakhali | 14. Kushtia  | 18. Rangpur  |
| 11. Barisal    | 15. Rajshahi | 19. Dinajpur |
| 12. Faridpur   | 16. Pabna    |              |

tance (km) according to modes of transport. The procedures for estimation of savings in transportation cost will now be explained.

(1) Savings in Distance

The savings in traveling distance after bridge construction can be calculated from the differences in inter district road and railway distances before and after bridge construction, as shown in Table 4-1. The time of river crossing by ferryboat was placed at 5 hours, allowing for the waiting time and was converted to a time distance, using an average vehicle speed of 30 km/h and an average train speed of 40 km/h.

(2) Man-km and Ton-km Savings

When the savings in distance are multiplied by the volume of passenger and cargo traffic crossing the Jamuna Bridge, the savings can be expressed in man km and ton km, as shown in Table 4-2.

Table 4-2 Man-km and Ton-km Savings

Mode of Transport	1993		2020	
	Man-km Saving (000s)	Ton-km Saving (000s)	Man-km Saving (000s)	Ton-km Saving (000s)
Road	1,051,320	33,801	1,651,540	110,732
Railway	1,759,530	361,641	2,781,220	1,041,526
TOTAL	2,810,850	395,441	4,432,760	1,152,258

(3) Unit-km Savings

The man-km and ton-km savings calculated above are converted to unit-km savings by the method which has already been mentioned in the section on "Estimation of Traffic Crossing the Jamuna River" according to modes of transport, as shown in Table 4-3.

Table 4-3 Unit-km Savings by Modes of Transport in Thousands

Mode of Transport \ Year	1993	2020
Passenger Car	150,189	235,934
Bus	13,142	20,644
Truck	8,450	27,683





Table 4-5 Motor Transportation Cost per km

Items	Passenger Car	Truck	Bus
Fuel	0.23	0.48	0.43
Lubricant	0.03	0.04	0.06
Tire & Tube	0.07	0.14	0.25
Maintenance	0.18	0.27	0.47
Depreciation	0.30	0.46	0.53
Subtotal	0.81	1.39	1.74
Fixed Expenses	-	0.53	0.69
Grand Total	0.81	1.92	2.43

(6) Calculation of the Railway Cost

Passenger Fare

The railway fare of Bangladesh varies with the class of passenger cars. According to the fare rate table of the Railways of Bangladesh, the passenger fare is as shown in Table 4-6.

Table 4-6 Railway Fare in Bangladesh

		Unit: Tk		
		First Class	Second Class	Third Class
Case A	200 miles (322 km)	45.8	15.30	11.90
Case B	300 miles (483 km)	56.3	22.40	17.60

The fare per person per km is as follows:

Unit: Tk/km		
	Case A	Case B
First Class	0.14	0.15
Second Class	0.05	0.05
Third Class	0.04	0.04

Gasoline and diesel oil are priced at 3.3 Tk/ℓ and 1.18 Tk/ℓ respectively, in Bangladesh. Therefore, the motor fuel cost in Bangladesh can be estimated as follows:

Passenger Car	$3.3 \times 0.0694 = 0.23$ Tk/km
Truck	$1.18 \times 0.41 = 0.480$ Tk/km
Bus	$1.18 \times 0.365 = 0.43$ Tk/km

### Despreciation

The vehicle depreciation expenses in Bangladesh are estimated as follows.

- 1) Period of depreciation            12 years
- 2) Vehicle price

Passenger Car	34,667 TK/unit
Truck	173,333 TK/unit
Bus	195,000 TK/unit

- 3) Average daily service mileage

Passenger Car	26.7 km
Truck	86.2 km
Bus	83.3 km

Note: The figures obtained by a survey taken in Japan in 1974 are multiplied by 0.7 to estimate the average daily service mileage of motor transport in Bangladesh.

As a result, the vehicle depreciation expenses per km can be computed as follows:

$$\begin{aligned} \text{Passenger Car } & 34,667 \times \frac{1}{12 \times 365 \times 26.7} = 0.30 \text{ (TK/km)} \\ \text{Truck } & 173,333 \times \frac{1}{12 \times 365 \times 86.2} = 0.46 \text{ (TK/km)} \\ \text{Bus } & 195,000 \times \frac{1}{12 \times 365 \times 83.3} = 0.53 \text{ (TK/km)} \end{aligned}$$

### Lubricant, Tire, Tube, Maintenance, Repairs and Fixed Expenses

For lack of information about these expense items, the Survey Report on Motor Transport Expenses (by the Survey Commission of Japanese Highways) is used to transfer the ratios of fuel and depreciation costs to the above expenses in Japan to motor transport in Bangladesh in consideration of differences in labor cost between Japan and Bangladesh.

As a result, the motor transportation cost per km in Bangladesh can be estimated as shown in Table 4-5.

Therefore, the inter-zone railway fare is as follows:

First Class	0.15 TK/person/km
Second Class	0.05 TK/person/km
Third Class	0.04 TK/person/km

In 1968/69, however, the income from the first class service accounted for only a little less than 1% of the total fare revenue of the Railways of Bangladesh, and the proportion of second class fare income to third class income was about 8%:92%. Accordingly, the savings in railway transportation cost are estimated according to the following proportion of second class fare income to third class fare income in total man-km savings:

Second Class	10% (0.05 TK/person/km)
Third Class	90% (0.04 TK/person/km)

#### Railway Cargo Transportation Cost

According to the data of the Railways of Bangladesh, the railway cargo transportation cost is as follows:

		Distance	
Gravel	Sylhet - Jagannathganj	420 km	3.09 TK/mound
Cement	Khulna - Sirajganj Ghat	291 km	2.66 TK/mound
	Chittagong - Jagannathganj	444 km	3.34 TK/mound
Steel	Khulna - Sirajganj Ghat	291 km	4.59 TK/mound
Machinery	Khulna - Sirajganj Ghat	291 km	4.59 TK/mound
	Chittagong - Jagannathganj	444 km	9.96 TK/mound

The transportation cost of these commodities per ton per km is calculated below.

Gravel	0.20 TK/ton/km
Cement	0.25 TK/ton/km
	0.20 TK/ton/km
Steel	0.27 TK/ton/km
Machinery	0.43 TK/ton/km
	0.61 TK/ton/km

As ton-km savings in cargo transportation have already been estimated for all commodity items, the railway cargo transportation cost is calculated using the average of figures shown above.

The railway cargo transportation cost is therefore given as follows.

$$\begin{aligned} \text{Railway cargo transportation cost} &= 0.20 + 0.25 + 0.20 + \\ &\quad 0.27 + 0.43 + 0.61 \times \frac{1}{6} \\ &= 0.33 \text{ TK/ton/km} \end{aligned}$$

The cost thus calculated will be applied to all cargo traffic crossing the Jamuna Bridge, although it includes sugar, raw jute, fertilizer, and salt.

## 2.2. Savings in Time.

In this study a few time costs have been established in consideration of the labor cost in Bangladesh, as shown below.

Class A	2,500 TK/month	2,250 TK/month (after tax)
Class B	1,800 TK/month	1,620 TK/month (after tax)
Class C	800 TK/month	720 TK/month (after tax)

The average monthly working hours in Bangladesh are estimated as follows:

Class A	23 x 8 = 184 hours
Class B	23 x 9 = 207 hours
Class C	23 x 10 = 230 hours

Accordingly, the time costs of labor can be calculated as follows:

Class A	12.23 TK/hour
Class B	7.83 TK/hour
Class C	3.13 TK/hour

The time cost of passengers during transportation is estimated to be half the time cost of labor.

Class A	6.12 TK/hour
Class B	3.92 TK/hour
Class C	1.57 TK/hour

The calculation of time cost savings is based on the following assumptions:

### Passenger Car

80% of passenger car users offer labor that costs and belong to class B of labor.

### Bus

70% of bus passengers offer labor that costs, and of them 10% belong to class B of labor, and 90%, class C of labor.

## Railway

70% of railway passengers offer labor that costs, and of them 10% belong to class A labor, 20%, class B, and 70%, class C.

Accordingly, the time cost of labor by modes of transport can be estimated as follows:

Table 4-7 Time Cost of Labor by Modes of Transport

	Per Passenger	Per Car or Bus
Passenger Car	3.14 TK/hour	11.0 Tk/hour
Bus	1.26 TK/hour	50.5 TK/hour
Railway	1.746 TK/hour	

The man-km, ton-km, unit-km, and unit-time savings which will be afforded by the Jamuna Bridge and the transportation costs and time costs of labor by modes of transport have been estimated. The direct benefits of the Jamuna Bridge based on these figures can be calculated in money terms as shown in Table 4-8.

### Estimation of Annual Direct Benefits

The direct benefits which are expected to result from the construction of a bridge across the Jamuna River have been estimated for 1993 and 2020. As the Jamuna Bridge is planned to be completed in 1990, the yearly direct benefits will now be estimated for the period between 1990 and 2020 by a simplified method, using the estimates for 1993 and 2020.

### 3. Indirect Benefits.

The indirect benefits of the Jamuna Bridge are various, but in this study relatively obvious returns to the investment will be quantitatively estimated.

#### 3.1. Utilization of Bridge Construction Base Camps.

The bridge construction base camps include port facilities, motor pools, and so forth. As the bridge construction period is expected to extent for about 10 years, many facilities will be built in addition to land development. The areas developed for bridge construction will serve the purpose of housing people after bridge construction. In the estimation of the benefit of utilization of bridge construction base camps, the land is evaluated at current market price and the facilities, at residual value.

Table 4-8 Estimation of Annual Direct Benefits by Mode of Transport in 1993 & 2020

Unit: Million Tk/year (Million yen/year)

Benefits	Year	R O A D			R A I L W A Y			Total	
		Passenger Car	Bus	Cargo	Subtotal	Passenger Train	Cargo		Subtotal
Saving in Time Benefit	1993	51 (1,184)	21 (477)	-	72 (1,661)	72 (1,657)	-	72 (1,657)	144 (3,318)
	2020	81 (1,859)	33 (749)	-	114 (2,608)	114 (2,618)	-	114 (2,618)	228 (5,226)
Saving in Travelling Cost Benefit	1993	152 (3,507)	37 (855)	19 (460)	208 (4,822)	67 (1,551)	119 (2,742)	186 (4,293)	394 (9,115)
	2020	238 (5,510)	58 (1,346)	65 (1,507)	361 (8,363)	107 (2,455)	344 (7,926)	451 (10,381)	812 (18,744)
Total	1993	203 (4,691)	58 (1,332)	19 (460)	280 (6,483)	139 (3,208)	119 (2,742)	258 (5,950)	538 (12,433)
	2020	319 (7,369)	91 (2,095)	65 (1,507)	475 (10,971)	221 (5,073)	344 (7,926)	565 (12,999)	1,040 (23,970)

Table 4-9 Annual Economic Direct Benefits by year

<u>Year</u>	<u>Million TK/year</u>	
	(a)	(b) = Excluding shadow rate
1990	483	437
1991	501	454
1992	520	471
1993	538	489
1994	557	506
1995	575	524
1996	594	541
1997	612	558
1998	631	576
1999	649	593
2000	668	610
2001	686	628
2002	705	645
2003	723	662
2004	742	680
2005	760	697
2006	779	714
2007	797	732
2008	816	749
2009	834	766
2010	853	784
2011	871	801
2012	890	818
2013	908	836
2014	927	853
2015	945	870
2016	964	888
2017	982	905
2018	1,001	922
2019	1,019	940
<b>Total:</b>	<b>22,530</b>	<b>20,649</b>
(30 years)		

The areas where they can use for public use after completion of bridge construction are as follows:

Construction base	81.8 ha.
Residential area	70.6 ha.
<hr/>	
Total:	152.4 ha.

As the land price in Tangail is about 500,000 TK/acre ( = 1,236,000 TK/ha.), so we apply same price to the areas developed for bridge construction as follows:

$$1,236,000 \text{ TK/ha.} \times 152.4 \text{ ha.} = \underline{188.4 \text{ million TK}}$$

### 3.2. Saving Benefit of Ferry Related Facility.

In case of building the bridge; the effect to the ferry boat transportation can easily be realized, that the Ferry Boats as the existing mean of transportation will be cut down drastically.

The cut downed cost will have to be appropriate as the saving benefit.

Followings are saved cost of the Ferry related facility.

- Vessels (Ferry, Barge, Tug boat)
- Pontoon
- Management Cost

Remained Ferry traffic volume when the bridge is built, and regular traffic volume in case the bridge is not built, are compared and calculate the necessary number of Ferrys. This difference can be calculated as the saving benefit.

Considering an increase of the each ferry facilities (Berth: Pontoon) for the above-stated point, and it also would be made a part of ferry benefit. As a way of calculation on the ferry number use a operation cycle-time in the Report making a schedule of operation against that cycle-time, said ferry number is decided on getting to minimize the facility number and the effective utilization of Pontoon facilities.

#### (1) Car ferry (Road ferry)

Road ferry boat is estimated as following conditions.

Capacity	.....	Car 35 Cars/boat
Operation hour	.....	7 hours (around trip)
Service time a day	.....	two round trip/boat

1 Pontoon per 1 boat

1 Pontoon treats of 4 ferry boat a day

a one large car is evaluated in equal to 2.5 cars.



(2) Railway Ferry

Railway ferry is necessary to take into consideration two ferry transports which is Passenger ferry and car ferry.

a) Passenger ferry

Boarding Capacity ..... 1,000 persons/boat  
Required Hour ..... 6 hours ( a round trip)  
Service time per day ..... 3 round trips

Accordingly, available transport volume for the Passenger is as follows:

$$1,000 \times 3 \times 2 \times 0.9 = 5,400 \text{ per/day}$$

Two pontoons need per one ferry boat.

Two pontoons can treat of 5 (five) ships a day.

b) Car ferry

Ferry 1 set                    1 tugboat and 3 barges  
                                      ( 1 tugboat and 1 barge under the operation)  
Capacity                        Car 25 cars/barge  
Service time                    4 times  
Tonnage per car                8.56 tons  
Capacity of transport/a day one ferry boat  
=  $25 \times 8.56 \times 4 \times 2 \times 0.9 = 1,540 \text{ tons/day}$

Each two pontoons for loading/unloading and for berthing is needed per ferry 1 set.

Using the conditions above, the number of Ferry is calculated and showed its result in Table 4-10.

When the saving benefit is estimated, its benefit should be calculated against the each annual saving benefit adding to the following conditions.

The economic life of such ferry boat, tugboat, barges and pontoon as ferry boat facilities would be 18 years. Yearly maintenance and administration expenses should be shared on 20% of the yearly purchasing expenses on the ferry boat in itself or on 10% of yearly purchasing expenses on the pontoon and on 5% of the maintenance and administration expenses of parts required on ferry boat in itself.

These above expenses are calculated on except from the tax but in the case of converting a foreign portion into a economic cost using the shadow rate, annual purchasing expenses or parts expenses is estimated as a foreign portion.

Estimating on the assumption that constructed year of the bridge is 1990, against the large saving portion is calculated only residual cost as a saving expenses, on the other hand residual cost by the end of 2019 is calculated as a negative profit on 2020.

Table 4-10 Objective Traffic Volume of Saving in Ferry

	Road			Railway	
	Car	Bus (Vehicle/day)	Truck	Passenger (Person/day)	Cargo (Ton/day)
1990	2,810	246	126	27,717	5,427
91	2,875	252	141	28,314	5,905
92	2,941	257	155	28,910	6,382
93	3,006	263	169	29,507	6,860
94	3,071	269	183	30,104	7,338
95	3,137	274	197	30,700	7,815
96	3,202	280	212	31,297	8,293
97	3,268	286	226	31,894	8,771
98	3,333	292	240	32,490	9,249
99	3,399	297	254	33,087	9,726
2000	3,464	303	268	33,683	10,204
01	3,530	309	282	34,280	10,682
02	3,595	314	297	34,877	11,159
03	3,661	320	311	35,473	11,637
04	3,726	326	325	36,070	12,115
05	3,792	331	339	36,667	12,592
06	3,857	337	353	37,263	13,070
07	3,923	343	368	37,860	13,548
08	3,988	349	382	38,456	14,026
09	4,054	354	396	39,053	14,503
2010	4,119	360	410	39,650	14,981
11	4,185	366	424	40,246	15,459
12	4,250	371	439	40,843	15,936
13	4,316	377	453	41,440	16,414
14	4,381	383	467	42,036	16,892
15	4,447	388	481	42,633	17,369
16	4,512	394	495	43,229	17,847
17	4,578	400	509	43,826	18,325
18	4,643	406	524	44,423	18,803
19	4,709	411	538	45,019	19,280
2020	4,774	417	552	45,616	19,758

Table 4-11 Price of Ferry

Ferry	Road	Railway	
		Passenger	Car
Tug		6.66	6.66
Boat	10.0	20.00	-
Barge	-	-	12.00

Table 4-12 Price of Pontoon

Unit: Million Tk

Ferry	Road	Railway	
		Passenger	Car
for Passenger	1.2	3.55	-
for Loading	-	-	9.65
for Berthing	-	-	1.2

Table 4-13 Capital Expenses of Ferry

Year	Raad Ferry	Railway Passenger		Railway Cargo		Total
		Tug	Boat	Tug	Barge	
91	30.0					30.0
92	30.0			6.66	36.0	72.66
93	30.0					30.0
94	30.0					30.0
95	30.0					30.0
96	30.0					30.0
97	20.0	6.66	20.0			46.66
98	30.0	6.66	20.0			56.66
99	30.0					30.0
2000	30.0	6.66	20.0	6.66	36.0	99.32
01	20.0					20.0
02	20.0					20.0
03	20.0	6.66	20.0			46.66
04	20.0					20.0
05	20.0	6.66	20.0	6.66	36.0	89.32
06	20.0					20.0
07	20.0	6.66	20.0			46.66
08	40.0	6.66	20.0			66.66
09	30.0					30.0
2010	40.0			6.66	36.0	82.66
11	40.0					40.0
12	40.0					40.0
13	40.0					40.0
14	40.0					40.0
15	30.0	13.32	40.0			83.32
16	40.0	6.66	20.0			66.66
17	40.0					40.0
18	40.0	6.66	20.0	6.66	36.0	109.32
19	30.0			6.66	36.0	72.66
2020	-272.5	-23.64	-71.0	-14.65	-79.2	-460.69

Table 4-14 Capital Expenses of Pontoon

Unit: Million Tk

Year	Road	Railway		Total
		Passenger	Car	
1990	9.4	22.7	34.7	66.8
91				
92				
93	2.4			2.4
94				
95				
96				
97				
98	2.4			2.4
99				
2000		28.4	43.4	71.8
01				
02	2.4			2.4
03				
04				
05				
06	2.4			2.4
07				
08				
09				
1010				
11	4.8			4.8
12				
13				
14				
15	2.4			2.4
16	2.4			22.4
17				
18				
19	2.4	28.4	43.4	74.2
2020	-7.9	-22.7	-34.72	-65.32

Table 4-15 Benefits from Ferry System Saving  
(in Economic Cost)

Unit: Million Tk

	Ferry facilities' cost saving		Maintenance & Management Expenses saving		Total
	Ferry	Pontoon	Ferry	Pontoon	
1990	423.47	116.90	104.92	9.1	654.39
91	52.5	-	106.94	9.1	168.54
92	127.16	-	121.28	9.1	257.54
93	52.5	4.2	123.30	9.34	189.34
94	52.5	-	125.31	9.34	187.15
95	52.5	-	127.32	9.34	189.16
96	52.5	-	129.33	9.34	191.17
97	81.66	-	129.33	9.34	220.33
98	99.16	4.2	136.72	9.58	249.66
99	52.5	-	138.73	9.58	200.81
2000	173.81	125.65	140.75	9.58	449.74
01	35.0	-	142.76	9.58	187.34
02	35.0	4.2	144.77	9.82	193.79
03	81.66	-	146.79	9.82	238.27
04	35.0	-	148.80	9.82	193.62
05	156.31	-	163.15	9.82	329.28
06	35.0	4.2	165.16	10.06	214.42
07	81.66	-	172.54	10.06	264.26
08	116.66	-	174.55	10.06	301.27
09	52.5	-	174.55	10.06	237.11
2010	144.66	-	176.56	10.06	331.28
11	70.0	8.4	178.57	10.30	267.27
12	70.0	-	180.59	10.30	260.89
13	70.0	-	182.60	10.30	262.90
14	70.0	-	184.61	10.30	264.97
15	145.81	4.2	192.00	10.54	352.55
16	116.66	4.2	194.01	10.54	325.41
17	70.0	-	196.03	10.54	276.57
18	191.31	-	210.37	10.54	412.22
19	127.16	129.85	212.39	10.78	480.18
20	-806.21	-114.31	-	-	-920.52

