

CHAPTER 10
SOCIO-ECONOMIC CONDITIONS
IN BANGLADESH AND STUDY AREA

CHAPTER 10 SOCIO-ECONOMIC CONDITIONS IN BANGLADESH AND STUDY AREA

10-1 Socio-Economic Conditions in Bangladesh

In preparing material for this chapter much attention was paid to the major socio-economic conditions in the study area as well as Bangladesh, which are all related to the generation of the future vehicular traffic.

10-1-1 Administrative Set-up

Presently Bangladesh has a unitary form of Government. The President is the head of both the state and the Government, and Chief Martial Law Administrator. There is a cabinet of Ministers in charge of various ministries and departments, etc.

For administrative purposes, the country is divided into four Divisions, each placed under a Divisional Commissioner. Recently the Government introduced a policy of decentralisation in administration. Before the introduction of this policy, the country had 22 districts and 71 subdivisions in all. A district used to be administered by a Deputy Commissioner (DC). The officer-in-charge of a subdivision was known as Sub-divisional Officer (SDO). There were 500 Thanas (police stations) in the country before the time of introduction of the new system of administration.

According to the new system of administration following the policy of decentralisation, the Government decided to upgrade the subdivisions into districts by phase. By mid-1984 the Government has upgraded the subdivisions into districts. As per the new system of administration, the existing Thanas are upgraded into Upazilas, and no subdivisions now exist in the country. There are 460 Upazilas in the country at present. Each Upazila is headed by an officer called Upazila Executive (Nirbahi) Officer (UNO). An Upazila is the lowest tier of administration of the Government and is entrusted with the task of carrying out all development activities of the area under its jurisdiction. It has judicial functions also to discharge within the area. In this study the former district system was used as data based on the new system were not available.

10-1-2 Population

The population of Bangladesh in March 1981 stood at 87.12 million, of which 85% were rural inhabitants and 15% urban. Density of population is one of the highest in the world, being about 605 persons per sq. kilometre in 1981. The annual growth rate of population between 1974 and 1981 is estimated to be 2.8%, with a sex ratio of 106 males per 100 females. Family planning measures have long been emphasised. In spite of this, no appreciable reduction in the growth rate is seen to take place in the near future. (Ref. Table 10-1-1).

Table 10-1-1 Historical Population Data for Bangladesh

Year	Population (thousand)	Growth Rate/Year (%)
1941	41,997	0
1951	41,932	0
1961	50,840	1.9
1974	71,478	2.6
1981	87,120	2.8

Source: The 1982 Statistical Yearbook of Bangladesh (B.B.S.)

The average household consists of 5.7 members – the average family size in urban areas is 5.9 and in rural areas is 5.7. The 1981 census shows 23.6 million people in the civilian labour force; 14.5 million (61.4%) in the agricultural sector and 9.1 million (38.6%) in the non-agricultural sector. Table 10-1-2 gives a comparative labour force picture between 1961 and 1981 (three census years). Unemployment and underemployment in Bangladesh is substantial though a precise picture thereof is not available. In a predominantly agrarian economy like Bangladesh, where large members of people are self-employed and are unpaid family workers, they do not consider themselves to be unemployed but may be working only a few hours a week.

In Bangladesh literacy rate is 24.3% (1979-80). More than 85% of the population are followers of Islam. Other religious groups are Hindus, Christians, Buddhists, etc.

Table 10-1-2 Labour Force of Bangladesh (Age 10 Years and Above): 1961, 1974 and 1981

(In Millions)

Category	1961	1974	1981
Total Population	50.8	71.5	87.1
Civilian Labour Force	17.4	20.5	23.6
1) Agricultural Labour Force	14.9	15.8	14.5
2) Non-agricultural Labour Force	2.5	4.7	9.1

Source: Bangladesh Population Census 1981 (B.B.S.)

10-1-3. Structure of the National Economy

The economy of Bangladesh is predominantly agricultural. Over 80% of the people live in the rural areas. Agriculture provides employment and together with agro-based industries contributes about 50% of the Gross Domestic Product (GDP). Ap. Table 10-1 summarises the structure of the Bangladesh economy.

Bangladesh suffered a severe famine in 1974 and is frequently a victim of natural disasters such as floods and cyclones. These coupled with a rapid growth in population virtually offsets the growth in GDP. Agriculture's share of GDP has remained virtually static (with minor fluctuations) and the shares of industry, trade and services and housing have declined but only marginally between 1979-80 and 1983-84, and the share of construction, transport and communication and power have marginally increased (also with minor fluctuations). The growth of per capita income, with negative rates in 1978-79 and 1981-82, registered an increase but with fluctuations in 1980-81 and 1982-83.

The growth in the economy is thus meagre, and has developed more or less at an overall rate of about 3% (annual compound) over the last several years. The per capita national income at market prices was Tk.2,743, or US\$130 at the end of 1982-83, which is equivalent to Tk.717 at 1972-73 costs.

According to the identification of the United Nations, Bangladesh is one of the Least Developed Countries (LDCs) of the world which are the poorest and economically weakest of the developing countries, with the most formidable structural problems. During the period 1973-1981, the Government made financial investments of Tk.99,462 million under its development budgets. It appears

that about 20% of the recent public sector expenditure was incurred from domestic resources and the remaining funds came from foreign aid. Dependence on foreign aid has remained very heavy. The total volume of foreign loans received by Bangladesh since Independence amounts to US\$5,673.5 million. The debt servicing liabilities of the country has thus increased greatly over the years. In 1982-83 Bangladesh had to pay 136 million dollars in terms of debt servicing. The estimated loans for the current financial year may stand at around 1,577 million dollars.*

The Government is trying to make exports increase in terms of volume and value at a rapid rate. However, the real position is that in spite of whatever increase in export earning might have balance of payments position of Bangladesh is characterised by a growing deficit and dependence on workers' remittances from abroad and partly on foreign aid to finance it. Between 1973-74 and 1979-80, the import bill rose from Tk.7,400 million to Tk.36,670 million or from US\$925 million to US\$2,366 million. In dollars, imports increased at an annual rate of 17% though in real terms (at 1972-73 prices) at 5.6% only. Against this, exports increased from Tk.2,900 million (\$363 million) in 1973-74 to Tk.11,188 million (\$726 million) in 1979-80 at the then prevailing Taka-Dollar exchange rate giving an annual growth rate of 12.1% but no growth in real terms (at 1972-73 prices) over the same period.

The export earnings of Bangladesh meet less than 40% of the import bill and the rest is financed by foreign aid. The Bangladesh Economic Survey (1982-83) shows the import bill at Tk.54,650 million as against provisional export earnings of Tk.16,000 million leaving a gap of Tk.38,650 million.**

10-1-4 Agriculture in Bangladesh

Agriculture is the main occupation of the people and this sector directly contributes about 50% of the Gross Domestic Product. Bangladesh has most fertile land, where rice, wheat, jute, sugar-cane, tobacco, oilseeds, pulses and potatoes are the principal crops. Various kinds of vegetables and spices are also produced. 85 million pounds of tea per year is produced, a sizeable quantity of which is exported to foreign markets. Bangladesh produces about six million bales of

* The Bangladesh Observer, September 30, 1984

** The Bangladesh Observer, April 22, 1984

superior quality jute annually (one bale = 181.4 kg) and 75% of export earnings come from raw-jute and jute manufactures. Among the fruits and nuts grown in Bangladesh, bananas, papayas, pineapples, mangoes, jackfruits, guavas and coconuts are important. Bangladesh is now marginally deficient in food grains. All-out efforts are being made by the Government and the people to increase the production of food grains and to diversify agricultural output. About 1.5 million tons of food grains are being imported in normal years while in years of unfavourable weather and consequent production loss, the quantity imported goes up.

The main objective of future agriculture, water and rural development programmes will be a rapid expansion of irrigation-water-fertiliser-seed technology with a view to attaining food self-sufficiency over the shortest possible time. The food grain production target for the terminal year (1984–85) of the Second Plan has been set at 17.5 million tons from a bench-mark figure of 13.4 million tons in 1979–80. Besides expansion of agricultural output, the second objective of the Plan is to secure employment which will be pursued largely in the agriculture sector. Rural households depend on land and have a very strong attachment to land where the agricultural technology is labour-intensive. The third objective is to obtain better social justice and a more equitable distribution of income which has to be mainly realised through agricultural development. The main resource of the country is agricultural land and manpower, a large proportion of which suffers from high rate of unemployment and underemployment.

10-1-5 Industries in Bangladesh

Although Bangladesh is mainly an agricultural country, there are large industries based on indigenous raw materials. Among them jute manufacturing, carpet, paper and newsprint, rayon, sugar, cement, chemical fertilisers, and tanneries are important. Other notable industries are cotton textile, handloom industries, engineering, steel, oil refinery, electric cable and shipbuilding. Among the cottage industries, handlooms, carpet making, shoe making, coir, bamboo and cane products, earthenware, brass and bell metal products, bidi and cheroots, small tools and implements, ornaments, handicrafts, etc. are important. Although most of the industrial units are located in Dhaka, Narayanganj, Chittagong, and Khulna areas, steps have been taken to establish more industries in less developed regions so as to provide greater employment opportunities to the local people.

The industrial sector which contributes around 10% of the GDP, is dominated by jute processing which, in turn, contributes about one third of value added by all manufacturing units. Cotton textiles and cigarettes come next. Though the industrial sector contributes about 10% of the GDP, it plays a strong supportive role in the country's agricultural and infrastructural developments; it accounts for about 70% of the foreign exchange earnings and 30% of the off-farm employment and provides a wide range of essential consumer items.

Since agriculture has been awarded the highest priority in the Second Five Year Plan (1980-1985), the industrial programme has been oriented towards supporting agricultural development. However, overall resource constraints will limit investment in the industrial sector and require it to be more selective. Therefore, the Plan envisages a modest industrial growth rate of 8.3 percent.

The following major objectives will be the basis of the investment decisions in the industrial sector and in the determination of priorities for investment:

- supporting the rapid expansion of the food and agriculture sector through the establishment of agro-support and agro-based units;
- meeting the basic needs of people by increasing production of essential consumer goods such as clothes, medicines and utility goods;
- improving the balance of payment position through accelerated growth of export-oriented and import-substitution industries with focus on the maximum use of labour and indigenous resources;
- creating employment opportunities with a special emphasis on rural employment through the promotion of rural industries;
- promoting a balanced and harmonious regional development through rational dispersion of industries; and
- laying the foundation for an all-round growth of the economy by consolidating the base of the basic industries which are already established.

10-1-6 Mineral Resources and Energy

Bangladesh has few proven mineral resources except natural gas. By 1982, 13 gas fields have been discovered from which natural gas is available to meet the requirements of industry, power-generating plants and households. Fertiliser

factories in operation include the giant petro-chemical complex at Ashuganj, and those to be established will use a huge quantity of natural gas. In 1982-83 production of gas was 2,052 million cubic metres which is equivalent to 13.52 million barrels of crude oil, and the proven gas reserves in the 13 gas fields so far discovered is equal to 311,800 million cubic metres, which is roughly equivalent to 436 million tons of coal. About one percent of gas is being consumed annually at present.

Electricity is produced by thermal and hydro-electric processes. Total generation of electricity amounts to 3,433 million kilowatt-hours in 1982-83.

Coal deposits have been found and efforts are under way to open these up. Limestone, the basic raw material for the production of cement, has been found in some places. Other minerals found include hardrock, lignite, silica sand, white clay, etc. Salt is not mined but is manufactured on a cottage industry basis at several thousand evaporation sites in the coastal areas of Chittagong district.

10-1-7 Transport and Communication

1) General Transport Network

Bangladesh is served by railways, roads, waterways and airways.

Railways are handicapped by the difference in gauges and by the presence of the rivers. The system has about 2,900 km of line with 410 locomotives, 1,732 passenger coaches and 16,976 freight wagons (1982-83). However, it is possible to travel by rail to most parts of the country. The areas not served by railways are the four districts of Barisal, Patuakhali, Tangail and the Chittagong Hill Tracts.

In 1981 the country had about 14,400 km of paved roads and about 134,900 km of earthen roads with 7,283 buses and 13,496 trucks. Through unmetalled feeder roads, the long distance metalled roads have brought vast areas of remote country side closer to the urban centres. These are bringing about considerable changes in the country and the way-of-life in rural areas. Buses, trucks, auto-rickshaws and cycle-rickshaws have gone to areas where until recently bullock carts were the only wheeled vehicles. For transport and communication within the urban centres, use of cycle-rickshaws are most common, with auto-rickshaws, buses, trucks, push carts and bicycles.

Bangladesh is endowed with natural waterways as the country is criss-crossed by several big rivers, namely, the Ganges (Padma), the Jamuna, the Meghna and the Karnafuli together with their innumerable tributaries and distributaries. These rivers, though providing good means of water transport, make building of roads and railways difficult. As estimated by the Bangladesh Inland Water Transport Authority (BIWTA) of the country, about 8,300 km of waterways are navigable during rainy season and about 3,000 km during dry season.

Regarding air transport facilities, Dhaka is connected by air with London, Athens, Bangkok, Kuala Lumpur, Singapore, Karachi, Bombay, Calcutta, Dubai, Jeddah, Kathmandu, Rangoon, Tokyo, Amsterdam and Dhahran by her national airline (Biman). A number of foreign airlines operate their international services with a link to Dhaka. Regular air services are operated by the Biman between Dhaka and other major towns in the country.

Chittagong and Chalna are the two seaports of Bangladesh. Among the river ports and terminals Dhaka, Narayanganj, Chandpur, Barisal, Khulna, Aricha, Gualando, Nagarbari, Serajganjghat, Jagonathganjghat, Bhairab Basar, Bahadurabad and Fulchharighat are important.

2) Contribution of Transport Sector and Road Transport Subsector Towards GDP

The transport and communication sector plays an important role in the socio-economic development of a country, as the contribution of this sector towards the GDP of the country is quite significant. In Bangladesh, this sector comes after three sectors namely, agriculture, trade, and industry. The transport and communication sector (including the storage subsector which has little contribution in the sector) contributed about 6.1% and 8.7% towards the GDP at current prices in 1973-74 and 1982-83, respectively.

The road transport subsector (including both modern and traditional modes) had a share of about 3.1% and 5.1% of the GDP at current prices in 1973-74 and 1982-83, respectively. Within the road transport subsector itself, the share of traditional transport mode was 2.4% of the GDP in 1973-74 and about 3.8% in 1982-83, while the modern transport mode contributed about 0.7% and 1.3% of the GDP at current prices, respectively.

3) Movement of Goods by Different Means of Transport

Available data for recent years indicate that there has been an overall increase in goods movement by the different means of transport over the period from 1972-73 through 1982-83. Of the different means of transport, however, the road transport has played the dominant role. In 1972-73 the railway carried about 2.83 million tons of goods traffic, road transport about 47.82 million tons and water transport about 13.41 million tons, whereas the three modes of transport carried respectively about 3.25 million, 65.28 million and 15.45 million tons in 1982-83. It appears from this that the performance of road transport in respect of carriage of freight traffic is generally more than three times the role played jointly by both rail and water transport. Table 10-1-3 shows the statistics of goods movement by different modes of transport in recent years.

In terms of increase in movement of freight traffic over the same period, the road transport recorded the highest rate of increase of about 36.5% in movement by road transport. This increase over the period would put the growth rate at about 3.2% per annum for road transport. As against this, the overall increase over the period in freight traffic movement by rail and water transport was about 14.8% and 15.2%, respectively; the annual growth rate in performance of the two modes in this respect has been about 1.4% and 1.5%, respectively.

The performance of organised road transport in freight traffic movement was particularly remarkable during the period; it recorded an increase of 79.3% over the period, and a growth rate of about 6.0% per annum. The unorganised road transport achieved an increase of about 26.0% over the period, and a growth rate of about 2.4% per annum in movement of freight traffic.

4) Road Network

Construction and maintenance of roads are quite difficult propositions in Bangladesh for many reasons, of which mention may particularly be made of many wide rivers, flood waters and scarcity of construction materials. These not only pose serious problems for road construction and maintenance, but also make projects very expensive.

Table 10-1-3 Movement of Goods by Means of Transport

(Figures in thousand tons)

Year	Railway	Road Transport		Water Transport		Air	Total		
		Organised	Unorganised	Organised	Unorganised				
1972-73	2,830	9,436	38,384	47,820	3,344	10,066	13,410	1	64,061
1973-74	2,768	10,445	39,925	49,770	3,344	10,066	13,410	4	65,952
1974-75	2,898	10,579	36,032	46,611	3,331	10,343	13,674	4	63,187
1975-76	3,333	10,470	41,468	51,938	3,798	10,459	14,257	4	69,532
1976-77	3,110	11,086	42,292	53,378	3,503	10,528	14,031	3	70,522
1977-78	3,510	11,156	41,513	52,669	4,087	10,596	14,683	3	70,865
1978-79	3,184	13,143	42,851	55,994	4,063	10,712	14,775	4	73,957
1979-80	3,131	12,887	45,658	58,545	4,167	10,780	14,947	4	76,627
1980-81	2,938	15,017	45,673	60,690	4,095	10,780	14,875	2	78,504
1981-82	3,179	15,955	47,406	63,361	4,590	10,848	15,438	2	81,980
1982-83 (p)	3,249	16,918	48,362	65,280	4,488	10,964	15,452	2	83,983

Source : Bangladesh Bureau of statistics

The kilometreage of road network under the jurisdiction of Roads and Highways Department (RHD) in recent years is shown in Table 10-1-4. Total road length under RHD has grown from about 4,260 km in 1973 to about 7,430 km in 1982. The length of high type roads under RHD has increased from about 3,700 km in 1973 to about 4,780 km in 1982. This means that on an average there has been an increase of road length under RHD by about 29.2% over the period.

Table 10-1-4 Road Length under Roads and Highways Department
(Unit: Kilometres)

Year	High Type	Low Type	Total
1973	3,697	566	4,263
1974	3,771	566	4,337
1975	3,787	566	4,353
1976	3,851	566	4,417
1977	3,985	566	4,551
1978	4,076	566	4,642
1979	4,197	634	4,831
1980	4,284	1,405	5,689
1981	4,323	2,268	6,591
1982	4,776	2,655	7,431

- Note:
- (i) 'High type' refers to roads having cement concrete or bituminous concrete surface or bituminous surface.
 - (ii) 'Low type' refers to roads generally of stones, bricks, gravel or ordinary earth roads properly aligned and with drainage structure provided.
 - (iii) Road length contains only roads constructed and maintained by RHD.
 - (iv) Roads constructed and maintained by municipalities, district councils and other local bodies are not included here.

Source: Roads and Highways Department (B.B.S. 1982)

10-1-8 Policy and Strategy of the Second Five Year Plan

The Second Five Year Plan (SFYP) objective is the decentralisation of socio-economic activities for a rapid rural development. In this strategy of development the transport sector will contribute immensely in the growth process of the rural areas by the planned dispersion of economic activities and integrating the isolated and scattered growth centres of the country into the main stream of economic activities.

Having regard to the dual role of transport development, the main objectives of the transport sector programmes under the SFYP are as follows:

- provision of transport facilities commensurate with the increasing productive activities in the economy as a support to the development programmes of all sectors of the economy;
- development of a network of rural transport systems through implementation of a feeder road programme connecting growth centres of the country including upazilas, hats and bazars and the introduction of new technology in rural transport modes;
- tackling urban transportation problems in the major cities through close co-ordination of land use plan, traffic engineering and transport improvement plans;
- improvement of the operational efficiency of the public sector transport through better maintenance and efficient use of its assets and equipment, and enabling them to operate on commercial principles; and
- research and studies for achieving fuel efficiency.

An amount of Tk.12,870 million at 1979-80 prices has been allocated for the development of the transport sector under the SFYP. In addition to this, it is expected that Tk.9,760 million (at 1979-80 prices) will be utilised in the private sector.

10-2 Socio-Economic Conditions in Study Area

10-2-1 Definition of Study Area

The project sites, crossing points of the Dhaka-Chittagong Highway with Meghna and Meghna-Gumti Rivers, are located respectively about 25 km and 40 km east of Dhaka. From the engineering point of view the study area can be limited to the area covering the these two locations. In order to meet the requirements of the traffic study associated with the Dhaka-Chittagong Highway, the area adjacent to the road is considered as the study area in a broader perspective which includes parts of Dhaka, Comilla, Noakhali and Chittagong districts.

10-2-2 Area and Population of Study Area

1) Dhaka District

Dhaka, the capital of Bangladesh is located in Dhaka district which is one of the biggest districts of the country. It has a physical area of 7,459 sq.km occupying about 5.2% of the total area in the country. The total population of the district is around 10,490 thousand which is about 11% of the total population of the country (1981 Census). The density of population per sq.km in the district is 1,981 against that of 605 in Bangladesh as a whole. With the capital of the country located in the district, it is the most densely populated area in the country. The metropolitan area of Dhaka extends over 414 sq.km with a population of 3.5 million and contains 35% of the total population of the district. The annual increase in population between 1974 Census and 1981 Census is 4.0% which is the largest of all the districts in Bangladesh. The economically active population of the district is around three million which is about 12.5% of the national total.

2) Chittagong District

Chittagong is the 7th largest district of Bangladesh. The area of the district is 7,215 sq.km occupying about 5.0% of the total national area. The population of Chittagong district according to 1981 Census was 5,491 thousand which was 6.3% of the total population of the country. The density of population of the district is 1,343 persons against the national average of 605. In relation to the former 21 districts, the population density is relatively high because of the unique opportunities provided by the international seaport, railway headquarters and divisional headquarters and the prime business centre of the country. Annual increase in population between 1974 and 1981 was 3.5% which is high and is second in Bangladesh. The economically active population of the district is around 1.44 million which is about 6.1% of the national total.

3) Comilla District

Comilla occupies a physical area of 6,713 sq.km including rivers. In respect of physical area it occupies the 12th place. The population of the district according to 1981 Census is 6,881 thousand which is about 7.9% of the total population of Bangladesh. The density of population per sq.km is 1,025. The

population of the district showed an annual increase of 2.4% between 1974 and 1981 against 2.8% for Bangladesh over the same period. The economically active population of the district is around 1.7 million which is about 7.2% of the national total.

4) Noakhali District

Noakhali occupies a physical area of 5,265 sq.km including rivers, and ranks 14th. According to the 1981 population census the total population of the district is 3.8 million which is about 4.38% of the total population of the country. The density of population per sq.km is 725. Annual increase in population between 1974 and 1981 is 2.4% against 2.8% for Bangladesh for the same period. The economically active population of the district is around 871 thousand which is about 3.7% of the national total.

5) Dhaka and Chittagong Cities

Dhaka and Chittagong, the two largest cities in Bangladesh are located within the study area in the broader sense. The increase of population in the cities over the period between 1974 and 1981 is remarkable. Table 10-2-1 shows the population of major urban centres in the country in these two years.

10-2-3 Gross District Product in Study Area

Table 10-2-2 shows the Gross District Product for Dhaka, Comilla, Noakhali and Chittagong, along with the GDP of the country at current prices. The agriculture sector in the four districts contributes about 24% of the value added from agriculture in the whole country. The contribution of the industry sector in these districts is particularly high; about 72% of the national value added. The contribution of these four districts in respect of construction and transport sectors are 30% and 41%, respectively. Overall these four districts contribute over 33% of the GDP of Bangladesh at current prices.

Economic activities in the agricultural and industrial sectors in the four districts are described in Ap. Note 10-1.

10-2-4 Development Plans in Study Area

Most of the study area is agricultural except for the big cities of Dhaka and

Table 10-2-1 Population of Major Urban Centres and Towns in Bangladesh : 1974 and 1981

Locality (in largest order)	1981	1974	Increase in 1981 over 1974 (%)
1. Dhaka City	3,458,602	1,679,572	205.9
2. Chittagong City	1,388,467	889,760	156.0
3. Khulna City	623,184	437,314	142.5
4. Narayanganj City	196-139	270,680	(-)27.5
5. Rajshahi City	171,600	132,909	129.1
6. Sylhet Town	166,847	59,546	280.2
7. Barisal Town	159,298	98,127	162.3
8. Rangpur Town	155,964	72,829	214.2
9. Jessore Town	149,426	76,168	196.2
10. Saidpur Town	128,085	90,132	142.1
11. Comilla Town	126,130	86,442	145.9
12. Mymensingh Town	107,863	76,036	141.9
34. Noakhali Town	46,572	32,490	143.3
Bangladesh (in thousand)	87,120	71,478	121.4

Source: Statistical Yearbook of Bangladesh 1982

Chittagong along with their adjoining industrial environs and the district towns of Comilla and Feni, which are situated on the highway. Although Bangladesh is an agricultural country it is not self-sufficient in food, and imports a substantial amount of food grains every year.

Table 10-2-2 Gross District Product at Current Prices: Dhaka, Comilla, Noakhali and Chittagong

Sectors	(Million Taka)											
	District		Dhaka		Comilla		Noakhali		Chittagong		Bangladesh	
	Year	1980-81	1981-82	1980-81	1981-82	1980-81	1981-82	1980-81	1981-82	1980-81	1981-82	1980-81
1. Agriculture	7,597	8,367	7,264	8,858	4,390	4,568	6,673	7,346	108,953	121,689	83,632	94,798
1) Crops	5,091	6,041	5,289	6,777	3,596	3,830	4,355	4,970	5,848	6,502	12,451	12,713
2) Forestry	153	171	13	14	23	26	518	576	666	1,134	7,022	7,676
3) Livestock	1,258	958	1,015	1,032	538	507	763	666	1,037	1,134	7,022	7,676
4) Fisheries	1,095	1,197	947	1,035	188	205	1,037	1,134	7,022	7,676	7,022	7,676
2. Mining and Quarrying Industry	-	-	-	-	-	-	-	-	-	-	-	-
3. Industry	7,709	8,660	1,256	1,424	456	517	6,966	7,816	22,861	25,702	13,214	14,728
1) Large Scale	4,763	5,309	213	237	74	82	4,711	5,251	2,565	2,565	9,647	10,974
2) Small Scale	2,946	3,351	1,043	1,187	382	435	2,255	2,565	842	1,021	13,088	15,863
4. Construction	1,360	1,648	1,057	1,281	624	756	842	1,021	744	959	744	959
5. Power, Gas, Water and Sanitary Services	113	158	249	324	18	22	70	92	1,793	1,884	18,331	22,858
6. Transport, storage and communication	3,766	4,807	1,517	1,942	675	890	1,793	1,884	2,154	2,273	20,808	22,083
7. Trade Service	2,415	2,551	1,344	1,541	766	762	762	762	1,141	1,260	17,725	19,575
8. Housing Service	1,841	2,033	1,432	1,581	845	933	933	933	513	595	8,138	9,442
9. Public Admn. & Defence	940	1,091	643	746	356	414	513	595	312	312	4,331	4,191
10. Banking and Insurance	747	758	365	370	143	145	308	308	1,517	1,858	18,481	22,626
11. Professional & Miscellaneous Service	2,846	3,484	1,541	1,887	830	1,016	1,517	1,858	21,977	24,457	233,233	264,994
12. GDP at current Market Prices	29,334	33,557	16,668	19,954	9,103	10,023	21,977	24,457	871	871	13,464	13,824
13. Indirect Tax net of subsidies (-)	1,555	1,597	1,064	1,092	590	605	848	848	21,129	23,586	219,799	251,170
14. GDP at current factor cost	27,779	31,960	15,604	18,862	8,513	9,418	21,129	23,586	5.66	5.77	89.9	91.6
Population (in million)	10.38	10.58	7.10	7.24	3.94	4.01	5.66	5.77	3,733	4,088	2,445	2,742
Per capita GDP at Factor Cost (Taka)	2,676	3,021	2,198	2,605	2,161	2,349	3,733	4,088	2,445	2,742	2,445	2,742

Source: B.B.S.

However, efforts are being made through modern planning process to increase production of food grains in the study area. Some of the projects which have either been completed recently or are being implemented now are outlined in Ap. Note 10-2.

10-3 Existing Transport Conditions in Study Area

10-3-1 Railway

The railway that connects Dhaka with Chittagong has recently been improved to a higher capacity. Between Dhaka and Chittagong the fastest train takes six hours and a mail train is scheduled to run in seven hours and 40 minutes along the 320 km long route. At present the railway operates five passenger trains per day in one way and it is said that about 34,000 passengers are carried daily by the railway between Dhaka and Chittagong.

Passenger fares vary with the type of coaches: Tk.337.00, 203.00, 54.00 and 24.00 for air-conditioned, first class, second class and third class, respectively. Freight charges per ton are different for the different kinds of commodities carried; they vary from Tk.225 to approximately Tk.360 per ton. One freight train usually consists of 55 wagons. Commodities by railway take much longer than road because the average time required for assembling one train with commodities is said to be 24 hours at the Chittagong Port area, for example, and because the shunting operations and marshalling of trains require an additional 12 to 24 hours.

The railway route between Dhaka and Comilla is about 185 km, but it involves a long detour crossing the Meghna River about 60 km upstream of the highway crossing. The long detour is due to the restriction of the terrain and rivers. An interview with the Comilla Station Master about the rail transportation showed that the number of passengers to and from Dhaka and Chittagong has increased recently at an average annual rate of 7%. At present the station handles about 270 passengers for Dhaka daily with four express trains, the fastest of which takes three hours and 30 minutes. Passenger fares are Tk.215.50, 124.00, 30.50 and 13.50 for air-conditioned, first class, second class and third class coaches, respectively. This station does not handle the transportation of commodities by freight trains except parcels traffic which is negligible in quantity.

10-3-2 Highways

1) Road Length by Type

The length of road by type in the four districts in 1982 is presented in Table 10-3-1. The metalled road of Dhaka district is about 1,290 km which is about 10.6% of the total length of the country, while Chittagong district has semi-metalled roads of 1,115 km in length, and this is about 18.5% of the national total length under this category of roads.

Table 10-3-1 Length of Roads by Type: 1982

(Unit: Kilometres)

District	Metalled Road (as % of Bangladesh Total)	Semi-metalled Road	Un-metalled Road
Dhaka	1,290 (10.6)	235 (3.9)	6,971 (5.0)
Chittagong	450 (6.1)	1,115 (18.5)	10,190 (7.3)
Comilla	490 (4.0)	144 (2.4)	9,380 (6.7)
Noakhali	310 (2.6)	131 (2.2)	1,117 (8.0)
Bangladesh	12,180 (100)	6,030 (100)	139,420 (100)

Source: Bangladesh Bureau of Statistics

2) Dhaka-Chittagong Highway

The Dhaka-Chittagong Highway has a total length of 257 km, linking the largest cities in Bangladesh. This route originates in the southern part of Dhaka City, running towards the east and goes on the Sitalakhya Bridge. Turning towards the southeast, this highway crosses the Meghna River and the Meghna-Gumti River, reaching Daudkandi. The highway from Sitalakhya through Daudkandi is approximately 33 km in length, and its environs are inundated in the rainy season. The highway then enters Comilla district and reaches Comilla town about 51 km to the east.

From Comilla the highway turns south to Feni in Noakhali about 50 km distant. The area between the Mubari River and the Feni River which is 20 km in length, is flooded with water from the two rivers. The highway proceeds to Chittagong district in a southern direction to Chittagong City about 115

km from Feni. This final section of the highway runs almost parallel to the Dhaka-Chittagong Railway line. (See Fig. 10-3-1.)

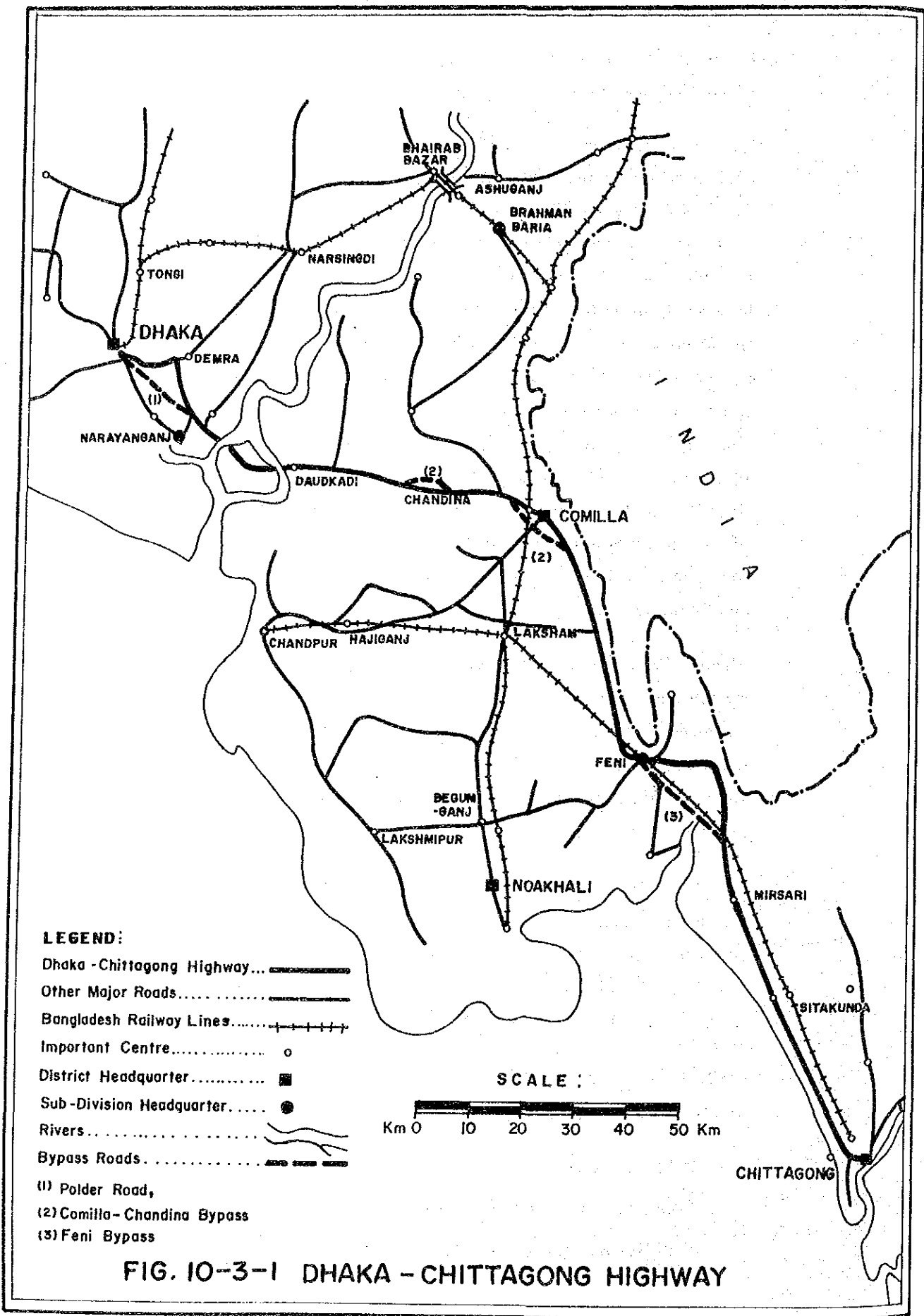
Fig. 10-3-2 shows the traffic volumes counted and converted to PCE (Passenger Car Equivalent) by the Traffic Engineering Division-1, RHD from 1968 to 1983. Except for Dhaka and Chittagong, generally, the traffic volumes on the section between Sitakunda and Feni which is located nearest to Chittagong, are the highest, while the traffic volumes on the section between Demra and Comilla which contains the bottlenecks on account of the Meghna and Meghna-Gumti Rivers are the lowest. The growth of traffic by type of vehicle is also low in these sections. The statements of the annual traffic survey conducted by the same division on the Dhaka-Chittagong Highway in the period from 1968 through 1983, show that the proportion of trucks in the traffic volume is the highest: they constitute 40 to 60% of the total flow and are followed by buses with a composition range of 20 to 40% of the traffic volume, and thus trucks and buses in combination constitute the majority (70 to 82%) of the traffic flow on road sections between Demra and Sitakunda.

The Dhaka-Chittagong Highway has been improved each year and the whole stretch has been widened to a two-lane asphalt-paved road. At present passenger cars can run at an average speed of 80 km per hour on the highway except on portions with sharp curves and in built-up areas. It is observed that the travel time for the journey between Dhaka and Chittagong is about seven hours for private cars.

Ap. Table 10-2 shows the recent inventory of the highway. The standard width of national highways of Category-A is 22 ft (6.7 m) as shown in Subsection 6-1-2, and this width exists for more than 58% of the whole length of the highway, whereas a 20 ft (6.1 m) pavement width constitutes about 5% and 18 ft (5.5 m) about 37% of the whole length.

RHD is continuing work to improve the Dhaka-Chittagong Highway under the following five programmes:

- Polder Road (Direct link from Dhaka to Sitalakhya Bridge)
- Comilla and Chandina Bypass Roads
- Feni Bypass Road (Pavement Improvement)



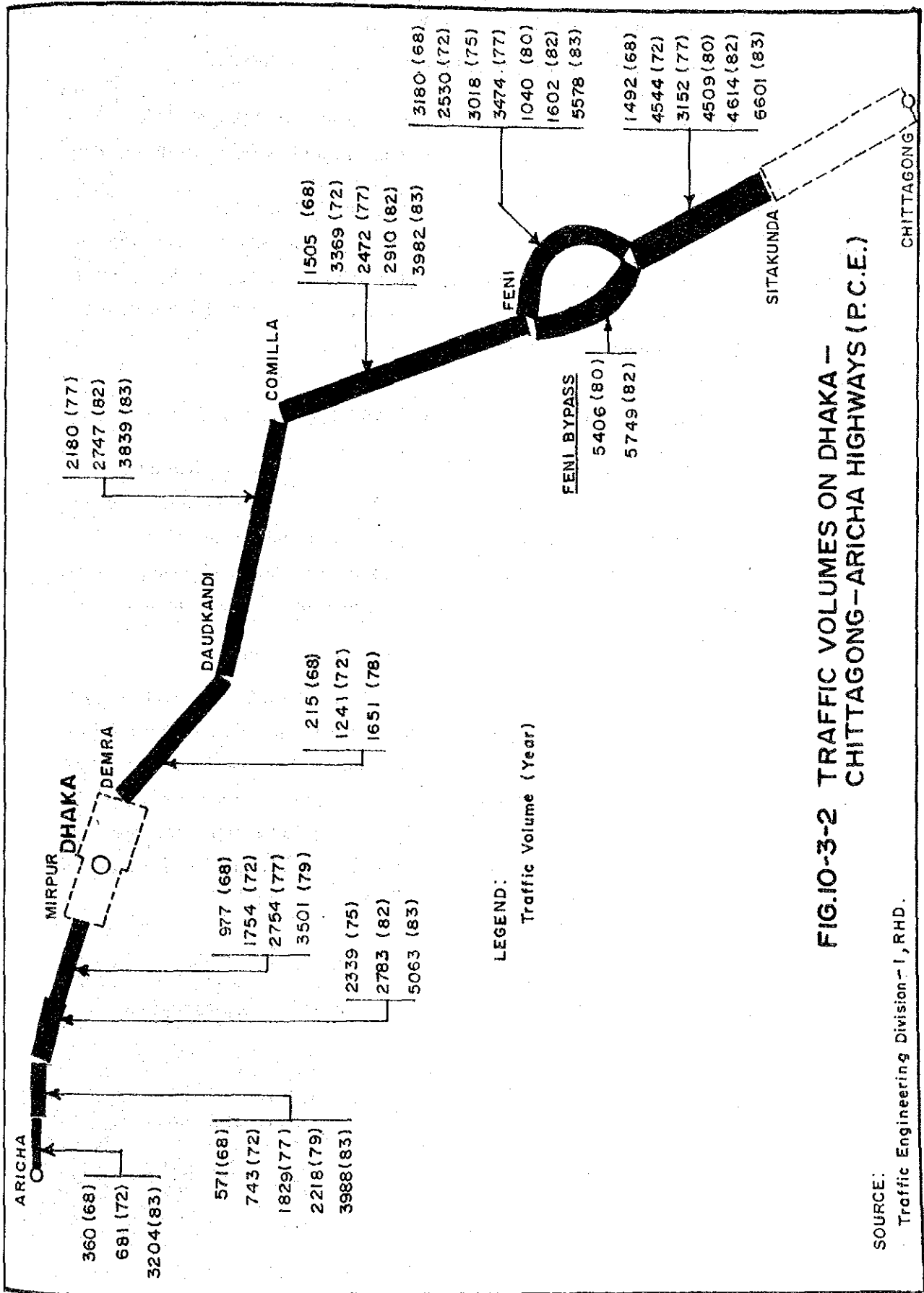


FIG.10-3-2 TRAFFIC VOLUMES ON DHAKA - CHITTAGONG-ARICHA HIGHWAYS (P.C.E.)

SOURCE:
Traffic Engineering Division-I, RHD.

- Widening: Daudkandi-Chittagong Portion
- Reconstruction of Bridges on Dhaka-Chittagong Highway

These highway improvement programmes are briefed in Ap. Note 10-3 and the locations of Polder Road, Comilla and Chandina Bypass Roads and Feni Bypass Road are shown in Fig. 10-3-1.

With completion of these improvement programmes the Dhaka-Chittagong Highway will provide a much smoother vehicular transportation, because the number of sharp horizontal radius curves will be reduced and the passing through of densely populated areas will be avoided.

3) Transport Problems at Meghna and Meghna-Gumti Ferries

The Dhaka-Chittagong Highway route is about 64 km shorter than the railway route, and has an extremely favourable location. At present, due to the absence of the two bridges over the Meghna River and Meghna-Gumti River, vehicular traffic on the road must depend upon ferries which handicap road transport as far as carrying capacity, travelling time and cost, mobility, etc. are concerned.

Representatives of the Bangladesh Bus-Truck Owners' Association gave information that the number of bus companies in operation in Bangladesh is nearly 1,000, with the largest companies owning 10 buses each and the smallest ones with one or two buses each. The average number of passengers carried by one big bus is 53 including driver and conductors. At present, 500 buses are scheduled to ply between Dhaka and Chittagong. The number of buses and bus fares from Dhaka are shown below:

Destination	Buses/Day	Fare (Tk.)		
		Daytime	Nighttime	Nighttime Air-conditioned
Comilla	100	17	—	—
Noakhali	150	40	50	—
Sylhet	20 (Cross the 2 ferries)	60	75	—
Feni	50	27	—	—
Chittagong	70	43	55	60

Due to the presence of the two ferries, buses along with other vehicles are kept waiting at the ferry sites. If the two bridges are provided, the travelling time will naturally be reduced, and the ferry toll of Tk.75.00 for the two ferries and Tk.5 for 50 passengers (Tk.0.10 per passenger) would be saved each way.

Currently 500 trucking companies are in operation in Dhaka, and the largest companies own 15 trucks each and the smallest ones with one unit each. Usually 5 to 7 ton trucks are used for long haul journey, with 3-ton trucks usual for local trips. The truck rates are fixed by the Government as follows:

<u>Origin -- Destination</u>	<u>Taka per 5 to 7 ton truck</u>
Chittagong to Dhaka	Tk.2,000
Dhaka to Chittagong	Tk.1,500
Dhaka to Comilla	Tk. 500
Dhaka to Noakhali	Tk.1,400
Dhaka to Feni	Tk.1,200

The above-mentioned truck rates between Dhaka and Chittagong vary with direction because the demands are different. If the two bridges are constructed, they estimate that the truck rates will fall and will be close to Tk.1,200 and Tk.400 for Chittagong-Dhaka and Dhaka-Comilla, respectively. At present an unfavourable situation exists for truck operations as the trucks must give priority to other types of vehicles for using the ferries; first to small vehicles and second to buses. At present trucks are often compelled to wait at the ferry sites for several hours, which time will be saved by the two bridges.

10-3-3 Inland Water Transport

Both the Meghna and Meghna-Gumti Rivers are utilised for the purpose of inland water navigation. The former is provided with a secondary inland port of Class B type and a landing stage of Class C type at Ashuganj, maintaining the controlling waterway depth of 12 feet (3.66 m), while the latter only with a landing stage of Class C type at Daudkandi, having the controlling waterway depth of six feet (1.83 m).

Ashuganj has developed as an industrial area, since the construction of the existing Bhairab Bazar railway bridge in 1918, where the Meghna River has stable banks. It has become the centre of collection and distribution of commodities for the region. Steel ships having 158 ft (48.16 m) length, 40 ft (12.20 m) width, 12 ft (3.66 m) draft and 35 ft (10.67 m) mast height can ply with a speed of 10 to 12 knots in the Meghna River.

At Daudkandi there is a landing stage on the left bank of the Meghna-Gumti River. A good number of country boats carry substantial quantities of commodities to and from many places west and north of Daudkandi, and at the Daudkandi landing stage the commodities are transshipped by means of trucks. No controlling depth is specified upstream of Daudkandi.

10-3-4 Movement of Dry Commodity Imports through Chittagong Port

Table 10-3-2, 10-3-3 and 10-3-4 provide statistics on dry commodity imports through the Chittagong Port, which were cleared by rail, road and water transport in the years 1976-77 through 1981-82. As these tables show the role of road transport in clearance of dry commodity imports from the Chittagong Port is predominant: road transport provided clearance for about 56 to 65% of the annual total of dry imports. It was followed by water transport with a clearance performance of 20 to 30% of the annual total. Rail transport achieved about 10 to 21% of the total flow of these commodities in these years.

Among the different major types of dry commodity imports, the role of water transport in general was the highest in respect of movement of food grains in these years. But as for the movement of cement, fertiliser, coal and other dry cargo, road transport provided the highest clearance rate.

Table 10-3-2 Clearance of Dry Commodity Imports by Rail in Chittagong Port

(Unit: 1,000 tons)

	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82
Foodgrain	201	306	219	384	162	292
Cement	3	6	6	32	31	20
Fertiliser	8	25	45	25	20	37
Other Cargo	76	101	83	68	92	92
Coal	51	34	26	27	24	29
Total	339	472	379	536	329	470

Source: Port Authority, Chittagong

Table 10-3-3 Clearance of Dry Commodity Imports by Road in Chittagong Port

(Unit: 1,000 tons)

	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82
Foodgrain	195	416	284	735	382	333
Cement	46	104	79	168	147	144
Fertiliser	72	250	362	285	155	210
Other Cargo	600	971	896	1,111	1,298	1,363
Coal	71	89	60	67	42	88
Total	984	1,830	1,681	2,366	2,024	2,138

Source: Port Authority, Chittagong

Table 10-3-4 Clearance of Dry Commodity Imports by River in Chittagong Port

(Unit: 1,000 tons)

	1976-77	1977-78	1978-79	1979-80	1980-81	1981-82
Foodgrain	181	597	427	810	473	357
Cement	42	65	70	97	78	158
Fertiliser	19	55	131	115	59	45
Other Cargo	65	230	129	77	73	69
Coal	15	23	27	39	111	58
Total	322	970	784	1,138	794	687

Source: Port Authority, Chittagong

CHAPTER 11
TRAFFIC STUDIES

CHAPTER 11 TRAFFIC STUDIES

11-1 Existing Traffic on Road

11-1-1 Vehicles on Road in Bangladesh

The number of mechanised vehicles on the road (which were registered and for which road tax was paid) are shown in Table 11-1-1. The total number of mechanised vehicles on the road stood at 48,475 in 1966, at 54,539 in 1973 and at 118,240 in 1981. The overall growth rate of these vehicles from 1975* to 1981 was about 11.07% per annum. Motor cars and jeeps registered an annual growth rate of about 11%, while the station wagons and motor-cycles grew at the rate of more than 14% per annum. Trucks increased at an annual growth rate of about 6.0%, while buses experienced a small increase with a growth rate of about 5.4% per annum in the same period.

11-1-2 Vehicles on Road in Study Area

Ap. Table 11-1 shows the number of mechanised vehicles on the road by type, classified by districts in 1981. An overwhelming majority of vehicles is concentrated in the two districts of Dhaka and Chittagong where the two largest cities in Bangladesh exist. The two districts accounted for 64% of the national total in this respect in 1981. If the vehicles on the road in the districts of Comilla and Noakhali are added, the number of vehicles on the road which are relevant to the Dhaka-Chittagong Highway is more than 67% of the national total in 1981.

11-2 Traffic Survey

In order to find the characteristics of the present traffic flows crossing the ferry ghats of the Meghna and Meghna-Gumti Rivers on the Dhaka-Chittagong Highway, the following surveys were conducted in June 1984.

* The period since 1975 may be called the period of consolidation while in the period preceding rehabilitation of the war-torn economy was completed. (Source: The Second Five Year Plan)

Table 11-1-1 Number of Mechanised Vehicles on Road by Type of Vehicles

Year	Motor Cars		Buses	Trucks	Jeeps	Station Wagons		Auto-rick-shaws	Motor-cycles	Others	Total	Annual growth rate
	Private	Taxis										
1966	10,512	795	3,739	7,053	4,703	1,223	7,896	11,001	1,553	48,475		
1967	10,710	810	4,340	7,170	4,910	1,256	6,922	12,112	1,570	49,800	1.027	
1968	12,538	813	4,339	7,878	5,117	1,224	7,130	14,281	1,739	55,059	1.105	
1969	15,725	874	5,522	8,864	5,777	1,586	7,842	18,305	1,720	66,215	1.202	
1970	17,097	879	5,879	9,608	5,275	1,416	7,750	20,525	1,657	70,086	1.058	
1971	9,198	805	3,812	6,344	2,682	759	5,062	11,226	912	40,800	0.582	
1972	9,847	847	4,497	7,278	3,177	950	5,206	12,996	947	45,745	1.121	
1973	10,413	928	6,030	8,440	3,521	1,201	7,375	15,264	1,367	54,539	1.192	
1974	11,160	904	6,207	9,380	4,100	1,360	8,424	17,026	1,358	59,919	1.098	
1975	11,882	815	5,223	9,457	4,112	1,583	7,398	21,094	1,403	62,967	1.050	
1976	12,409	837	5,264	9,469	4,570	1,586	7,486	22,605	1,753	65,979	1.047	
1977	14,869	836	5,494	9,757	5,828	2,015	7,953	26,739	3,263	76,754	1.163	
1978	16,692	881	5,773	10,871	6,354	2,385	8,762	31,705	3,561	86,984	1.133	
1979	18,868	906	6,044	11,894	6,793	2,855	9,316	35,355	3,615	95,646	1.099	
1980	21,685	1,100	6,457	12,522	7,185	3,557	11,465	40,183	3,829	105,747	1.105	
1981	23,100	1,112	7,183	13,496	7,727	3,549	11,990	46,336	3,747	118,240	1.118	

Note: From 1982 onwards data have not been available.

Source: Ministry of Railways, Roads, Highways and Road Transport.

- Traffic count survey;
- Origin-destination interview survey; and
- Crossing time survey

11-2-1 Traffic Count Survey

The traffic count survey conducted for this study is:

1) Date and Period

120 hours running from 6:00 a.m. on June 18 through 6:00 a.m. on June 23, 1984.

2) Location

2 stations: east of Daudkandi for the westbound traffic and west of the Meghna River for the eastbound traffic.

3) Type of Vehicles Classified

The vehicular traffic was classified as follows according to the survey practice of RHD.

- (1) truck,
- (2) bus,
- (3) mini-bus,
- (4) car,
- (5) other 4-wheeled vehicles,
- (6) tractor trailer,
- (7) auto-rickshaw, and
- (8) motor-cycle

11-2-2 Origin-Destination Interview Survey

The origin-destination (O-D) interview survey conducted for this study is:

1) Date and Period

72 hours running from 6:00 a.m. on June 18 through 6:00 a.m. on June 21, 1984.

2) Location

2 stations: east of Daudkandi for the westbound traffic and west of the Meghna River for the eastbound traffic.

3) Type of Vehicles Classified

Same as in Subsection 11-2-1.

4) Survey Form

The survey form used for the O-D survey is shown in Ap. Table 11-2. The trip purposes were asked to the passenger cars only.

5) Classification of Truck Commodities

The commodities carried by the trucks were classified as:

- (1) food grains,
- (2) fruits and vegetables,
- (3) machinery and metal products,
- (4) brick, earth, stone, timber, ores, etc.,
- (5) processed food, medicine, spices, etc.,
- (6) chemical engineering products, paper, fossil fuel, etc.,
- (7) textile, clothes and leather,
- (8) furniture, sundry items and stationery goods, and
- (9) other miscellaneous goods and cattle

6) Zones for O-D Survey

Since the proposed bridge sites are located on the Dhaka-Chittagong Highway and the traffic movement is closely associated with the vicinity of the highway, the study area of the Project was delineated to cover a substantial part of the vicinity of the highway.

In view of the necessity to meet the requirements of the study for the traffic associated with the bridges, the whole country was divided into 28 zones, as illustrated in Ap. Fig. 11-1. The zoning for the O-D study was determined in such a way that the areas adjacent to the bridge sites are in smaller zones and the ones distant from the bridge sites in larger zones.

11-2-3 Crossing Time Survey

1) Definition of Crossing Time

The crossing time is defined as the time which a vehicle spends from the moment it reached the end of the queue of waiting vehicles until the moment it has landed at the other bank of the river, crossing the river on board a ferry.

2) Date and Period

48 hours running from 12:00 noon on June 21 through 12:00 noon on June 23, 1984.

3) Location

For each ferry, two pairs of two surveyors each were staffed for the two traffic directions.

4) Survey Form

The survey form used for the crossing time survey is shown in Ap. Table 11-3.

5) Survey Method

One Surveyor was standing at the end of vehicle queue, and when a vehicle arrived at the queue end he put the arrival time of the vehicle on the survey form and passed it to its driver. The driver, when he landed at the other ghat, passed the form to the partner surveyor who immediately filled in the receiving time.

11-3 Characteristics of Present Traffic Crossing the Rivers

11-3-1 Vehicular Traffic Crossing the Rivers

The results of the traffic count survey are presented in Tables 11-3-1, 11-3-2 and 11-3-3.

It appears from Tables 11-3-1 and 11-3-2 that the total traffic in one direction does not show much difference from the one in the opposite direction. This indicates that almost all the traffic is through traffic and few vehicles originate from or terminate at places under Gazaria Upazila located between the two rivers. This fact was cleared by the O-D interview survey mentioned in Subsection 11-2-2. The survey result revealed that on an average only two cars per day plied between Sadar South, Dhaka and Gazaria as shown in Ap. Table 11-7.

From these three tables the following facts emerge:

- Truck traffic occupies more than 55% of the total traffic. This indicates that the Dhaka-Chittagong Highway is a major transportation road.
- Truck traffic running during the nighttime from 10:00 p.m. through 6:00 a.m. occupies about 50% of the daily total truck traffic.
- In the vicinity of the two ferry berths the number of trucks running in the early morning hours from 0:00 midnight to 6:00 a.m. is a little greater than that running in the night hours from 6:00 p.m. to 0:00 midnight. The share of the former is 54% while that of the latter is 46%.
- Bus traffic including mini-buses occupies more than 35% of the total traffic.
- Bus traffic concentrates on the ferries in the daytime generally from 7:00 a.m. to 7:00 p.m.
- Use of westbound buses during early morning hours (0:00 midnight to 6:00 a.m.) is higher compared to the eastbound bus flow during the same period.
- Passenger cars are found to concentrate between 8:00 a.m. and 12:00 noon for the eastbound traffic, and between 3:00 p.m. and 7:00 p.m. for the westbound flow.

Table 11-3-1 Volumes of Traffic Crossing Meghna and Meghna-Gumti Rivers
by Time-band, by Vehicle Type: Westward Direction

(Unit: Vehicles/day)

Vehicle Type Time Band	1. Truck	2. Bus	3. Mini- bus	4. Car	5. Other 4-wheel	6. Tractor Trailer	7. Auto- Rickshaw	8. Motor- cycle	Total
1. 0-1	23	0	0	0	0	0	0	0	23
2. 1-2	30	2	0	0	0	0	0	0	32
3. 2-3	24	2	0	0	0	0	0	0	26
4. 3-4	19	6	0	0	0	0	0	0	25
5. 4-5	14	4	0	1	0	0	0	0	19
6. 5-6	22	2	0	0	1	0	0	0	25
7. 6-7	20	6	1	1	0	0	0	0	28
8. 7-8	27	8	0	3	1	0	0	(2)	39
9. 8-9	20	10	2	3	2	0	0	0	37
10. 9-10	22	12	2	3	1	(2)	0	(1)	40
11. 10-11	19	14	3	2	1	0	0	(1)	39
12. 11-12	15	16	3	2	0	0	0	(1)	36
13. 12-13	13	21	3	2	1	0	0	0	40
14. 13-14	13	18	4	2	0	0	0	(1)	37
15. 14-15	10	22	3	3	1	0	(1)	(1)	39
16. 15-16	7	17	4	5	1	0	0	0	34
17. 16-17	8	18	3	5	2	0	(1)	0	36
18. 17-18	8	14	2	6	1	0	0	0	31
19. 18-19	10	10	4	5	0	0	0	0	29
20. 19-20	7	5	2	3	1	0	0	0	18
21. 20-21	14	4	2	2	2	0	0	(1)	24
22. 21-22	16	3	1	3	1	(1)	0	0	24
23. 22-23	24	2	1	1	0	0	(1)	0	28
24. 23-24	28	0	0	0	0	0	0	0	28
Total	413	216	40	52	16	(3)	(3)	(8)	737

Note: Figure in () is the total of 5-day traffic. It is too small to be rounded up to daily average by time band. The total on the right-hand column by time band does not include figures for columns 6, 7 and 8.

Source: Traffic Count Survey 1984

Table 11-3-2 Volumes of Traffic Crossing Meghna and Meghna-Gumti Rivers
by Time-band, by Vehicle Type: Eastward Direction

(Unit: Vehicles/day)

Vehicle Type Time Band	1. Truck	2. Bus	3. Mini- bus	4. Car	5. Other 4-wheel	6. Tractor Trailer	7. Auto- Rickshaw	8. Motor- cycle	Total
1. 0-1	15	0	0	1	0	0	0	0	16
2. 1-2	25	0	0	0	0	0	0	0	25
3. 2-3	18	0	0	1	0	0	0	0	19
4. 3-4	21	0	0	0	0	0	0	0	21
5. 4-5	17	0	0	0	0	0	0	0	17
6. 5-6	19	2	0	4	1	0	(1)	0	26
7. 6-7	20	9	1	2	0	0	0	0	32
8. 7-8	8	14	3	3	1	0	0	(2)	29
9. 8-9	6	20	3	6	1	0	0	0	36
10. 9-10	8	20	3	5	2	0	0	0	38
11. 10-11	9	18	4	4	1	0	0	(1)	36
12. 11-12	10	20	5	4	1	0	0	0	40
13. 12-13	11	17	4	3	1	0	0	(1)	36
14. 13-14	16	18	5	3	1	0	0	0	43
15. 14-15	16	16	4	2	1	0	(1)	0	39
16. 15-16	20	16	3	3	1	0	(1)	0	43
17. 16-17	25	13	3	3	0	0	0	0	44
18. 17-18	22	11	2	2	1	(1)	0	0	38
19. 18-19	22	6	3	1	0	0	0	0	32
20. 19-20	18	3	1	1	1	0	0	(1)	24
21. 20-21	22	3	1	1	0	0	0	0	27
22. 21-22	21	1	0	1	0	0	0	0	23
23. 22-23	15	8	0	1	0	0	0	(1)	24
24. 23-24	14	8	0	1	0	0	0	0	23
Total	398	223	45	52	13	(1)	(3)	(6)	731

Note: Figure in () is the total of 5-day traffic. It is too small to be rounded up to daily average by time band. The total on the right-hand column by time band does not include figures for columns 6, 7 and 8.

Source: Traffic Count Survey 1984

Table 11-3-3 Volumes of Traffic Crossing Meghna and Meghna-Gumti Rivers
by Time-band, by Vehicle Type: Both Directions

(Unit: Vehicles/day)

Vehicle Type Time Band	1. Truck	2. Bus	3. Mini- bus	4. Car	5. Other 4-wheel	6. Tractor Trailer	7. Auto- Rickshaw	8. Motor- cycle	Total
1. 0-1	38	0	0	1	0	0	0	0	39
2. 1-2	55	2	0	0	0	0	0	0	57
3. 2-3	42	2	0	1	0	0	0	0	45
4. 3-4	40	6	0	0	0	0	0	0	46
5. 4-5	31	4	0	1	0	0	0	0	36
6. 5-6	41	4	0	4	2	0	(1)	0	51
7. 6-7	40	15	2	3	0	0	0	0	60
8. 7-8	35	22	3	6	2	0	0	(4)	68
9. 8-9	26	30	5	9	3	0	0	0	73
10. 9-10	30	32	5	8	3	(2)	0	(1)	78
11. 10-11	28	32	7	6	2	0	0	(2)	75
12. 11-12	25	36	8	6	1	0	0	(1)	76
13. 12-13	24	38	7	5	2	0	0	(1)	76
14. 13-14	29	36	9	5	1	0	0	(1)	80
15. 14-15	26	38	7	5	2	0	(2)	(1)	78
16. 15-16	27	33	7	8	2	0	(1)	0	77
17. 16-17	33	31	6	8	2	0	(1)	0	80
18. 17-18	30	25	4	8	2	(1)	0	0	69
19. 18-19	32	16	7	6	0	0	0	0	61
20. 19-20	25	8	3	4	2	0	0	(1)	42
21. 20-21	36	7	3	3	2	0	0	(1)	51
22. 21-22	37	4	1	4	1	(1)	0	0	47
23. 22-23	39	10	1	2	0	0	(1)	(1)	52
24. 23-24	42	8	0	1	0	0	0	0	51
Total	811	439	85	104	29	(4)	(6)	(14)	1,468

Note: Figure in () is the total of 5-day traffic. It is too small to be rounded up to daily average by time band. The total on the right-hand column by time band does not include figures for columns 6, 7 and 8.

Source: Traffic Count Survey 1984

- Utilisation of cars on this road is very low: car traffic occupies only about 8% of the total traffic.
- The number of tractor-trailers, auto-rickshaws and motor cycles is very small.
- The ferry sites, which are located respectively about 25 km and 40 km from Dhaka City, are not subject to urban transportation.

11-3-2 Origin-Destination Analysis of Traffic Crossing the Rivers

1) Origin-Destination (O-D) by Vehicle Type

The result of the O-D interview survey is presented in the form of traffic matrix by vehicle type in Ap. Tables 11-4 through 11-9. These traffic volumes are the only traffic that crossed the rivers on board the ferry boats. The following points can be clarified:

- Truck movement is largely divided into two (Ref. Ap. Table 11-4): one has origin/destination at Dhaka (65% of the total truck traffic), and the other at Chittagong (83%). The truck movement between Dhaka and Chittagong is very conspicuous, occupying about 53% of the total.
- The truck movement between Narayanganj and Chittagong ranks second, occupying 13.7% of the total truck movement. This can be accounted for by the fact that Narayanganj is a city with an inland port and industry adjacent to Dhaka city.
- The movement of the other types of traffic is mostly to and from Dhaka, having its origin/destination in the vicinity of the Dhaka-Chittagong Highway such as Sadar North and South Comilla, Chandpur, Sadar Noakhili, Feni, etc. (Ref. Ap. Tables 11-5 through 11-8).
- In general, smaller vehicles like mini-buses, cars and other small types of vehicles undertake short haul journeys compared to big vehicles like trucks and buses. Most of them ply between Dhaka and mainly Chandpur and Sadar Noakhali, while a small number of vehicles go through to Chittagong. (Ref. Ap. Tables 11-6 through 11-8).
- Traffic originating from and terminating at, Gazaria located between the two rivers is negligible.

2) Commodities Carried by Trucks

The movement of commodities carried by trucks was surveyed during the O-D interview survey. The result is summarised in Table 11-3-4. More than half of the total tonnage in this table was for movement between Dhaka and Chittagong. Among the commodities observed, machinery and metal products occupied the largest share, followed by the textile, clothes and leather. The movement of processed foods, medicines, fruits and vegetables as well as furniture, sundry items, etc. is remarkable.

The movement of machinery and metal products especially from east to west is conspicuous, having a larger share, which is accounted for by the imports through the Chittagong Port. On the other hand agricultural products have a large share in the movement from west to east.

Empty trucks were observed among truck fleets: 6% of the total westbound truck traffic and 17% of the total eastbound truck traffic were empty.

3) Bus Passengers

The number of passengers carried by buses, mini-buses and cars was recorded at the O-D interview survey. The result is summarised in Table 11-3-5. One bus carried 53 passengers per trip on the average. More than 25% of the bus passengers undertook through travel between Dhaka and Chittagong.

One mini-bus carried 28 passengers per trip on the average. Less than one percent of the total mini-bus traffic moved between Dhaka and Chittagong, while most of the mini-buses took up the journey as far as Comilla and Noakhali.

It was observed that a total of 66 buses daily undertook a short-haul journey between Dhaka and Meghna ferry ghat: these terminated at the west bank of the Meghna River and did not cross. These serve for passengers of the boats plying up and down the river. Most of these buses are expected to cross the river when the bridges are complete.

4) Car Passengers

On an average one car carried 3 passengers per trip. Table 11-3-5 shows the division of car passengers by trip purpose. Most of the cars were driven

Table 11-3-4 Commodity Movement by Trucks Crossing the Rivers

(Unit: Tons/day)

Commodities	Movement		Total
	Westbound	Eastbound	
1. Food grains	0	211	211
2. Fruits & vegetable	113	374	487
3. Machinery & Metal Products	1,014	105	989
4. Brick, Earth, Stone, Timber, Ores, etc.	48	51	99
5. Processed Food, Medicine, Spices, etc.	243	260	503
6. Chemical Engineering Products, Paper, Fossil Fuel, etc.	167	100	267
7. Textile, Clothes & Leather	406	443	849
8. Furniture, Sundry Items and Stationery Goods	175	294	469
9. Other Miscellaneous Goods and Cattle	<u>32</u>	<u>30</u>	<u>62</u>
Total	<u>2,198</u>	<u>1,868</u>	<u>4,066</u>
Average Load per Truck (ton)	5.4	4.6	5.0

Source: O-D Interview Survey 1984

Table 11-3-5 Vehicle Passengers Crossing the Rivers and Trip Purposes of Car Passengers and Average Passengers Per Vehicle

Type of Vehicle		Number of Passengers/Day	Average Passengers per Vehicle
Bus		23,056	53
Mini-bus & Micro-bus		2,405	28
Car	Trip Purpose :		
	1. Social & Recreational	42	-
	2. Work and Business	278	-
	3. Shopping	3	-
	4. Others	14	-
Total Car Passengers		337	3
Total Vehicle Passengers		25,798	-

Source: O-D Interview Survey 1984

for work and business. Car movement for social and recreational purposes occupied 10% of the total car traffic. More than 30% of the cars interviewed were for the through movement between Dhaka and Chittagong.

5) Vehicles Terminating at Daudkandi

In terms of the O-D interview survey at the east of the Daudkandi ferry, observation was made of vehicles which did not use the ferry, but terminated at Daudkandi. They were 56 trucks, 10 buses, 3 cars and 3 vehicles of other types per day. This can be accounted for by the fact that Daudkandi is an important centre for collection and distribution of the commodities in this area, having a landing stage of Class C type. Trucks and buses serve for the movement to and from boats plying up and down the river. Among the 56 trucks mentioned above 32 vehicles came from Chittagong. Most of them carried metal products in which galvanised sheets occupied a large share. After the completion of the bridge, some of the above-mentioned trucks might proceed westward beyond the river.

11-3-3 Analysis of Present Crossing Time

The result of the crossing time survey at the Meghna and Meghna-Gumti ferry berths is summarised in Table 11-3-6. Compared with the Meghna ferry, generally the Meghna-Gumti is unfavourable with respect to crossing time. This can be accounted for by the river width: about 830 metres for the Meghna River and about 1,360 metres for the Meghna-Gumti River.

A big difference in directional crossing time was not noticed for the Meghna: it showed close figures by time-band in the corresponding vehicle types, and produced almost similar figures in the weighted average and the total weighted average (45 and 46 minutes respectively for westward and eastward directions) as shown at the bottom of Table 11-3-6. On the other hand, the Meghna-Gumti ferry showed different figures in directional crossing times. This tendency was very conspicuous in the case of trucks, followed by buses, and as such the directional total weighted average values showed big differences, 91 and 59 minutes for the westward and the eastward traffic, respectively. This is because the vehicles on the Daudkandi side have to wait a much longer time to get on the ferry.

The longest crossing time delay was observed in the case of trucks waiting for crossing during the early morning hours on the eastern side of the Meghna-Gumti

Table 11-3-6 Average Crossing Time for Ferries, by Site,
by Direction, by Vehicle Type, by Time-Band

(Minutes)

Site Direction Vehicle Time Band		Meghna River						Meghna-Gumti River					
		East to West			West to East			East to West			West to East		
		Truck	Bus	Car	Truck	Bus	Car	Truck	Bus	Car	Truck	Bus	Car
1.	0-1	53	56	59	71	54	47	133	54	49	100	58	36
2.	1-2	63	53	50	55	57	42	211	121	42	112	81	38
3.	2-3	59	59	35	124	53	41	238	52	46	159	75	37
4.	3-4	85	40	35	85	59	46	203	54	42	81	70	31
5.	4-5	111	46	31	114	54	44	156	26	48	61	62	34
6.	5-6	89	40	34	86	57	39	124	38	43	78	61	30
7.	6-7	106	47	33	94	42	37	130	38	45	60	64	44
8.	7-8	51	41	26	59	26	26	120	38	38	54	47	36
9.	8-9	37	25	16	38	22	24	112	39	39	48	45	42
10.	9-10	40	42	31	39	38	32	133	38	31	51	47	48
11.	10-11	25	24	21	31	21	21	137	32	33	52	53	42
12.	11-12	25	29	27	34	26	29	130	42	37	48	43	39
13.	12-13	30	31	26	40	33	33	133	45	44	34	33	30
14.	13-14	27	26	29	31	30	26	103	73	52	41	37	33
15.	14-15	26	27	29	28	28	28	97	72	48	49	43	31
16.	15-16	32	26	22	34	28	23	92	92	38	64	46	36
17.	16-17	41	29	25	25	26	27	86	83	35	73	64	48
18.	17-18	51	31	35	51	32	35	65	48	40	66	56	35
19.	18-19	53	39	34	41	30	39	51	35	33	69	41	31
20.	19-20	60	35	29	59	31	31	36	37	39	82	37	37
21.	20-21	64	48	41	59	44	30	36	34	35	74	42	42
22.	21-22	60	42	37	59	50	36	36	36	39	67	38	49
23.	22-23	58	36	33	48	33	30	62	37	31	61	36	50
24.	23-24	51	51	31	91	53	34	113	37	39	91	57	54
Weighted Av.		57	32	28	60	30	29	120	57	38	69	47	40
Total Weighted Average		45			46			91			59		

River: the trucks at this point were found to wait for a maximum of about four (4) hours (238 minutes) during 2:00 to 3:00 a.m. Calculated on weighted average, the trucks had to wait for two (2) hours at this point during the survey time. This unusual delay can be accounted for by the fact that trucks have to give priority for crossing to other types of vehicles: first to small vehicles and second to buses. This problem of unusual delay for trucks can be overcome if more ferry boats are kept in operation during nighttime. At present two large size ferry boats are in operation between 10:00 p.m. and 6:00 a.m.

11-4 Traffic Forecast

11-4-1 General

The Bangladesh economy is predominantly agricultural. The production trend in other sectors has shown a remarkable progress in recent years, but their magnitudes in GNP are modest, against the high rate of growth in population. Economic activities will generate traffic demands but the statistical data which indicate the time-sequential changes in these activities are scarce.

The traffic was predicted on the basis of traffic study, socio-economic conditions and other factors in the study area. The traffic induced from the construction of two bridges was considered. However, development traffic was not estimated since no development impact is expected to be created in the study area as a result of implementation of the Project.

The process which was used for the forecast of traffic crossing the Meghna and Meghna-Gumti Rivers is shown in diagram in Fig. 11-4-1.

11-4-2 Population Forecast by Zone

The Ministry of Health and Population Control has estimated the population of the whole country up to the year 2025. The population for the years 1990, 2000, 2010 and 2020 are respectively 104,407,000 (which is 1.198 times the population in 1981), 122,970,000 (1.411 times), 141,882,000 (1.628 times) and 160,968,000 (1.847 times). These populations were broken down to populations by zones for the respective years, and the future population of each zone was estimated as described in Ap. Note 11-1. The result is shown in Table 11-4-1. It can be seen from the table that the population growth of Sadar

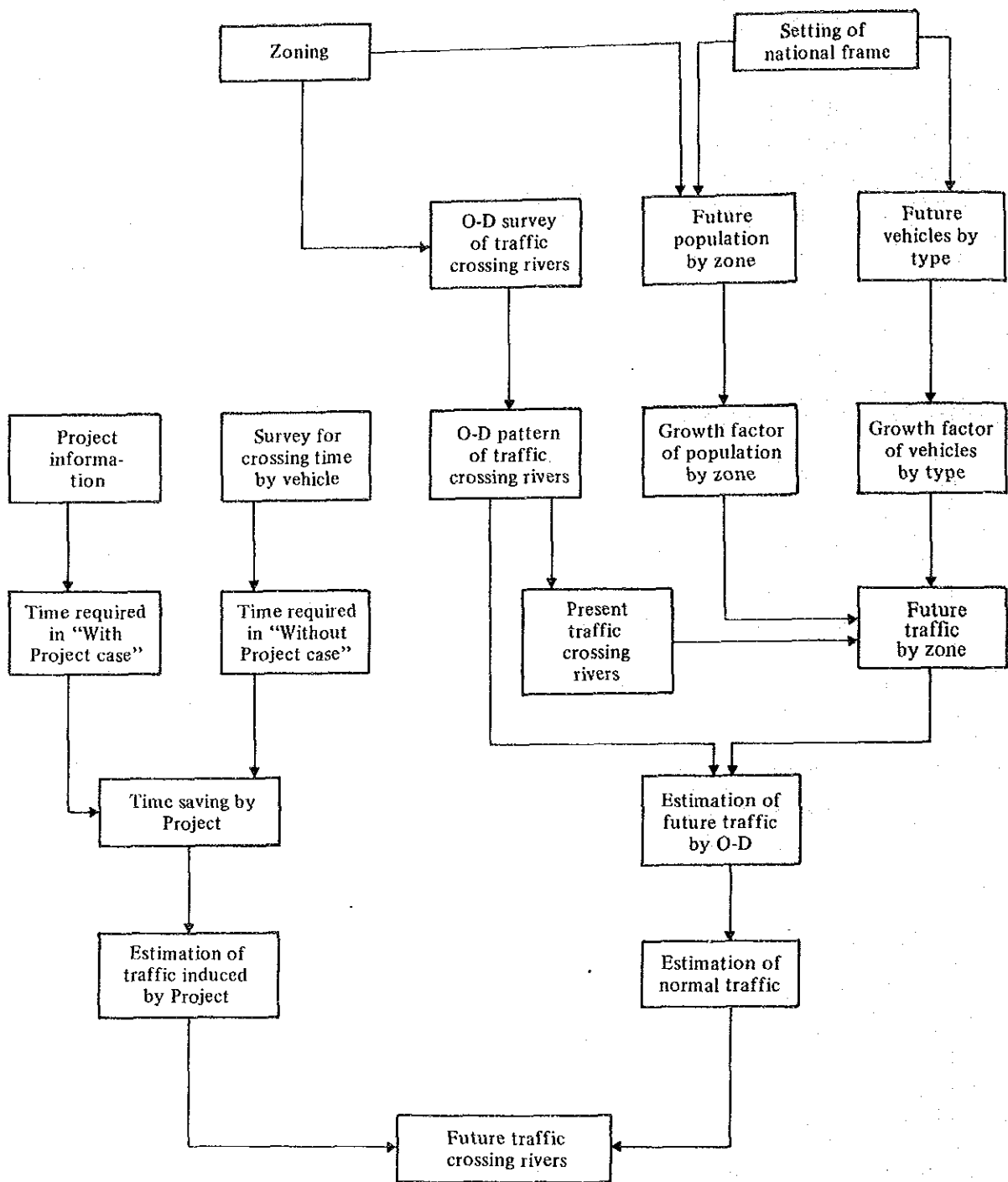


Fig. 11-4-1 Forecasting Process of Traffic Crossing the Meghna & Meghna-Gumti Rivers

Table 11-4-1 Population Census and Future Population Estimated

(Unit: 1,000 Persons)

Zone No.	Name of Place	Year						
		Census (1)			Estimation (3)			
		1961	1974	1981	1990	2000	2010	2020
1.	MANIKGANJ	701	905	1,060	1,247	1,435	1,627	1,821
2.	SADAR SOUTH DHAKA	1,438	2,322	3,540	4,332	5,370	6,426	7,491
3.	MUNSHINGANJ EXCEPT GAZARIA	657	814	952	1,081	1,228	1,377	1,529
4.	GAZARIA	73	95	113	133	154	175	197
5.	NARAYANGANJ	1,599	2,144	2,682	3,176	3,729	4,292	4,861
6.	SADAR NORTH DHAKA	927	1,332	1,699	2,056	2,452	2,855	3,262
7.	MYMENSINGH	5,532	7,567	9,020	10,724	12,519	14,349	16,196
8.	TANGAIL	1,487	2,078	2,444	2,942	3,443	3,954	4,469
9.	FARIDPUR	3,179	4,040	7,464	5,535	6,351	7,184	8,025
10.	RAJSHAHI	2,812	4,268	5,270	6,473	7,743	9,037	10,342
11.	PABNA	1,959	2,815	3,424	4,124	4,874	5,639	6,410
12.	BOGRA	1,574	2,231	2,728	3,285	3,879	4,484	5,095
13.	RANGPUR	3,796	5,447	6,510	7,874	9,282	10,716	12,164
14.	DINAJPUR	1,710	2,571	3,200	3,895	4,655	5,429	6,210
15.	KHULNA	2,449	3,557	4,329	5,246	6,215	7,202	8,198
16.	JESSORE	2,190	3,327	4,020	4,935	5,883	6,848	7,822
17.	KUSHTIA	1,166	1,884	2,292	2,855	3,438	4,031	4,630
18.	BARISAL	2,982	3,928	4,667	5,486	6,353	7,239	8,131
19.	PATUAKHALI	1,117	1,499	1,843	2,163	2,528	2,900	3,276
20.	BRAHMANBARIA	1,151	1,473	1,728	1,998	2,291	2,590	2,892
21.	SADAR NORTH COMILLA	961	1,245	1,477	1,715	1,976	2,243	2,512
22.	SADAR SOUTH COMILLA	1,118	1,558	1,878	2,231	2,617	3,011	3,408
23.	CHANDPUR	1,159	1,543	1,796	2,131	2,465	2,807	3,151
24.	SADAR NOAKHALI	1,793	2,474	2,917	3,489	4,074	4,670	5,271
25.	FENI	590	760	899	1,043	1,200	1,360	1,521
26.	CHITTAGONG	2,983	4,315	5,491	6,642	7,923	9,227	10,544
27.	CHITTAGONG HILL TRACTS	385	508	752	873	1,050	1,230	1,412
28.	SYLHET	3,490	4,759	5,656	6,723	7,840	8,979	10,128
TOTAL POPULATION		50,978	71,459	87,151	(2) 104,407	(2) 122,970	(2) 141,882	(2) 160,968
GROWTH FACTOR		-	-	1.000	1.198	1.411	1.628	1.847

Note: (1) Statistical Year-book of Bangladesh 1982
(2) Alternative Population Estimation, Ministry of Health & Population Control.
(3) Estimated by this study

South, Dhaka is the greatest but those of all the remaining zones show balanced growth.

11-4-3 Forecast of Number of Vehicles on Road

Projected population and Gross Domestic Product (GDP) are essential factors to estimate the number of future vehicles, because the number of vehicles is related to population and GDP. In estimating the major types of vehicles on the road, the GDP was used, and increases in population and road freight transportation were incorporated according to the vehicular types. The procedure for estimating future vehicles is described in Ap. Note 11-2. The result of the forecast of future traffic thus estimated by type of vehicle is shown in Table 11-4-2 in which the projected population, GDP and goods movement by road transport are tabulated together. The traffic projection is illustrated in Fig. 11-4-2.

11-4-4 Future Traffic Crossing the Rivers

1) Normal Traffic Crossing the Rivers

Most of the area through which the Dhaka-Chittagong Highway runs are and will continue to be agricultural areas, and the pattern of future traffic is presumed to be similar to that of the present traffic. Therefore, the future generation trips by zone and by vehicle type were estimated based on the present traffic pattern. The estimation process is shown in Ap. Note 11-3.

The generated trips thus estimated for the years 1990, 2000, 2100 and 2020 were allocated to respective O-D matrices by type of vehicle based on the present pattern. Calculation process is shown in Ap. Note 11-3.

The normal traffic thus estimated by type of vehicle and by year is shown in the form of a traffic matrix in Ap. Tables 11-10 through 11-33, and the summary of the above-mentioned normal traffic crossing the rivers is shown in Table 11-4-3. The figures in the table show that the growth of cars is the greatest but even in 2020 the number of cars will not exceed that of trucks. It may be because the Dhaka-Chittagong Highway is a very important transportation link and because the sites of proposed bridges will not subject to the urban transportation of Dhaka City.

Table 11-4-2 Estimation of Future Vehicle Ownership Vs. Population, GDP and Goods Movement by Road

Year	Population (1,000 persons)	GDP at 1972 Market price (Million Taka)	Goods Movement by Road Transport (1,000 tons)	Vehicle Ownership by Type			
				Trucks	Buses	Passenger Cars	Others
1966				7,053	3,739	10,512	5,926
1967				7,170	4,340	10,710	6,166
1968				7,878	4,339	12,538	6,341
1969				8,864	5,522	15,725	7,363
1970				9,608	5,879	17,097	6,691
1971				6,344	3,812	9,198	3,441
1972				7,278	4,497	9,847	4,127
1973		43,898	47,820	8,440	6,030	10,413	4,722
1974		* 49,283	49,770	9,380	6,207	11,160	5,460
1975	78,961	50,907	46,611	9,457	5,223	11,882	5,695
1976	80,815	57,698	51,938	9,469	5,264	12,409	6,156
1977	82,713	58,651	53,378	9,757	5,494	14,869	7,843
1978	84,655	63,340	52,669	19,871	5,773	16,692	8,739
1979	86,643	66,227	55,944	11,894	6,044	18,868	9,648
1980	88,678	67,095	58,545	12,522	6,457	21,685	10,742
1981	90,626	71,644	60,690	13,496	7,183	23,100	11,276
1982	92,616	72,227	63,361	(14,064)	(7,387)	(25,872)	(11,673)
1983	94,651	74,579	65,280	(14,711)	(7,832)	(28,977)	(12,391)
1984	(96,045)	(77,115)	(67,916)	(15,600)	(8,233)	(32,454)	(13,173)
1990	104,407	97,450	89,718	22,944	11,180	63,987	19,374
2000	122,970	136,140	131,199	36,918	17,045	151,649	31,186
2010	141,882	190,192	189,150	56,441	24,557	298,749	47,689
2020	160,968	265,703	270,109	83,715	34,341	534,761	70,743

Source: Bangladesh Statistical Year Book

* Ministry of Health and Population Control

Note: Figures in () are also estimated.

1,000 VEHICLE
UNITS

GROWTH FACTOR AND ANNUAL INCREASE RATE IN VEHICLE OWNERSHIP

TYPE YEAR	TRUCK	BUS	PASSENGER CAR	OTHERS
1975	0.61 (5.7%)	0.63 (5.2%)	0.37 (11.8%)	0.43 (9.8%)
1984	1.00 (6.6)	1.00 (5.3)	1.00 (12.0)	1.00 (6.6)
1990	1.47 (4.9)	1.36 (4.3)	1.97 (9.0)	1.47 (4.9)
2000	2.37 (4.3)	2.07 (3.7)	4.67 (7.0)	2.37 (4.3)
2010	3.62 (4.0)	2.98 (3.6)	9.21 (6.0)	3.62 (4.0)
2020	5.37	4.17	16.48	5.37

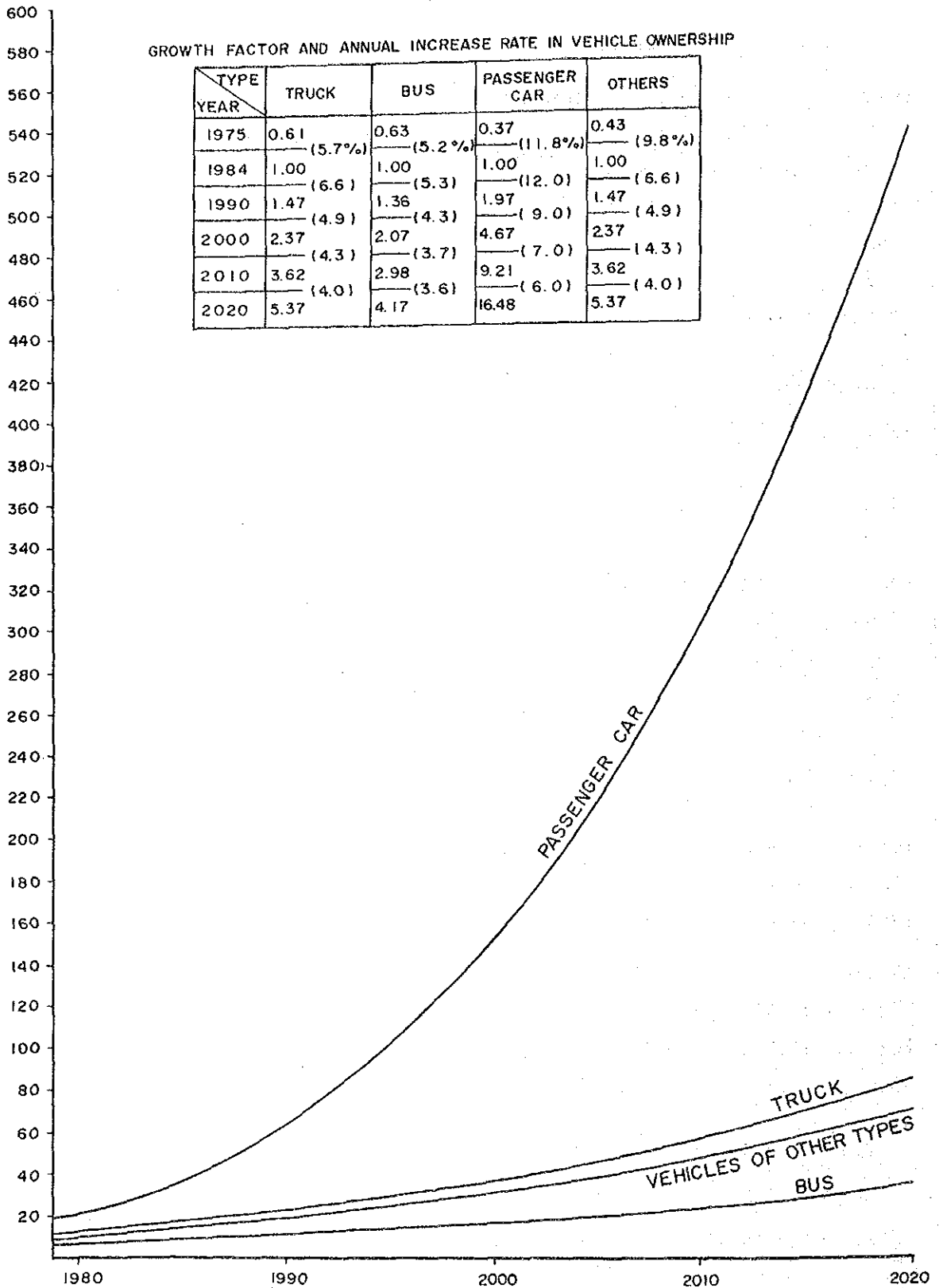


Fig. 11-4-2 Forecast of Vehicles and Increase Rates

**Table 11-4-3 Estimation of Normal Traffic Crossing the Rivers :
in 1990, 2000, 2010 and 2020**

(Unit: Vehicles/day)

Type of Vehicle \ Year	1984 (Actual)	1990	2000	2010	2020
Truck	811	1,195	1,927	2,943	4,366
Bus	439	597	909	1,308	1,831
Mini-bus	85	116	176	254	355
Car	104	291	689	1,358	2,431
Others	29	40	64	98	145
TOTAL	1,468	2,239	3,765	5,961	9,128

**Table 11-4-4 Induced Traffic by Vehicle Type from Bridge Construction
in 1990, 2000, 2010 and 2020**

(Unit: Vehicles/day)

	Year	Truck	Bus	Mini-bus	Car	Others	Total
Construction of Meghana Bridge only	1990	70	53	10	47	6	180
	2000	113	81	16	97	9	316
	2010	173	116	23	189	14	515
	2020	245	162	31	338	20	796
Construction of Meghna and Meghna-Gumti Bridges	1990	213	179	35	127	18	572
	2000	432	274	53	295	28	992
	2010	524	394	77	574	42	1,611
	2020	787	557	108	1,024	62	2,538
Inducing Rate (%)	Meghna Bridge only	6	9	9	14	14	9
	Two Bridges	18	30	30	42	42	27

2) Induced Traffic

Traffic induced from the completion of two bridges was estimated by using the rate of vehicle running time from the without-project case to that from the with-project-case between zones, since no other relevant data was available for this purpose. The estimating process is shown in Ap. Note 11-4.

The induced traffic estimated as mentioned above is shown in Table 11-4-4 and the combined traffic, normal and induced, is tabulated by type of vehicle in Table 11-4-5.

Table 11-4-5 Future Traffic Crossing Two Rivers With and Without Induced Traffic : in 1990, 2000, 2010 and 2020

Unit: Vehicles/day

Traffic By Vehicle Type. By Case		Year					
		1984	1990	2000	2010	2020	
Truck	Normal Traffic	811	1,195	1,927	2,943	4,366	
	Normal and Induced	Meghna Only	-	1,265	2,040	3,116	4,611
		Two Bridges	-	1,408	2,269	3,467	5,153
Bus	Normal Traffic	439	597	909	1,308	1,831	
	Normal and Induced	Meghna Only	-	650	990	1,424	1,993
		Two Bridges	-	776	1,183	1,702	2,388
Minibus	Normal Traffic	85	116	176	254	355	
	Normal and Induced	Meghna Only	-	126	192	277	386
		Two Bridges	-	151	229	331	463
Car	Normal Traffic	104	291	689	1,358	2,431	
	Normal and Induced	Meghna Only	-	332	786	1,547	2,769
		Two Bridges	-	418	984	1,932	3,455
Others	Normal Traffic	29	40	64	98	145	
	Normal and Induced	Meghna Only	-	46	73	112	165
		Two Bridges	-	58	92	140	207
Total	Normal Traffic	1,468	2,239	3,765	5,961	9,128	
	Normal and Induced	Meghna Only	-	2,419	4,081	6,476	9,924
		Two Bridges	-	2,811	4,757	7,572	11,666
Total Converted to HVEs	Normal Traffic	1,351	1,979	3,202	4,902	7,285	
	Normal and Induced	Meghna Only	-	2,124	3,442	5,273	7,831
		Two Bridges	-	2,442	3,961	6,075	9,060

Note: HVEs = Heavy Vehicle Equivalentents
Truck and Bus = 1.00, Mini-bus = 0.67, Car and Others = 0.33

CHAPTER 12
TRANSPORT COST ANALYSIS

CHAPTER 12 TRANSPORT COST ANALYSIS

12-1 Vehicle Operating Cost

12-1-1 General

Studies on vehicle operating cost were conducted for representative vehicle types, each of which has different operating characteristics. Cost items were classified into distance-related cost (running cost) and time-related cost (fixed hourly cost). The procedures adopted in this study for the calculation of vehicle operating cost are mainly based on the methodology established in the Bangladesh Transport Survey 1974.

Vehicle operating cost was first estimated in terms of market prices (financial costs), and then converted into economic costs, taking into consideration such transfer items as taxes or duties. Shadow pricing was applied both to the foreign exchange portion cost and labour cost. Shadow pricing coefficients applied were 0.80 for average labour cost and 1.22 for the foreign exchange cost, the details of which are described in Chapter 13 (Refer to Section 13-2).

12-1-2 Representative Vehicles

Vehicles were classified into 4 major types: truck, bus, mini-bus and passenger car. A vehicle model which represents each classified type was selected. Major characteristics were investigated, and average life in years, annual working hours in use and average running distance per annum were assumed for each type. The results are summarised and shown in Table 12-1-1.

The survey of market prices of vehicles was made by visiting dealers in Dhaka. Such cost items as CIF import prices, import related costs, local assembly costs, or customs duties and sales taxes were also investigated. The survey results are summarised and shown in Ap. Table 12-1.

Table 12-1-1 Characteristics of Representative Vehicles

	Truck	Bus	Mini-bus	Passenger Car
1. Representative Model	Bedford	Mitsubishi/FUSO	ISUZU	Mitsubishi/Lancer
Loading capacity	7.0 tons	52 passengers	22 passengers	5 passengers
Length (mm)	8,000	7,600	5,955	4,125
Width (mm)	2,314	1,900	2,100	1,635
Height (mm)	2,170	2,800	2,370	1,360
Weight/GVW (kg)	10,923	11,000	6,800	1,340
Engine Capacity (cc)	5,417	5,400	2,659	1,300
2. Import/Production Engine & Chassis	CKD Import	CKD Import	Complete set import	Complete set import
Body	Local made	Local made	Local made	-
3. Type of Fuel	Diesel	Diesel	Diesel	Gesoline
4. Tyres : Total set	6	6	4	4
Size	9.00-20 14PR	8.25-20 14PR	7.00-16 10PR	5.60-13
5. Years in Use (years)	10	10	10	10
6. Residual Value (%)	30	30	20	10
7. Annual Utilisation Working Hours				
(365 days x 0.8x10 or 5 hrs)	2,920	2,920	2,920	1,460
Running Distance (km)	72,000	72,000	72,000	20,000

Source : Field interview survey with Progoti Industry, Rangs Ltd. and others

12-1-3 Prices of Fuel and Engine Oil

Prices of fuel and engine oil in Bangladesh are under the control of the Government. Table 12-1-2 shows the prices of fuel and engine oil in Bangladesh. For the estimation of economic costs, the tax element of market prices was excluded, and then divided into local and foreign currency components as shown in the same table.

Table 12-1-2 Prices of Fuel and Engine Oil

(Unit: Taka/ℓ)

	Market Price	Net of Taxes	Local Costs	Foreign Costs	Economic Costs
1. Gasoline					
Petrol	15.08	12.72 ⁽¹⁾	6.61	6.11 ⁽⁵⁾	14.06
Octane	17.06	14.59 ⁽²⁾	8.48	6.11 ⁽⁵⁾	15.93
Combined	16.07	13.66	7.55	6.11 ⁽⁵⁾	15.00
2. Diesel Oil	7.40	6.80 ⁽³⁾	0.68 ⁽⁶⁾	6.12	8.15
3. Engine Oil	28.60	19.13 ⁽⁴⁾	1.91 ⁽⁶⁾	17.22	22.92

- Remarks: (1) Taxes on petrol include excise tax of Taka 1.14/ℓ and customs duty of 20% on crude oil imports.
- (2) Taxes on octane include excise tax of Taka 1.25/ℓ and customs duty of 20% on crude oil imports.
- (3) Taxes on diesel oil include customs duty of Taka 0.30/ℓ and surcharge/licence fee of 5% on import value.
- (4) Taxes on engine oil includes customs duty of 50% and surcharge/licence fee of 5% on import value.
- (5) Average CIF value of crude oil is US\$232.00/ton, Tk.5,800/ton x ton/950 ℓ = Taka 6.11/ℓ.
- (6) 10% of net of tax market prices are assumed to be local costs.

Source: Bangladesh Petroleum Corporation and Petrol Stations in Dhaka.

The consumption of fuel and engine oil varies according to types and running speeds of vehicles. Based on available experimental data, the average consumption of fuel and engine oil at running speeds of 25 km/hour and 70 km/hour was investigated. The results are shown in Table 12-1-3.

Table 12-1-3 Consumption of Fuel and Engine Oil by Type of Vehicle and by Running Speed

(Unit: ℓ /1,000 km)

	Running Speed	
	25 km/h	70 km/h
Fuel Consumption		
Truck	270.8	209.6
Bus	333.3	232.6
Mini-bus	200.0	139.6
Car	105.0	74.0
Engine Oil Consumption		
Truck	7.73	5.85
Bus	8.50	6.45
Mini-bus	3.88	3.30
Car	1.42	1.17

Source: "Feasibility Study on the Second Stage Expressway System in the Greater Bangkok", Nov. 1983, JICA
"Jakarta Intra-Urban Tollway Project, Phase II" March 1980, JICA.

12-1-4 Tyre Price

The market prices of tyres in July 1984 were obtained from interview surveys with major dealers in Dhaka. The most popular types of tyres in Bangladesh are those imported from Japan. Besides market prices, dealers' commission, taxes, port handling charges and CIF import prices were also obtained as shown in Table 12-1-4.

Table 12-1-4 Tyre Prices ⁽¹⁾

		Market Price	Agent and Dealers Commission	Port Handling Charge	Sales Tax (20%)	Customs Duty (50%,100%)	Development Surcharge (2%)	Import Price (CIF)	Normal Life (km)
Truck:	9.00-20 14 PR	5,800	565	190	840	1,400	55	2,750	30,000
Bus:	8.25-20 14 PR	4,800	505	160	690	1,150	45	2,250	30,000
Mini-bus:	7.00-16 14 PR	2,840	320	70	410	1,020	20	1,000	30,000
Car:	5.00-13	1,400	140	35	205	510	10	500	25,000

(Unit: Taka)

(1) A tyre with tube, excluding metal wheel frame

Source: Interview survey with Dealers in Dhaka, Trading Houses and Others.

12-1-5 Maintenance Cost

No accurate information was available for maintenance cost of motor vehicles from the field interview survey. Most vehicle drivers or owners do not keep accounting records of repair and maintenance. In addition, drivers and assistants do occasional repair work on the road by themselves. They often transfer parts used by other models. In this study, maintenance cost per km was assumed to be equivalent of 50% of the sum of the costs of fuel, engine oil and tyre wear. From the interview results with local workshops, the ratios of parts and labour for maintenance were determined.

12-1-6 Depreciation and Interest Cost

Depreciation and interest costs were calculated with conventional methods making use of the following formula:

$$CR = \frac{i \times (1+i)^n - RS}{(1+i)^n - 1}$$

$$DP = \frac{1.00 - RS}{n}$$

$$IT = CR - DP$$

where CR = capital recovery factor
i = discount rate, 15% p.a.
n = years in use
RS = residual value as a ratio to initial value
DP = depreciation factor
IT = interest factor

12-1-7 Wages

The average wage level for each type of job was obtained from the field interview survey. The wage levels vary considerably according to the differences in working hours, distance of operation, years of employment or the extent of fringe benefits. But the average wage level in Bangladesh related to the transport cost is still very low, and most of such wages are not subject to any income tax. Table 12-1-5 summarises the wages of workers including meal and other supplementary payments.

Table 12-1-5 Wages to Vehicle Workers

(Unit: Taka)

Type of Vehicle	Type of Workers	Number of Workers	Monthly Payment	Remarks
1. Truck	Driver	1	2,800	Tk.1,000/Month+Meal allowance Tk.50/Day +Commission Tk.500/Month
	Helper	2	750	Tk.50/Day+Meal allowance Tk.25/Day (Working days: 10/Month)
2. Bus	Driver	1	3,500	Tk.100/Day+Meal allowance Tk.40/Day
	Conductor	1	2,500	Tk.70/Day+Meal allowance Tk.30/Day
	Helper	1	1,125	Tk.50/Day+Meal allowance Tk.25/Day (Working days: 15/Month)
3. Mini-bus	Driver	1	3,500	Tk.100/Day+Meal allowance Tk.40/Day
	Conductor	1	2,500	Tk.10/Day + Meal allowance Tk. 30/Day
4. Car	Driver	1	1,250	Tk.40/Day + Overtime (25%)

Remarks : Working days are 25 per month when it is not specifically remarked.

Source : Interview survey with Bangladesh Bus-Truck Owners' Association and Bangladesh Truck & Bus Labour Unions Association.

12-1-8 Insurance, Road Tax and Others

The average insurance cost, registration fee, road tax and road route permit fee by type of vehicle were investigated, the results of which are summarised as shown in Table 12-1-6.

Table 12-1-6 Insurance, Registration, Road Tax, etc. by Type of Vehicle

(Unit: Taka)

Type of Vehicle : Capacity	Insurance Cost/year(1)	Registration(2)	Road Tax(3)	Road Route Permit(4)
1. Truck: 7 tons loading	2,250	350	1,800	1,372.50
2. Bus: 52 Passengers	4,950	350	3,250	750
3. Mini-bus: 22 Passengers	3,000	350	1,750	750
4. Passenger Car: 5 Passengers	3,700	250	900	-

(1) Comprehensive cover for the first 5 years and third party cover thereafter

(2) Initial purchase time only

(3) Renewal every year

(4) Interdistrict charge for 3 years

Source: Field interview survey with related organisations

12-1-9 Vehicle Operating Cost

Based upon the above data and methodology, the vehicle operating costs by type of vehicle were calculated. The detailed calculation procedures are shown in Ap. Tables 12-2 through 12-5, the summary of which is shown in Table 12-1-7.

Table 12-1-7 Summary of Vehicle Operating Cost

(Taka/km)

Type of Vehicle:	Capacity	Speed (km/hour)	Market Cost	Net of Taxes and Transfers	Economic Cost
Truck:	7 tons loading	V = 25	7.630	6.341	7.042
		V = 70	5.217	4.260	4.794
Bus:	52 Passengers	V = 25	9.129	7.766	8.455
		V = 70	5.593	4.658	5.173
Mini-bus:	22 Passengers	V = 25	5.543	4.741	5.095
		V = 70	3.177	2.653	2.922
Car:	5 Passengers	V = 25	5.574	3.991	4.135
		V = 70	3.113	2.301	2.466

Source: Ap. Tables 12-2 through 12-5.

12-2 Time Value

12-2-1 General

The reduction of travel time would be one of the primary benefits of the project. The reduced travel time would not only contribute to the more effective use of vehicles but also create benefits from savings both for passengers and commodities carried by vehicles. The time value of vehicles was quantified from the annual fixed cost of vehicles taking into consideration their average annual working hours and effective use ratio. The time value of passengers was estimated based upon the Income Earning Method, the results of which were further examined by the application of the National Income Method. In the present study, the time value of commodities was not counted due to their uncertainties. This would lead to rather conservative economic evaluation results of the project.

12-2-2 Vehicle Time Value

As described in the previous section, vehicle operating costs are divided into time-related costs and distance-related costs. The reduction of travel time would

directly contribute to the savings of the above time-related costs. However, it would be rather risky to count all of the saved time-related costs as the time value of vehicles since there is no assurance that all of the saved time would be fully used for other economic uses of the vehicles. In the present study, the effective use rate of saved vehicle time was assumed to be 0.8. This rate was assumed to be rather high because of the considerably low level of vehicle holding rates and high financial costs of vehicles in Bangladesh. The results of the computation of vehicle time value are summarised as shown in Table 12-2-1.

Table 12-2-1 Economic Time Value of Vehicles

(Unit: Taka)

	Truck	Bus	Mini-bus	Car
1. Time-related economic cost p.a.	130,668	186,810	136,889	34,454
2. Average working hours p.a.	2,920	2,920	2,920	1,460
3. Time-related cost per hour	44.749	63.976	46.880	23.599
4. Effective use ratio	0.8	0.8	0.8	0.8
5. Economic time value per hour	35.799	51.181	37.504	18.879
6. Economic time value per minute	0.597	0.853	0.625	0.315

Source: Ap. Tables 12-2 through 12-5 and Table 12-1-1.

12-2-3 Passenger Time Value

The computation of passenger time value includes many uncertain factors. For passengers time can be money, but it may not always be so in a country like Bangladesh. In the urban area of developed countries passengers in vehicles are conventionally classified into those travelling in working (business) or non-working (leisure) time. If they are travelling during working hours, time is valued at net marginal output which is usually taken to be equal to earnings. However, in the rural area of many developing countries, it is very difficult to define working and non-working time. Another problem is the existence of unemployment and underemployment. The former problem is partly covered by the estimation of a business trip ratio and the latter by the application of shadow priced wage rates.

In the present study, passenger time value by type of vehicle was estimated based upon the Income Earning Method. The results are shown in Table 12-2-2.

Table 12-2-2 Passenger Time Value by Vehicle Type

Type of Vehicle	Number of Passengers	Average Monthly Wage (Tk)	Share of Business Trip	Shadow Wage Rate	Working Hours per Month	Time Value (Taka/hour)
Bus	Passengers x 53	950	0.825	0.80	200	166.16
Mini-bus	Passengers x 28	950	0.825	0.80	200	87.78
Car	Owner x 1 Co-rider x 2	6,000 1,500	0.825	1.00 0.75	200	34.03

Source: Traffic survey results and field interview survey

The average numbers of passengers by type of vehicle and by business trip ratio were obtained from the traffic survey results. The average monthly wages of bus and mini-bus passengers were computed as follows:

$$AMWP = NNI \div TEP \div 12$$

where AMWP = average monthly wage per passenger
 NNI = net national income
 TEP = total employed persons

The net national income of Bangladesh in 1982/83 was Tk.256,711 million and that in 1983/84 was estimated at Tk.292,650 million assuming an annual growth rate of 14%. The number of total employed persons in 1981 was 23,617,000 and that in 1984 was estimated at 25,657,000 using an average annual growth rate of 2.8%.

Because of the very high financial costs, the car ownership in Bangladesh is still limited to a small number of people in very high income levels. Accordingly, the wage level of car owners and co-riders were supposed to be relatively high.

12-3 Ferry Operating Cost

12-3-1 General

There are no reliable data showing all the operating costs of the Meghna and Meghna-Gumti ferry services. This is mainly due to the following:

- The operation of the Meghna and Meghna-Gumti ferries, as well as other ferry services in Bangladesh, is under the direct control of the Bangladesh Government through the Roads & Highways Department, Ministry of Communication;
- The responsibilities for daily ferry services and operations, routine maintenance of ferries and terminal facilities, and provision of ferries and terminal facilities are divided into different sub-divisions; and
- Each sub-division covers not only the operation of the Meghna and Meghna-Gumti ferry services but also many other ferry services and operations in Bangladesh.

As an initial approach to enumerate savings of ferry operating costs with a "project" in the future, the current actual ferry operating costs were estimated by analysing data and information obtained from all subdivisions related to the Meghna and Meghna-Gumti ferry services.

12-3-2 Personnel Expenses

The present number of workers by job classification and their average wage level were investigated and the annual personnel expenses for both the Meghna and Meghna-Gumti ferry services were calculated. The results are summarised in Ap. Table 12-6. The workers' wage levels depend not only on their job classifications but also on their length of employment. Accordingly the wage levels were shown in generalised figures including all of the regular and periodical allowances. For the estimation of economic costs of personnel expenses, the average shadow wage rate of 0.8 was applied.

12-3-3 Costs of Fuel and Lubricant Oil

1) Consumption for Ferry Operation

Unit consumption volumes of fuel oil and lubricant oil per round trip both at the Meghna and Meghna-Gumti ferry services were obtained from the field interview survey. The average number of round trips was assumed; the annual consumption volumes of fuel and lubricant oil estimated; and their respective costs both at market and economic prices were computed. The results are shown in Ap. Table 12-7.

2) Consumption for Ferry Terminal Facilities

Fuel oil and lubricant oil are also consumed at ferry terminals, mainly by the generators for lighting, trucks, lift trucks and others. From the field interview survey and the data obtained from the operating sub-division, the total consumption of fuel and lubricant oil at ferry terminals is assumed to be around 20% of those for the ferry operation.

12-3-4 Maintenance Costs

1) Maintenance Costs for Ferries and Pontoons/Gangways

The maintenance costs of ferries and pontoons/gangways consist of (1) running maintenance costs, (2) overhauling costs of engines, and (3) regular maintenance costs. The running maintenance costs are for the daily minor repair and maintenance of ferries and pontoons/gangways. This work is mainly handled by the staff of the Ferry Maintenance Sub-division located both at the Meghna and Meghna-Gumti ferry ghat workshop and the workshop at Katchpur. Overhauling of engines is needed at regular intervals of about 3 months. Regular maintenance is for the docking and painting of ferries and pontoons, which are required every 3 to 4 years. These jobs are undertaken by the dockyards both of the Ferry Maintenance Sub-division at Katchpur and outside contractors. Through interview surveys with the staff of the Ferry Maintenance Sub-division, average unit maintenance costs of ferries and pontoons/gangways were estimated and the annual maintenance costs were computed. The results are summarised as shown in Ap. Table 12-8. For maintenance, economic costs were computed from the market prices by applying SCF of 0.82 (For SCF, refer to Section 13-2).

2) Maintenance Cost for Other Facilities

Maintenance is also needed for facilities other than ferries and pontoons/gangways. Major facilities of such nature include buildings like guest houses, worksheds, and offices or fuel dumps, trucks or crane trucks, diesel generators and water pumps and jetty and approach roads. From the past records of the Ferry Operating Sub-division, the costs for the above-mentioned maintenance were estimated at around 20% of the maintenance costs of ferries and pontoons/gangways.

12-3-5 General Administration Expenses

Because the Meghna and Meghna-Gumti ferry operation is administered as a part of various kinds of activities of RHD, there are no specific data to estimate the general administration expenses on account of operation of ferries. From the general private business operations in Bangladesh, the general administration expenses for the two ferries were estimated at 20% of direct ferry and terminal operating costs.

12-3-6 Depreciation

Unit depreciation costs were calculated for such major facilities as ferries and pontoons/gangways both at market and economic prices, taking into consideration their initial value, useful economic life and salvage values. The annual depreciation costs for the year 1984 were computed. In addition to ferries and pontoons/gangways, there are various kinds of facilities and equipment which have to be depreciated. The equipment consists of such items as lift trucks, trucks, water pumps or diesel engines; the facilities include such buildings as guest houses, offices or fuel dumps. The depreciation costs of these miscellaneous equipment and facilities are roughly estimated at 30% of the depreciation costs of ferries and pontoons. The details of the estimate of depreciation costs are shown in Ap. Table 12-9.

12-3-7 Total Ferry Operating Costs

Based on the estimate of each cost item, the total costs for the Meghna and Meghna-Gumti ferry operations in 1984 were calculated. The results are shown in Tables 12-3-1 and 12-3-2 respectively in terms of financial and economic prices.

Table 12-3-1 Estimated Ferry Operating Costs (1984) in Financial Prices

(Unit: 1,000 Taka)

	Meghna	Meghna-Gumti	Total
A. Direct Ferry Operating Costs	7,562	10,908	18,470
1. Ferry Crew Wages	(452)	(411)	(863)
2. Fuel and Lubricant Oil	(4,520)	(7,907)	(12,427)
3. Ferry Maintenance Costs	(2,590)	(2,590)	(5,180)
B. Terminal Operating Costs	2,451	3,199	5,650
4. Terminal Worker Wages	(904)	(970)	(1,874)
5. Fuel and Lubricant Oil ⁽¹⁾	(904)	(1,581)	(2,485)
6. Pontoon Maintenance Costs	(75)	(75)	(150)
7. Other Maintenance Costs ⁽²⁾	(533)	(533)	(1,066)
8. Other Operating Expenses ⁽³⁾	(35)	(40)	(75)
	10,013	14,107	24,120
C. General Administration Expenses			
9. (A + B) x 20%	2,003	2,821	4,824
D. Subtotal	12,016	16,928	28,944
E. Depreciation	7,130	7,130	14,260
10. Ferry Boats	(4,256)	(4,256)	(8,512)
11. Spare Engines	(860)	(860)	(1,720)
12. Pontoons with Gangway	(369)	(369)	(738)
13. Others ⁽⁴⁾	(1,645)	(1,645)	(3,290)
F. Total Operating Costs	19,146	24,058	43,204

(1) $2 \times 20\%$

(2) $(3 + 6) \times 20\%$

(3) Data reported from Ferry Circle, RHD

(4) $(10 + 11 + 12) \times 30\%$

Source : Ap. Tables 12-6 through 12-9

Table 12-3-2 Estimated Ferry Operating Costs (1984) in Economic Prices

(Unit: 1,000 Taka)

	Meghna	Meghna-Gumti	Total
A. Direct Ferry Operating Costs	7,298	10,877	18,175
1. Ferry Crew Wages	(362)	(329)	(691)
2. Fuel and Lubricant Oil	(4,812)	(8,424)	(13,236)
3. Ferry Maintenance Costs	(2,124)	(2,124)	(4,248)
B. Terminal Operating Costs	2,219	3,000	5,219
4. Terminal Worker Wages	(723)	(776)	(1,499)
5. Fuel and Lubricant Oil ⁽¹⁾	(962)	(1,685)	(2,647)
6. Pontoon Maintenance Costs	(62)	(62)	(124)
7. Other Maintenance Costs ⁽²⁾	(437)	(437)	(874)
8. Other Operating Expenses ⁽³⁾	(35)	(40)	(75)
C. General Administration Expenses			
9. (A + B) x 20%	1,903	2,775	4,678
D. Subtotal	11,420	16,652	28,072
E. Depreciation	5,195	5,195	10,390
10. Ferry Boats	(3,080)	(3,080)	(6,160)
11. Spare Engines	(574)	(574)	(1,148)
12. Pontoons with gangway	(342)	(342)	(684)
13. Others ⁽⁴⁾	(1,199)	(1,199)	(2,398)
F. Total Operating Costs	16,615	21,847	38,462

(1) $2 \times 20\%$

(2) $(3 + 6) \times 20\%$

(3) Data reported from Ferry Circle, RHD

(4) $(10 + 11 + 12) \times 30\%$

Source: Ap. Tables 12-6 through 12-9