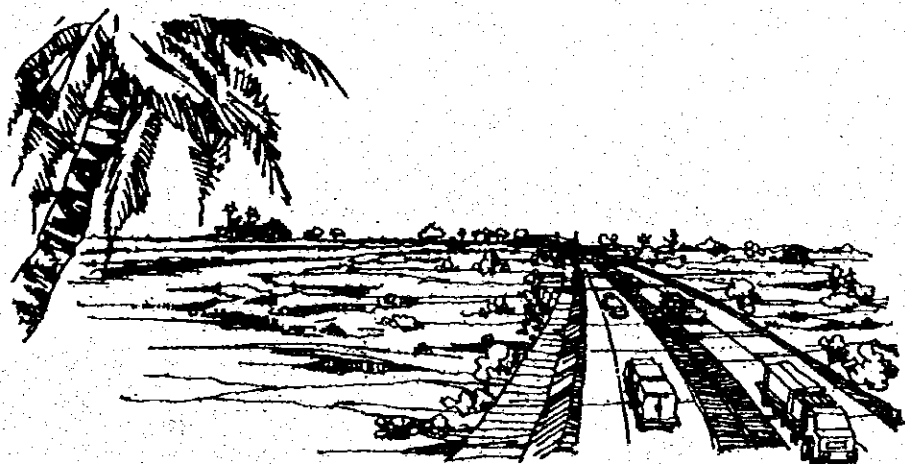


CHAPTER 1

INTRODUCTION



CHAPTER 1 INTRODUCTION

1.1 Introduction

In response to the request of the Government of the People's Republic of Bangladesh (hereinafter referred to as "Bangladesh"), the Government of Japan decided to conduct the Study on Construction of the Bridge over the River Rupsa in Khulna in accordance with the relevant laws and regulations in force in Japan.

Accordingly, Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, undertook Phase 1 of the Study from February 1998 to March 1999 to formulate a master plan for integral components of transport development in Khulna and Mongla Port including a construction plan of Rupsa Bridge.

The Government of Bangladesh and the Japan International Cooperation Agency (JICA) have agreed to the Scope of Work in March 1999 to conduct Phase 2 of the Study on Construction of the Bridge over the River Rupsa in Khulna (hereinafter referred to as "the Study") based on the findings and recommendations prepared under Phase 1 in close cooperation with the Government of Bangladesh.

1.2 Study Objectives

The objectives of the Study are;

- (1) to conduct the feasibility study for the construction of a road bridge over the river Rupsa including its approaches and the Southern Section of Khulna Bypass from Khulna-Satkhira Road to Khulna-Mongla Road; and
- (2) to pursue technology transfer to Bangladesh counterpart personnel in the course of the Study.

1.3 Scope of the Study

1.3.1 Study Area

The Study area covers the proposed site for Rupsa Bridge and the southern section of Khulna Bypass in Khulna city as shown in Project Location Map.

1.3.2 Target Year

The target year of the plan is the year 2015 which accords with that of the studies implemented by the World Bank.

1.3.3 Components of Engineering Design

The Study includes the following components of engineering design within the agreed Scope of Work;

- (1) Rupsa Bridge and its Affixed Utilities**
- (2) Approach Roads and the Southern Section of Khulna Bypass**
- (3) River Bank Revetment against Erosion and Protection of Piers against Scouring**
- (4) Resettlement Plan for Project Affected Persons (PAPs)**

1.3.4 Concept of Work Flow

Fig. 1.3.1 shows the concept of work flow for the Study and its progress.

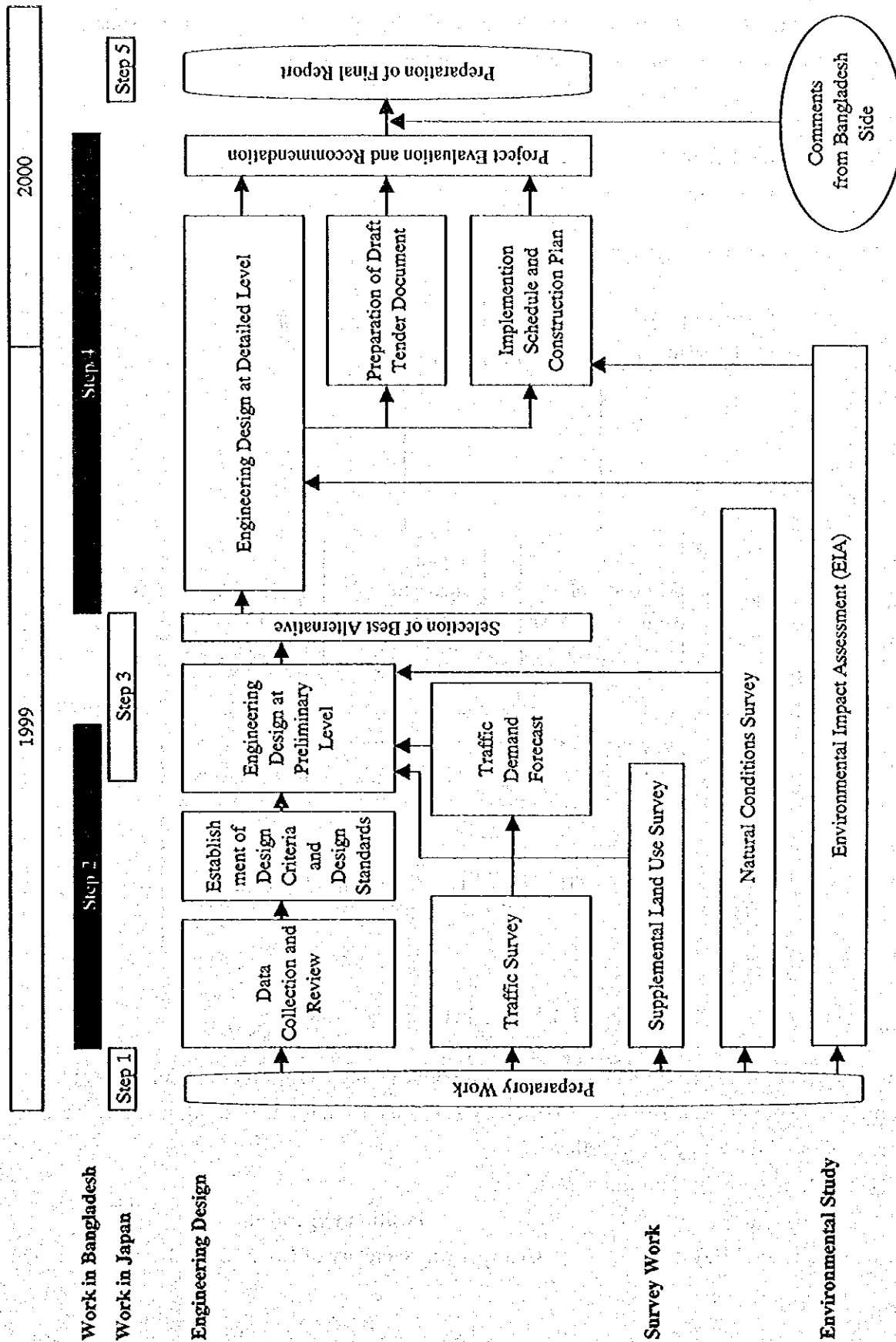


Fig. 1.3.1 Concept of Work Flow and its Progress

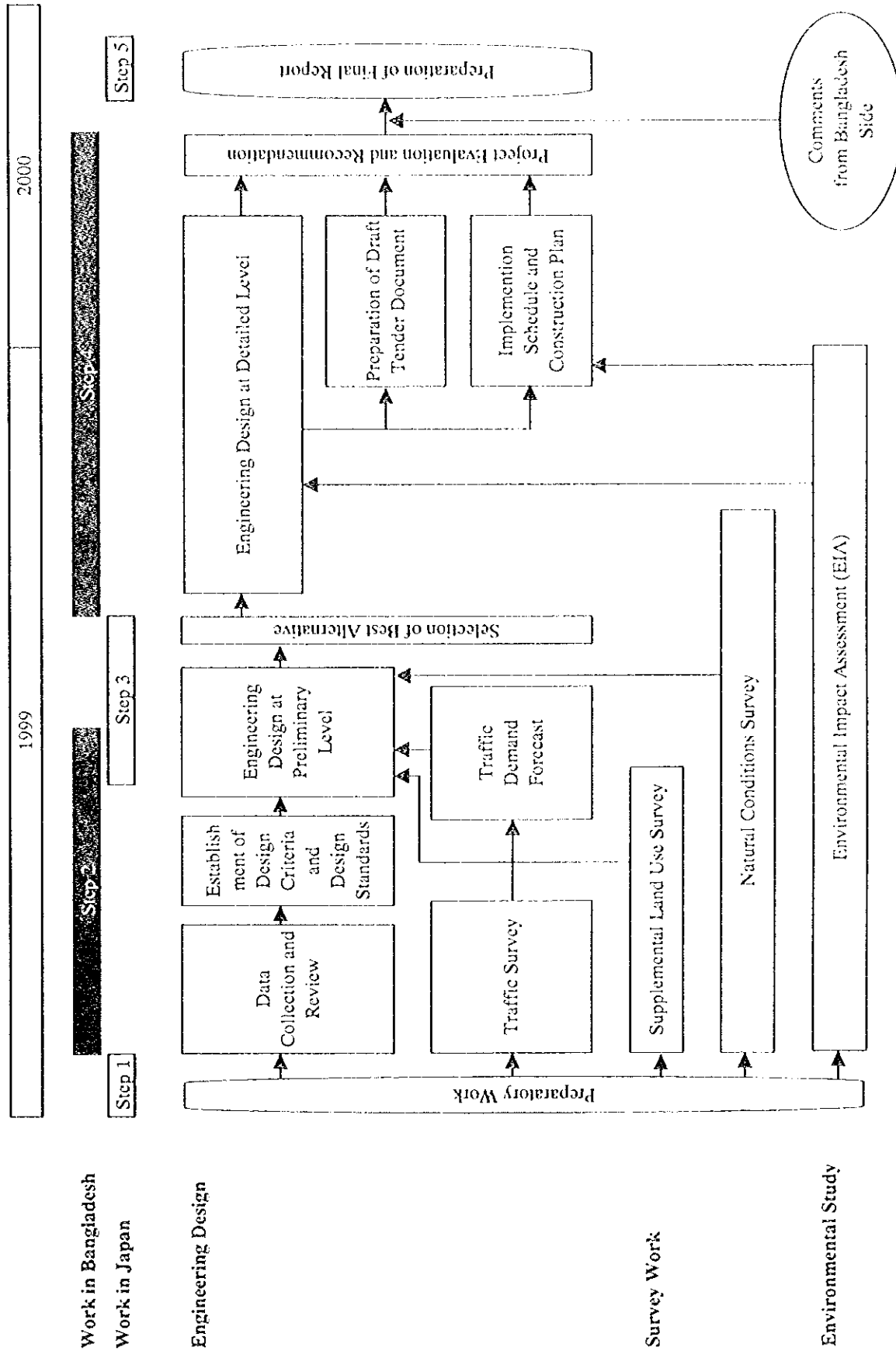


Fig. 1.3.1 Concept of Work Flow and its Progress

1.4 Study Organization

The JICA Study Team closely collaborates with the Bangladesh counterpart personnel from various organization of the Bangladesh Government. The following committees are set up for the entire duration of the Study:

- Steering Committee of the Bangladesh Government, and
- JICA Advisory Committee.

The Study Organization is shown in Fig. 1.4.1.

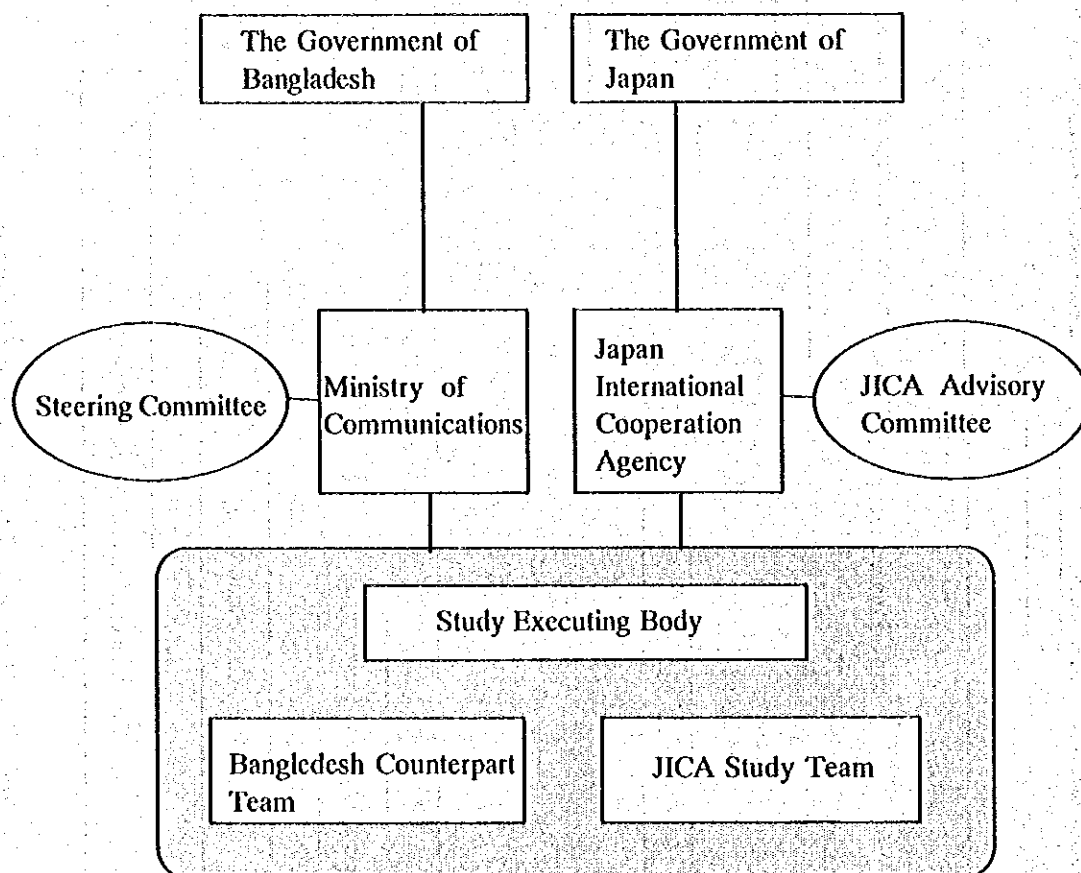


Fig. 1.4.1 Study Organization

The members of the Government's steering committee (Bangladesh Steering Committee) and counterparts (Bangladesh Counterparts), JICA Advisory Committee and JICA Study Team for execution of the Study are as follows:

(1) Bangladesh Steering Committee Members

Name	Position/Organization
1) Mr. Syed Rezaul Hayat	Chairperson, Secretary of Roads & Railways Division

2) Mr. Sohel Ahmed	Additional Secretary of Economic Relations Division
3) Mr. SK. Mainuddin Ahmed	Division Chief of Planing Commission
4) Mr. Mia Mohammed Mostaque	Deputy Secretary of Ministry of Shipping
5) Mr. Md. Abdus Sattar	Additional Chief Engineer of RHD
6) Mr. Md. Syed Ahmed	Additional Director General/I of Bangladesh Railway
7) Mr. Md. Safiullah Khan	Chief Engineer of Mongla Port Authority
8) Mr. Pervez Anwar Khan	Chief Engineer of BIWTA
9) Mr. Liakat Ali Sarif	Chief Engineer of Khulna City Corporation

(2) Bangladesh Counterpart Team Members

Name	Position/Organization
1) Mr. Md. Sheikh Rabiul Islam	Coordinator, Additional Chief Engineer of RHD Khulna
2) Mr. Moiz Uddin Ahmed Jaigirdar	Team Leader, Superintendent Engineer of RHD
3) Mr. Habibur Rahman	Road Engineer, Executive Engineer of RHD
4) Mr. Ashraf-ul-Islam	Bridge Engineer, Executive Engineer of RHD
5) Mr. Md. Khalilur Rahman	Regional Development Specialist, Planning Officer, KDA
6) Mr. G.M. Masudur Rahman	Regional Development Specialist, Assist. Engineer, KDA

(3) JICA Advisory Committee Members

1) Dr. Yuzo AKATSUKA	Chairperson, Professor/Dean Toyo University
2) Mr. Ikuo YAMADA	Honshu-Shikoku Bridge Authority
3) Mr. Kenji NOMURA	Japan Highway Public Corporation
4) Mr. Takeo MATSUZAWA	Japan Bank for International Cooperation
5) Mr. Kenji KURODA	Japan Bank for International Cooperation

(4) JICA Study Team Members

1) Mr. Kenji MARUOKA	Team Leader / Road Planner/Document Specialist
2) Mr. Takashi CHUJO	Deputy Team Leader/Bridge Planner
3) Mr. Jiro KOYAMA	Bridge Engineer (Superstructure 1)
4) Mr. Yukihiro INOUE	Bridge Engineer (Substructure 1)
5) Mr. AMIR MALIK FAEIZ	Bridge Engineer (Substructure 2)
6) Mr. Tomoaki TAKEUCHI	Highway Engineer
7) Mr. Takashi INOUE	River Engineer
8) Mr. Kenji MORITA	River Facilities Engineer

9) Mr. Tsutomu KUDO	Traffic Engineer
10) Mr. John SPURR	Economic Analyst
11) Mr. Hiroki KAWAHARA	Geodetic Engineer
12) Mr. Yutaka KOMATSU	Geotechnical Engineer
13) Mr. Hiroshi TANAKA	Resettlement Planner / Landscape Specialist
14) Mr. Yoshitoshi KOBAYASHI	Environmental Specialist
15) Mr. Toshinari KOBAYASHI	Construction Planning Specialist / Cost Estimator

1.5 Draft Final Report

The Final Report contains integrated parts of work components taking into consideration a series of discussions with the RHD and other agencies concerned during the study in Bangladesh.

The Final Report consists of the volumes as listed below:

Volume I : Main Report

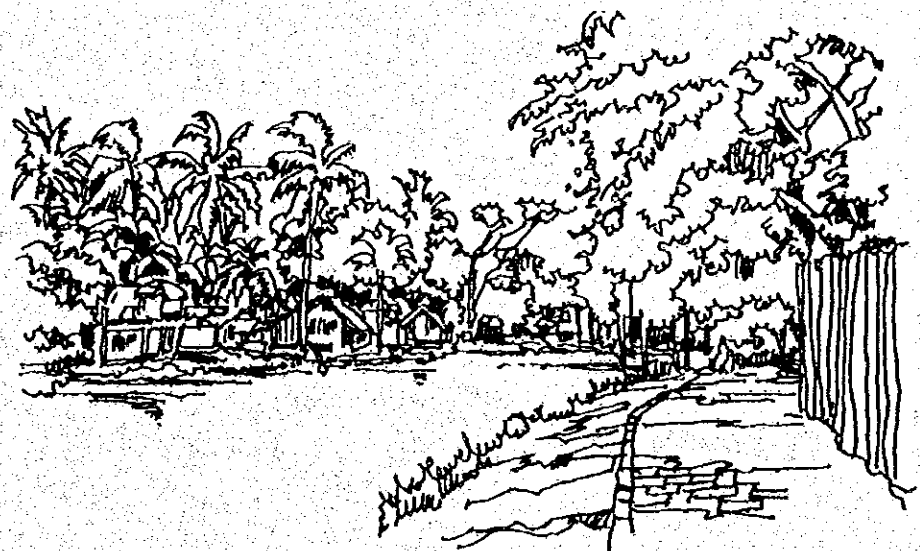
Volume II : Appendix

Volume III : Drawings

The Summary Report was prepared separately.

CHAPTER 2

SOCIOECONOMIC CONDITIONS AND FRAMEWORK



CHAPTER 2 SOCIOECONOMIC CONDITIONS AND FRAMEWORK

2.1 Definition of the Study Area and its Influenced Areas

The study area covers Khulna city, Mongla port and the area of their outskirts. Moreover, taking account of the existing transport networks, administrative units and the jurisdiction of RHD local offices (i.e. Circles), the scope of influenced areas from this project is defined as two areas of Khulna Former District including the study area and Jessore Former District are included (see Fig. 2.1.1).

- * For administrative convenience, Bangladesh is divided into six (6) administrative divisions. Each division is further sub-divided into 64 zilas (districts). Zila (district) is sub-divided in a number of Thanas. Currently there are 490 thanas. At present, the units of Former Districts are mainly used as statistical units.

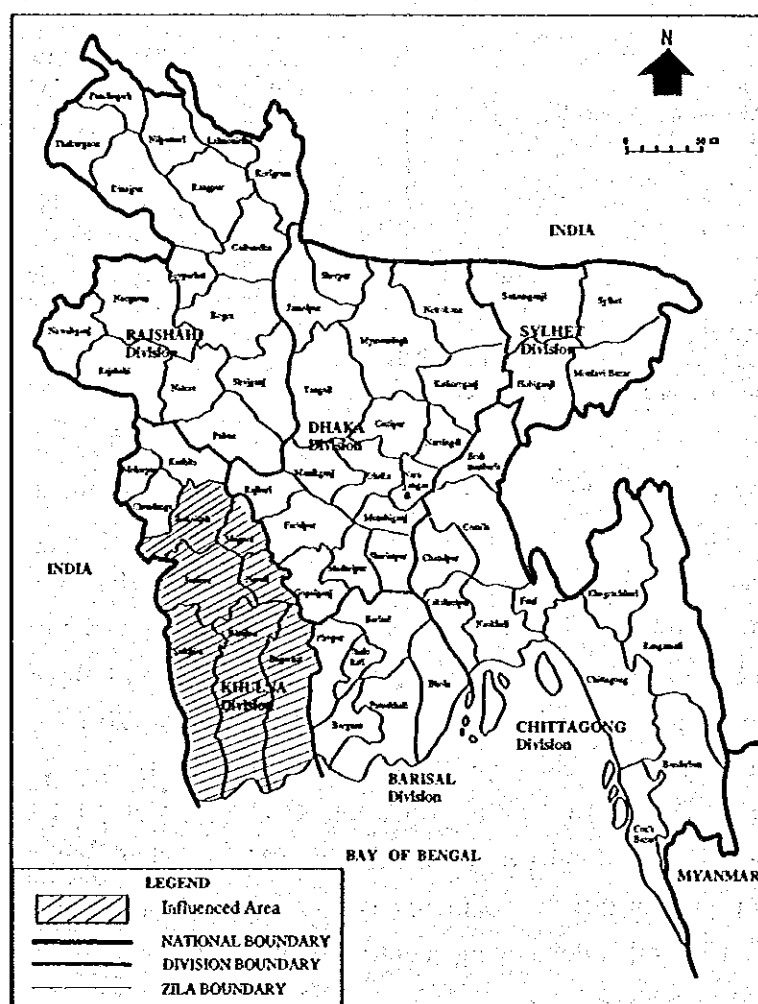


Fig. 2.1.1 Influenced Area Including Study Area

2.2 Present Socioeconomic Conditions

2.2.1 Population

The Bangladesh Bureau of Statistics (BBS) conducted the third population census in the country in 1991. As per the results, the population of the country was 111.455 million in 1991. The percentage of urban population was 19.6% while that of rural was 82.8%. The population growth rate from 1981 to 1991 was 2.5% per annum, and from 1991 to 1995 it was estimated as 1.85% per annum. (see Table 2.2.1)

The population density was approximately 590 persons/Km² in 1981. It has increased to 755 persons/Km² in 1991. There were 19.4 million households in the country, and the average household size was 5.6 persons in 1991.

Table 2.2.1 Population in Bangladesh

	1974	1981	1991	1995
Population (million persons)	71.5	87.1	111.5	120.0
Population Annual Average Growth Rate (%)	-	2.86	2.50	1.85
Population Density (persons/ Sq. Km)	485	590	755	813
Population by Age Group (%)				
0 - 14	48.00	46.70	45.30	42.90
15 - 64	48.50	50.80	52.10	53.10
65 -	3.50	2.50	2.60	4.00
Urban population (as % of total population)	8.80	15.20	19.63	22.00
Sex Ratio (Male/Female)	108	106	106	106

Source : 1997 Statistical Yearbook of Bangladesh

Note : Population in 1995 was estimated by BBS.

Table 2.2.2 shows population in various Khulna areas such as Khulna City Corporation (KCC), Khulna Statistical Metropolitan Area (SMA), Khulna Zila (district), Khulna Former District and Khulna Division in 1991. Total population in Khulna Division was 12.7 million (11.4% of Bangladeshi population), of which 2.13 million were in Khulna Zila. The population in KCC and Khulna SMA were 663 thousand and 921 thousand, respectively. The percentage of urban population was 47.3% in Khulna Zila (20.1% in whole country). The growth rate of Bangladeshi population from 1981 to 1991 was 2.5%, while that of Khulna Division, Former District, Zila, SMA and KCC were 1.7%, 1.5%, 1.8%, 3.7% and 1.7%, respectively. Especially growth rate of Khulna SMA was higher than that of KCC and Bangladesh. It is evident that the population concentration on metropolitan area takes place in Bangladesh, same as other developing countries in the region.

The nature of major population concentrations in Khulna Development Authority (KDA) Master Plan Study Area at the micro-level (wards/mouzas), is shown in Fig. 2.2.1. Most of

the density populated areas are found in the core KCC area. Fig. 2.2.2 shows the population change by micro-level areas between 1981 and 1991. Although a fewer number of wards/mouzas, especially the central city area, showed depopulation, most of the other areas witnessed increase in population. The highest growth took place outside the KCC, towards southwest, Rupsa thana area and so on. The pattern of growth clearly indicates the course of expansion of the city in this direction in future.

Table 2.2.2 Population in Various Khulna Areas in 1991

	Khulna City Corporation	Khulna SMA	Khulna Zila	Khulna Former District	Khulna Division
Population (thousand persons)	663	921	2130	5039	12689
Population Annual Growth Rate (1981-91, %)	1.67	3.67	1.82	1.53	1.78
Population Density (persons/ Sq. Km)	9471	3449	485	413	570
Urban population (as % of total population)	-	-	47.3	26.4	18.3
Sex Ratio (Male/female)	121	118	111	107	106

Source : (1) 1997 Statistical Yearbook of Bangladesh

(2) Bangladesh Population Census 1981, Community Tables of All Thanas of Khulna District

(3) Bangladesh Population census 1991, Volume 3 Urban Area Report (Nov. 1997)

Note : (1) Khulna SMA (Statistical Metropolitan Area) includes Khulna City Corporation and whole of Rupsa and Dighalia thanas.

(2) Khulna Former District includes Khulna, Bagerhat and Satkhira Zilas.

2.2.2 Labor Forces

According to 1995/96 Labor Force Survey (LFS), the total labor force of the country was estimated at 56.0 million, of which 34.7 million are male and 21.3 million are female.

Out of the number of employed population by major industry, the agriculturally based population is the most. Its share to total employed population was 66.7% in 1990/91 LFS and 62.7% in 1995/96, respectively. The change of each industrial share between 1990/91 and 1995/96 were from 11.8% to 7.5% in manufacturing, 1.0% to 1.8% in construction, 8.6% to 11.1% in trade and restaurant, 3.2% to 4.2% in transport, storage and communication, 0.6% to 1.1% in finance and business service, 3.8% to 9.3% in community and personal service and 4.4% to 2.2% in household sector (see Fig. 2.2.3). Taking account of the phenomenon mentioned above, it is clear that the industrial structure in Bangladesh is changing.

Though the open unemployment rate (about 30% in 1996/97) based on official statistics is low, extremely high underemployment caused by the less demand for labor is a major challenge in the labor market. It is estimated that about 40% of the 56.0 million labor force are underemployed, or are forced to work less than full time. Wage rates are substantially different between the rural and urban areas, public and private enterprises, and informal and formal. An international comparison shows that labor costs in Bangladesh are probably one of the lowest in Asia. For example, the annual wage rate for making shirts in Bangladesh is only one half that in India and Sri Lanka, one quarter that in Pakistan.

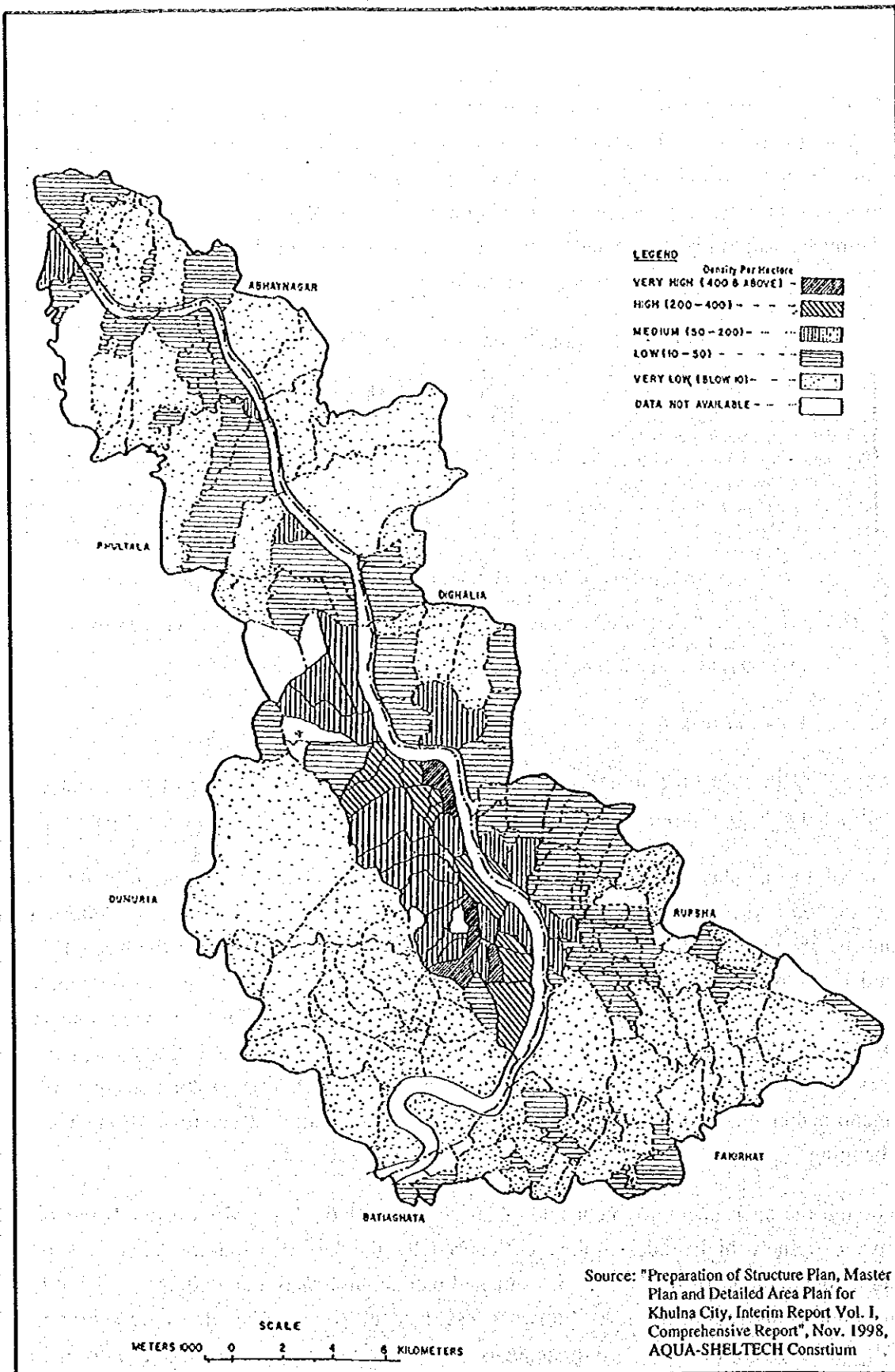


Fig. 2.2.1 Population Density, 1991

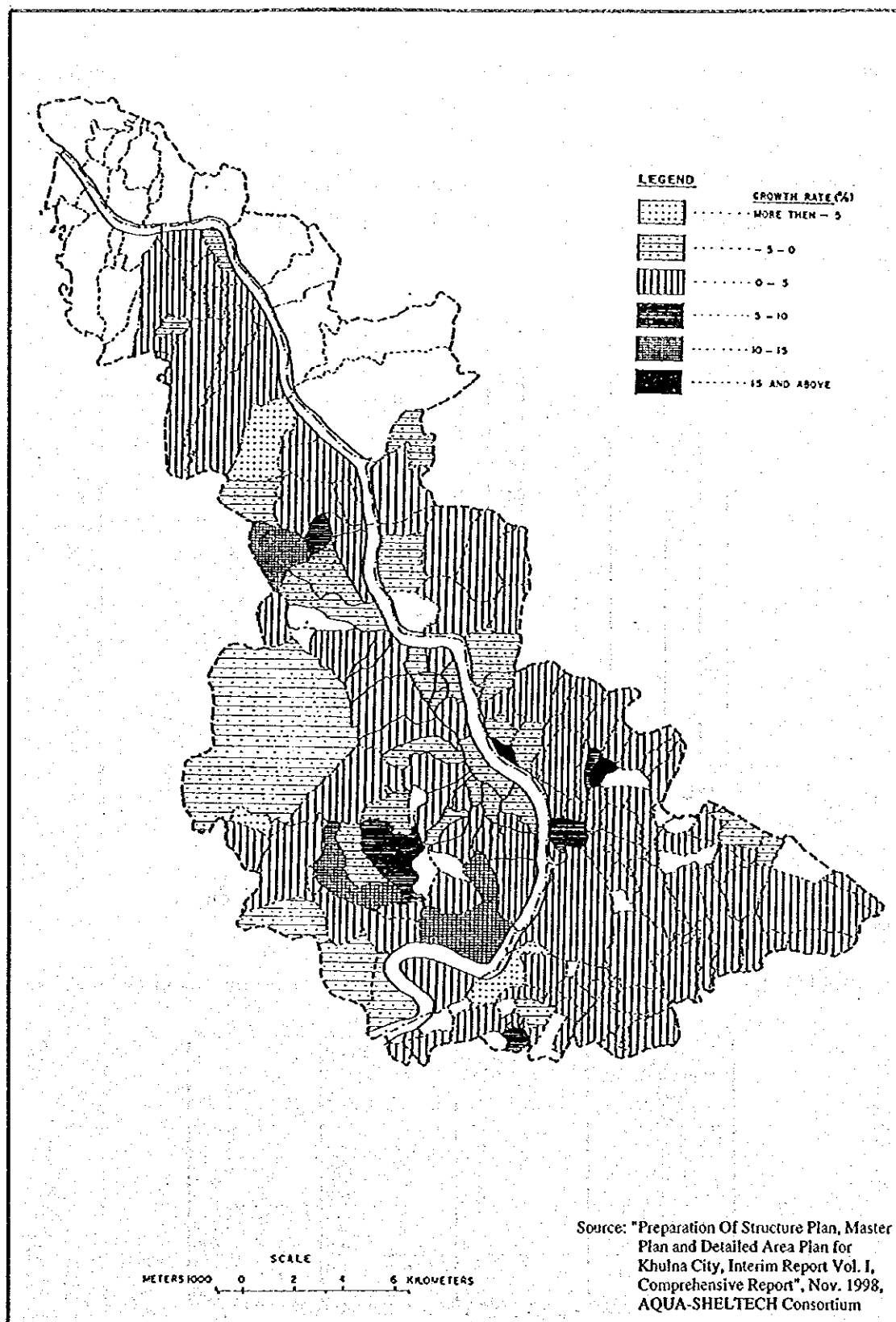
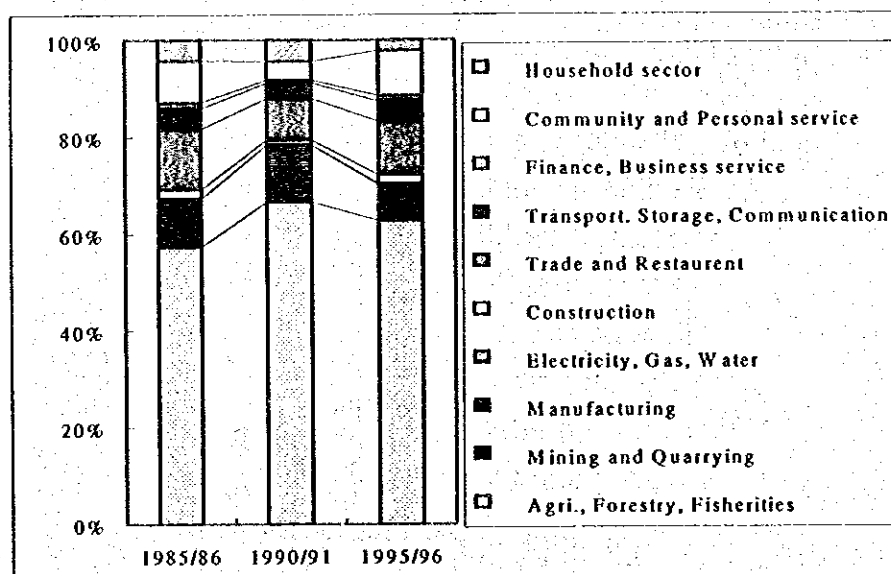


Fig. 2.2.2 Population Growth, 1981-1991

The number of economically active persons aged 15 and over was 50.3 million in Bangladesh, of which 1.3 million are in Khulna Zila and 0.8 million are in Bagerhat Zila. The economically active persons in urban area are 18.3% in the country, while those are 70.4% in Khulna Zila and 9.5% in Bagerhat Zila. The share in Khulna Zila is almost same in capital Dhaka, and it shows that Khulna Zila has the many chances of urban economic activities. On the other hand, the economic activities in Bagerhat Zila are mainly based on agriculture. (see Table 2.2.3)



Source: 1997 Statistical Yearbook of Bangladesh

Fig. 2.2.3 Trend of Labor Force Composition by Industry

Table 2.2.3 Economically Active Persons aged 15 and over by Zila in 1995/96

	(x 1000)		
	Urban	Rural	Total
Bangladesh	9187	41150	50337
(%)	18.3	81.7	100
Dhaka Zila	2046	845	2891
(%)	70.8	29.2	100
Chittagong Zila	1182	1170	2352
(%)	50.3	49.7	100
Khulna Zila	901	378	1279
(%)	70.4	29.6	100
Bagerhat Zila	73	699	772
(%)	9.5	90.5	100

Source : 1997 Statistical Yearbook of Bangladesh

2.2.3 Land Use

Important developments in Khulna area took place since 1960s. Some of these are shipyard, jute mills, newsprint factory, match factories, KDA industrial estate at Shiromoni, housing estates and land development schemes at Khalishpur, Mujgunni and Boyra, roads like Khulna Bypass connecting Khulna-Jessore highway with the proposed bridge over the Rupsa river, new market, inter-city bus terminal, parks, cantonment, medical college, university and other activities. Over the years, some areas adjacent to the KCC area have been developing. The present trend of growth is on the south side of Rupsa river and along the Khulna-Mongla road which is emerging as the new axis of urban growth, and some developments on Khulna-Satkhira road began to take place after the establishment of Khulna University and housing areas like Nirala area.

Table 2.2.4 and Fig. 2.2.4 show broad categories of land use in the KDA Master Plan Study Area. A clear dominance of farmland is observed in existing land use pattern. Of the total 41,966 ha of 69% is used for field crop production. About 19% are used as rural settlements. The next position of land use goes to water-bodies such as ponds, rivers, canals, swamps, etc. The urban residential area comprise mixed and planned housing areas. The coverage under urban housing constitutes 3.4% of the estimation indicates about 1,424 ha belong to urban housing of which planned area cover about 20%.

Table 2.2.4 Present Land Use Pattern

Land Use Classification	Area (ha)	%
Commercial	126	0.3
Urban Housing	1,441	3.4
(Mixed Residential)	(1,152)	(2.7)
(Planned Residential)	(289)	(0.7)
Rural Settlement	8,068	19.2
Administrative	189	0.5
Education & Health	285	0.7
Industrial	620	1.5
Warehouse	121	0.3
Transport Establishment	324	0.8
Agricultural Land & Others	28,987	69.1
Shrimp Farm	156	0.4
Water-bodies	1,631	3.9
Total	41,948	100.0

Source: KDA Master Plan Report

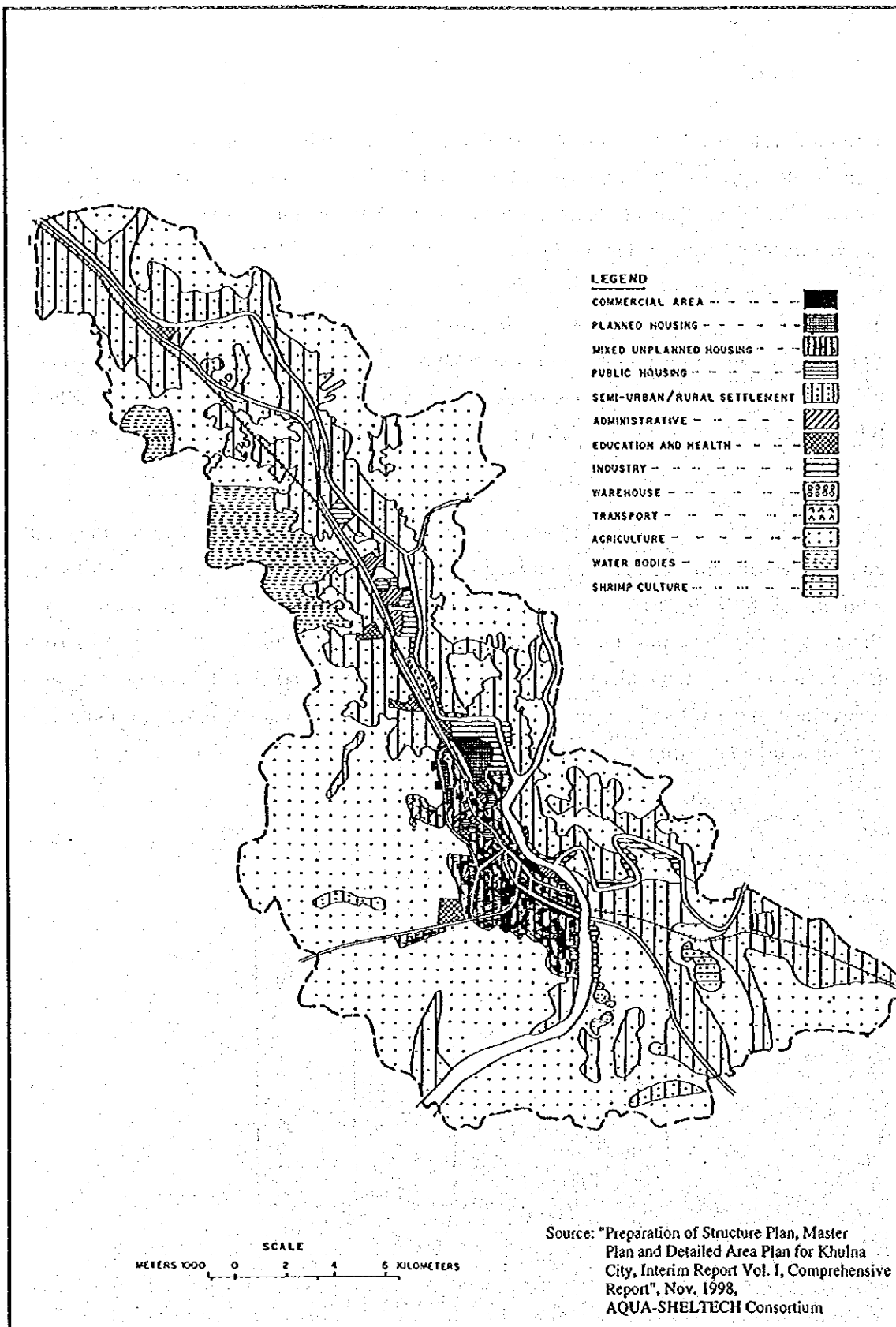


Fig. 2.2.4 Present Land Use

2.2.4 Transportation System

Bangladesh is served by four (4) modes of transport, namely rail, road, water and air transport. More and less, these four modes of transport are having with a number of problems and being constrained by these problems, the transport system in Bangladesh has been operating across the different regions of the country. And the three modes of transportation - rail, roads and waterways are available for the movement of passenger and goods traffic in Khulna area. The summary of the existing individual transport mode is as follows:

(1) Railway

The rail transport of the country consists of both broad gauge and meter gauge lines. Out of total 2,706 route Km, broad gauge accounts for 34%, while the meter gauge accounts for 66%. The existing railway system is divided into roughly two equal parts by the river Jamuna and Padma. The bulk of the meter gauge lines are in the eastern part of the country and remainder is in the western part. The two systems were previously linked by ferry at two points of the river Jamuna, namely Bahadurabad-Fulchhari and Jamalganj-Sirajganj. On completion of the Jamuna Multipurpose Bridge, two parts of the country were linked by "dual gauge" line laid on the bridge.

The Khulna area is served by a broad gauge main line from Khulna to Jessore. It is the main railway transportation route of the Khulna city which establishes railway links with the northern, eastern and southeastern regions of the country. The railway line also established very good links with roads and waterways in the Khulna city.

(2) Roads

The road transport of Bangladesh plays an important role in providing nationwide transport services. The growth of traffic (both passenger and freight) over the years has been largely shared by the road transport of the country. Although other modes of transport are also sharing the increased transport, the predominance of road transport (both motorized and non-motorized) in carrying the increased traffic is remarkable. The detailed situation of current road development and road traffic will be described later.

Presently, the ferry facilities are provided with about 80 river gaps without bridges on the RHD road network, of which the ferry ghats (piers) are developed at 75 river gaps; among them 12 are on national highways, 19 on regional highways and 44 on feeder roads. There are 12 ferry ghats in Khulna RHD Zone (one of the seven regional administrative zones under RHD).

(3) Waterways

Inland water transport is the oldest mode of transport in Bangladesh. In fact, rivers in Bangladesh are the lifeline of nation which provide the cheapest means of transport and the water for agricultural operation and ensure supply of fish for the people. The inland water transport is composed of both mechanized and non-mechanized water vessels plying in the country. These water vessels provide services across the country's navigable waterways. The navigable waterways consist of roughly 5,968 Km during monsoon and about 3,865 Km in the dry season. The river network is a natural drainage of the country and it has been a major means of transport for some areas, particularly the southern divisions such as Khulna and Barisal of the country. The inland water transport services are mainly provided by the private sector.

The two seaports of Bangladesh are Chittagong and Mongla. Among many river ports Dhaka, Narayanganj, Chandpur, Barisal, Khulna, Aricha, Bhairab Bazar etc. are important terminals.

The river Rupsa is principal river transportation route serving the Khulna city. Rupsa River is an important channel of the Madhumadhi river system. In Khulna region, its tributaries are forming a network of river transportation from primary to tertiary. There are regular launch communications between Khulna and adjacent district and thana towns and important trading centers. In total 22 launches operate in 12 routes everyday. Besides rocket steamer service by IWTA operates one steamer everyday between Dhaka and Khulna. Large number of barges and cargo launches and other water vessels carrying cargo operate between Khulna and other destination such as Mongla, Dhaka, Chittagong and Barisal. Moreover, there are 33 river ghats within the Khulna area.

(4) Air transport

Air transport system in Bangladesh operates through eight (8) operational airports including two (2) international airports. Dhaka is connected by air with a lot of major foreign cities by the national airline (Biman). A number of foreign airlines operate their international services with a link to Dhaka. Domestic air transport is serviced by the Biman between Dhaka and other major cities in the country. Moreover, the private airlines have started operating on the domestic routes recently.

Air transport links the Khulna city through the Jessore Airport (62 km from Khulna) with the capital city of Dhaka and Chittagong. The Dhaka-Khulna indirect air service requires almost two hours extra road journey. Civil Aviation is studying on a new STOL airport at Foila on Khulna-Mongla road, about 21 km south from Khulna.

2.2.5 Gross Domestic Product (GDP)

Recent macroeconomic management in Bangladesh has achieved successes in promoting stability in the economy. GDP growth has improved in recent years.

As shown in Table 2.2.5 and Fig. 2.2.5, annual growth rate of GDP of 4.8% was observed from 1990/91 to 1996/97. Because Bangladesh economy is structurally an agrarian economy, the agriculture sector continued to play a major role in the national economy. Although the share declined in the last decade, it still constitutes about one third (32.4% in 1996/97) of total GDP, and engages two third (62.7% in 1995/96) of total domestic labour force. Food security and the performance of agriculture both continue to be important factors in the country's overall economic performance in general and poverty alleviation in particular.

In the recent years, although manufacturing sector's contribution is slightly more than that of previous years, it is not yet substantially high. The contribution of manufacturing increased from 9.8% in 1990/91 to 11.1% in 1996/97.

The GDP has increased steadily during 1991 - 1996, however, the per capita GDP has not significantly increased over the years. From TK 4,694 in 1990/91, per capita GDP has increased to TK 5,472 in 1996/97 at constant market price. Annual growth rate of per capita GDP was 2.6% during the same period.

In general, the regional GDP variations reflect the effects of a number of factors such as natural resources, location of industry, availability of agriculture land and government policies on regional development and investment. In Khulna Former District, the regional GDP and per capita GDP were TK 35,909 million and TK 5,985 in 1996/97 respectively (see Table 2.2.6). Khulna's contribution to whole country's GDP was 5.3% in 1996/97. The annual growth rate of GDP during 1990/91-1996/97 in Khulna was 4.6%, this was almost same as that of GDP of the country. Although the composition of GDP by industrial sector in Khulna is structurally same as that of whole country, the shares of manufacturing and transport & communication sector in Khulna are slightly higher than that in whole country. On the contrary, the shares of electricity, gas & water, banking & insurance and professional services become a little low (see Fig. 2.2.6). It is by reason of that Khulna Former District possesses a number of industries such as textile, newsprint, hardboard, iron-re-rolling, ship building, engineering workshop and fish processing. Moreover, it includes Mongla Port which is the second sea port of the country and is performing an important role by facilitating transshipment of freights between Bangladesh and other countries of the world.

Table 2.2.5 GDP by Sector in Bangladesh (Constant 1984/85 Prices)

(Unit: million TK)

	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98 ^a
A. Agriculture	193,421	197,662	201,230	201,915	199,822	207,126	220,456	227,325
1. Crops	152,575	155,101	156,392	153,852	148,068	152,168	161,572	164,193
2. Forestry	12,845	13,147	13,536	14,077	14,712	15,338	15,980	16,667
3. Livestock	14,102	14,615	15,522	16,841	18,239	19,706	21,278	22,980
4. Fisheries	13,899	14,799	15,780	17,145	18,803	19,914	21,626	23,485
B. Industry	88,294	94,558	102,105	110,044	119,234	125,603	130,389	139,869
1. Mining & Quarrying	80	94	107	121	137	174	222	278
2. Manufacturing	50,423	54,117	59,033	63,665	69,165	72,823	75,401	81,480
a. Large Scale	29,269	32,342	36,627	40,363	44,884	47,595	49,189	54,167
b. Small Scale	21,154	21,775	22,406	23,302	24,281	25,228	26,212	27,313
3. Construction	31,087	32,471	34,032	36,074	38,593	40,146	42,098	44,708
4. Electricity, Gas & Water	6,704	7,876	8,933	10,184	11,339	12,460	12,668	13,403
C. Services	232,727	243,969	256,894	271,881	290,737	309,712	329,361	350,933
1. Transport & communications	60,840	63,349	66,416	70,089	74,203	77,889	82,949	88,506
2. Trade Services	46,707	48,561	50,631	53,284	58,669	64,544	68,797	73,069
3. Housing Services	39,316	40,656	42,197	43,792	45,457	47,204	49,039	50,965
4. Public Administration & Defence	22,334	24,184	26,240	28,484	30,962	33,533	36,344	40,087
5. Banking & Insurance	9,755	10,002	10,302	10,663	11,090	11,478	11,914	12,366
6. Professional & Miscellaneous Services	53,775	57,217	61,108	65,569	70,356	75,064	80,318	85,940
GDP at Constant Prices	514,442	536,189	560,229	583,840	609,793	642,441	680,206	718,127
Population (million)	109.6	113.3	115.5	117.7	119.9	122.1	124.3	126.6
Per Capita GDP	4,694	4,732	4,850	4,960	5,086	5,262	5,472	5,677
Annual Growth of GDP (%)	3.4	4.2	4.5	4.2	4.4	5.3	5.9	5.6
Annual Growth of Per Capita GDP (%)	1.4	2.1	2.5	2.3	2.5	3.5	4.0	3.7

Note : a; provisional

Source : 1997 Statistical Yearbook of Bangladesh

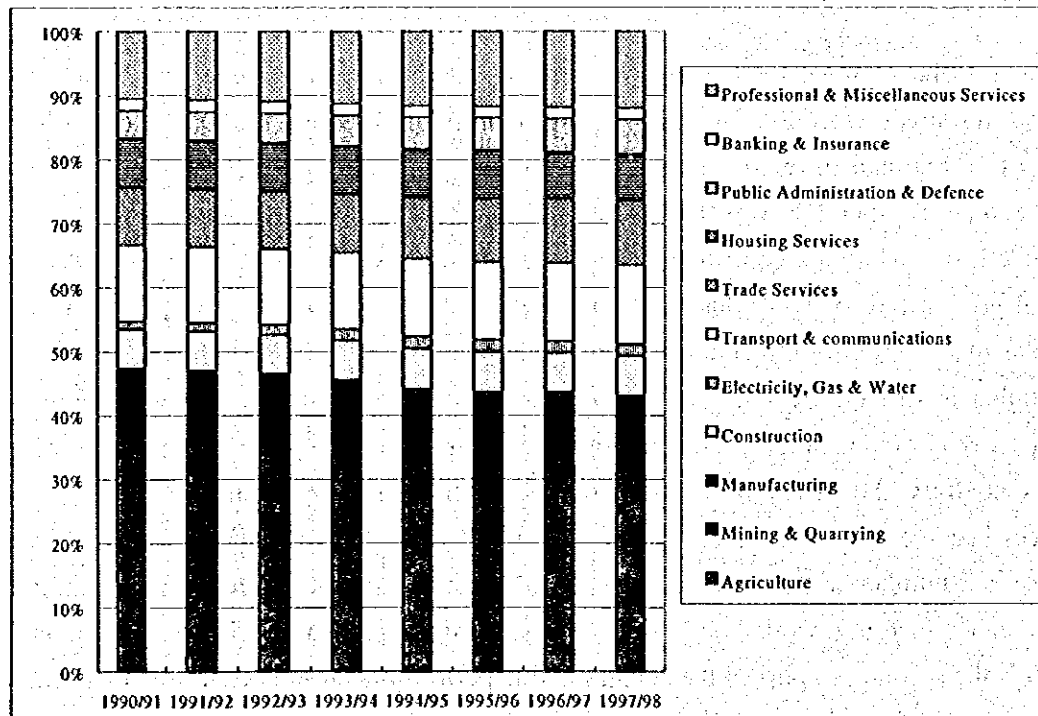


Fig. 2.2.5 Trend of GDP Composition by Sector in Bangladesh

Table 2.2.5 GDP by Sector in Bangladesh (Constant 1984/85 Prices)

(Unit: million TK)

	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98 ^a
A. Agriculture	193,421	197,662	201,230	201,915	199,822	207,126	220,456	227,325
1. Crops	152,575	155,101	156,392	153,852	148,068	152,168	161,572	161,193
2. Forestry	12,845	13,147	13,536	14,077	14,712	15,338	15,980	16,667
3. Livestock	14,102	14,615	15,522	16,841	18,239	19,706	21,278	22,980
4. Fisheries	13,899	14,799	15,780	17,145	18,803	19,914	21,626	23,485
B. Industry	88,294	94,558	102,105	110,044	119,234	125,603	130,389	139,869
1. Mining & Quarrying	80	94	107	121	137	174	222	278
2. Manufacturing	50,423	54,117	59,033	63,665	69,165	72,823	75,401	81,480
a. Large Scale	29,269	32,342	36,627	40,363	44,884	47,595	49,189	54,167
b. Small Scale	21,154	21,775	22,406	23,302	24,281	25,228	26,212	27,313
3. Construction	31,087	32,471	34,032	36,074	38,593	40,146	42,098	44,708
4. Electricity, Gas & Water	6,701	7,876	8,933	10,181	11,339	12,460	12,668	13,403
C. Services	232,727	243,969	256,894	271,881	290,737	309,712	329,361	350,933
1. Transport & communications	60,840	63,349	66,416	70,089	74,203	77,889	82,949	88,506
2. Trade Services	46,707	48,561	50,631	53,284	58,669	64,544	68,797	73,069
3. Housing Services	39,316	40,656	42,197	43,792	45,457	47,204	49,039	50,965
4. Public Administration & Defence	22,334	24,184	26,240	28,484	30,962	33,533	36,314	40,087
5. Banking & Insurance	9,755	10,002	10,302	10,663	11,090	11,478	11,914	12,366
6. Professional & Miscellaneous Services	53,775	57,217	61,108	65,569	70,356	75,064	80,318	85,940
GDP at Constant Prices	514,442	536,189	560,229	583,840	609,793	642,441	680,206	718,127
Population (million)	109.6	113.3	115.5	117.7	119.9	122.1	124.3	126.6
Per Capita GDP	4,694	4,732	4,850	4,960	5,086	5,262	5,472	5,677
Annual Growth of GDP (%)	3.4	4.2	4.5	4.2	4.4	5.3	5.9	5.6
Annual Growth of Per Capita GDP (%)	1.4	2.1	2.5	2.3	2.5	3.5	4.0	3.7

Note : a; provisional

Source : 1997 Statistical Yearbook of Bangladesh

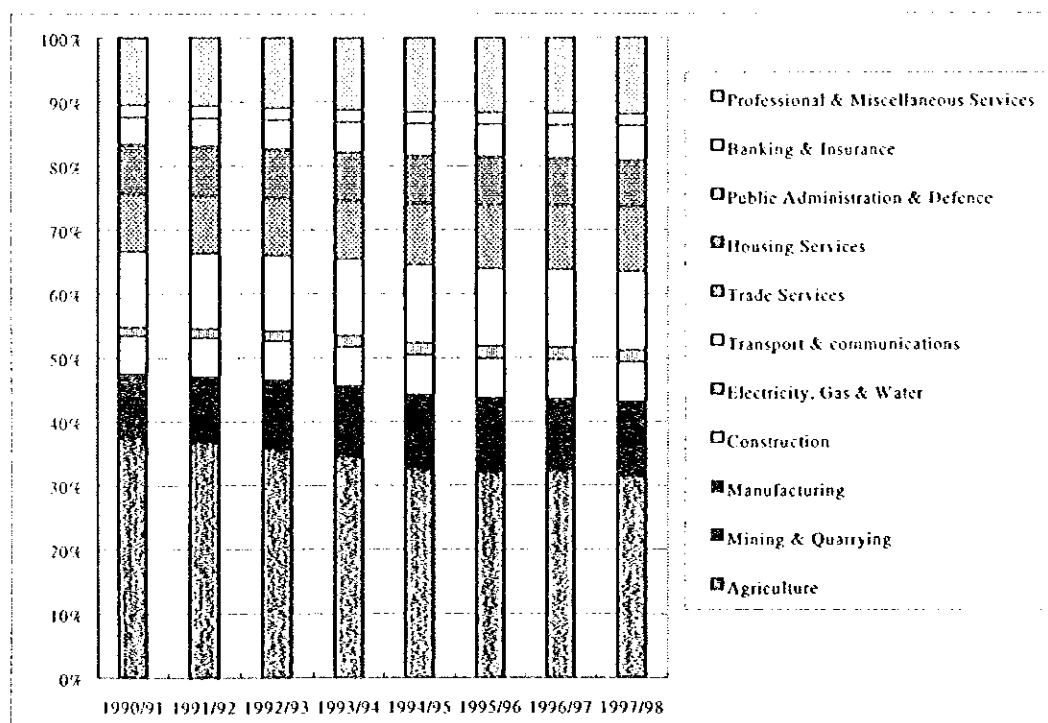


Fig. 2.2.5 Trend of GDP Composition by Sector in Bangladesh

Table 2.2.6 GDP by Sector in Khulna Former District (Constant 1984/85 Prices)

(Unit: million TK)

	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97
A. Agriculture	10,279	10,643	11,508	11,435	11,006	11,579	11,572
1. Crops	6,041	6,302	6,502	6,472	5,811	6,118	5,811
2. Forestry	3,137	3,205	3,370	3,549	3,582	3,735	3,892
3. Livestock	662	671	1,053	778	835	902	974
4. Fisheries	439	465	583	636	778	824	895
B. Industry	4,409	4,753	5,235	5,784	6,259	6,611	6,856
1. Mining & Quarrying	0	0	0	0	0	0	0
2. Manufacturing	2,562	2,825	3,189	3,589	3,895	4,128	4,267
a. Large Scale	2,473	2,733	3,095	3,411	3,793	4,022	4,157
b. Small Scale	89	92	94	98	102	106	110
3. Construction	1,568	1,638	1,717	1,820	1,947	2,025	2,123
4. Electricity, Gas & Water	279	290	329	375	417	458	466
C. Services	12,794	12,988	13,643	14,446	15,437	16,440	17,481
1. Transport & communications	3,743	3,897	4,086	4,312	4,565	4,792	5,103
2. Trade Services	2,485	2,161	2,810	2,957	3,256	3,582	3,818
3. Housing Services	1,983	2,051	2,128	2,209	2,293	2,381	2,473
4. Public Administration & Defence	1,070	1,159	1,244	1,364	1,498	1,620	1,754
5. Banking & Insurance	491	504	479	496	490	507	526
6. Professional & Miscellaneous Services	3,022	3,216	2,896	3,108	3,335	3,558	3,807
GDP at Constant Prices	27,482	28,384	30,386	31,585	32,702	34,630	35,909
Population (million)	5.3	5.4	5.4	5.5	5.8	6	6
Per Capita GDP	5,185	5,256	5,627	5,743	5,638	5,869	5,985
Annual Growth of GDP (%)	3.0	3.3	7.1	3.9	3.5	5.9	3.7
Annual Growth of Per Capita GDP (%)	1.1	1.4	7.1	2.1	-1.8	4.1	2.0

Source : 1997 Statistical Yearbook of Bangladesh

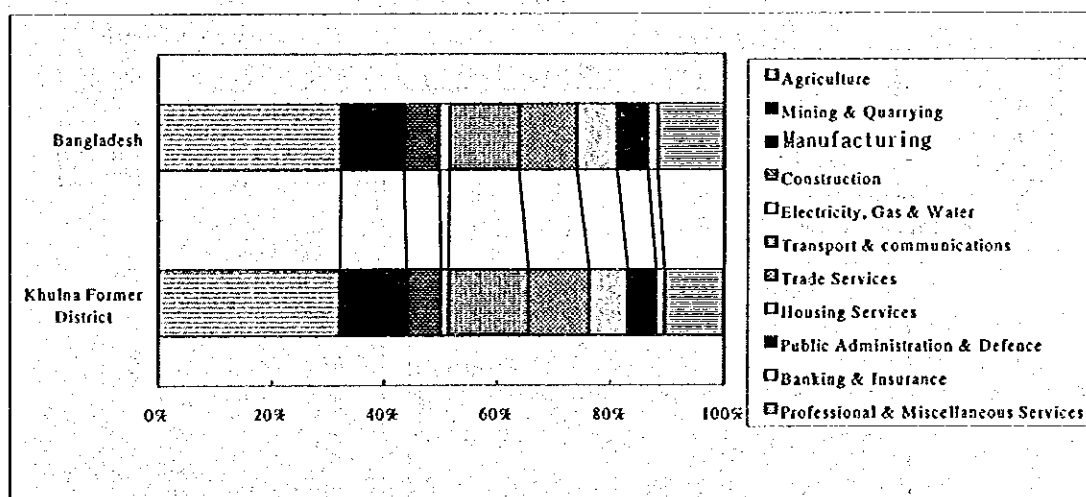


Fig. 2.2.6 Comparison of GDP Composition by Sector

Table 2.2.6 GDP by Sector in Khulna Former District (Constant 1984/85 Prices)

(Unit: million TK)

	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97
A. Agriculture	10,279	10,643	11,508	11,435	11,006	11,579	11,572
1. Crops	6,041	6,302	6,502	6,472	5,811	6,118	5,811
2. Forestry	3,137	3,205	3,370	3,549	3,582	3,735	3,892
3. Livestock	662	671	1,053	778	835	902	974
4. Fisheries	439	465	583	636	778	824	895
B. Industry	4,409	4,753	5,235	5,784	6,259	6,611	6,856
1. Mining & Quarrying	0	0	0	0	0	0	0
2. Manufacturing	2,562	2,825	3,189	3,589	3,895	4,128	4,267
a. Large Scale	2,473	2,733	3,095	3,411	3,793	4,022	4,157
b. Small Scale	89	92	94	98	102	106	110
3. Construction	1,568	1,638	1,717	1,820	1,947	2,025	2,123
4. Electricity, Gas & Water	279	290	329	375	417	458	466
C. Services	12,794	12,988	13,643	14,446	15,437	16,440	17,481
1. Transport & communications	3,743	3,897	4,086	4,312	4,565	4,792	5,103
2. Trade Services	2,485	2,161	2,810	2,957	3,256	3,582	3,818
3. Housing Services	1,983	2,051	2,128	2,209	2,293	2,381	2,473
4. Public Administration & Defence	1,070	1,159	1,244	1,364	1,498	1,620	1,754
5. Banking & Insurance	491	504	479	496	490	507	526
6. Professional & Miscellaneous Services	3,022	3,216	2,896	3,108	3,335	3,558	3,807
GDP at Constant Prices	27,482	28,384	30,386	31,585	32,702	34,630	35,909
Population (million)	5.3	5.4	5.4	5.5	5.8	6	6
Per Capita GDP	5,185	5,256	5,627	5,743	5,638	5,869	5,985
Annual Growth of GDP (%)	3.0	3.3	7.1	3.9	3.5	5.9	3.7
Annual Growth of Per Capita GDP (%)	1.1	1.4	7.1	2.1	-1.8	4.1	2.0

Source : 1997 Statistical Yearbook of Bangladesh

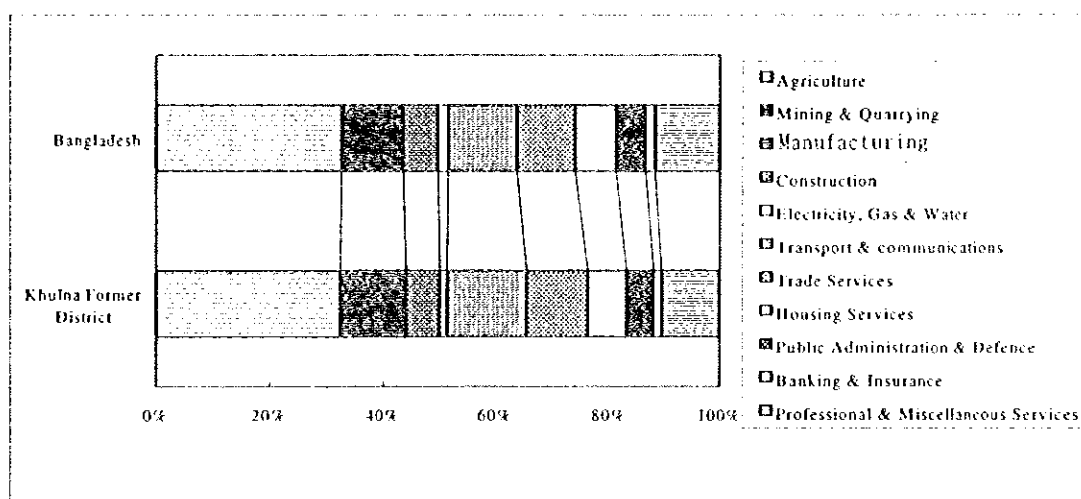


Fig. 2.2.6 Comparison of GDP Composition by Sector

2.2.6 Trade

Trade liberalization and export promotion policy initiated in the early 1990s resulted in a sharp expansion of external trade in Bangladesh. The average growth rate for exports during 1990 - 1996 was about 17%, in terms of US dollars. Imports increased at about 13% per annum during the same period. In the recent year, the export earnings from ready-made garments increased largely. Export earnings from knitwear, raw jute, agricultural products, tea and chemical products also grew progressively. In fact, garments and knitwear alone account for two thirds of the total exports. On the other hand, the proceeds from leather exports declined, as did those of jute products, reflecting a softening of external demand. Export prospects of frozen foods, the fastest growing sector, recently slowed down due to an outbreak of disease and cyclones, and declining prices in the international market. Imports grew slowly. This low growth is attributable mainly to a decline in food-grain import. Moreover, the weak growth of the industrial sector and a stagnant private investment reduced the import demand for raw materials and machinery. (see Table 2.2.7)

Fig. 2.2.7 shows the direction of export and import. The share of export to Europe area from Bangladesh in 1993-94 was the highest, second to North America area. The highest share of import was from Asia excluding Middle East countries.

Table 2.2.7 Export and Import

	(US\$ million)						
	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97 ^a
Export	1,718	1,994	2,383	2,534	3,473	3,882	4,380
Import	3,510	3,526	4,071	4,191	5,834	6,881	7,170
Balance	-1,792	-1,532	-1,688	-1,657	-2,361	-2,999	-2,790

Note : a provisional

Source : Country Economic Review, Bangladesh (ADB, Oct. 1997)

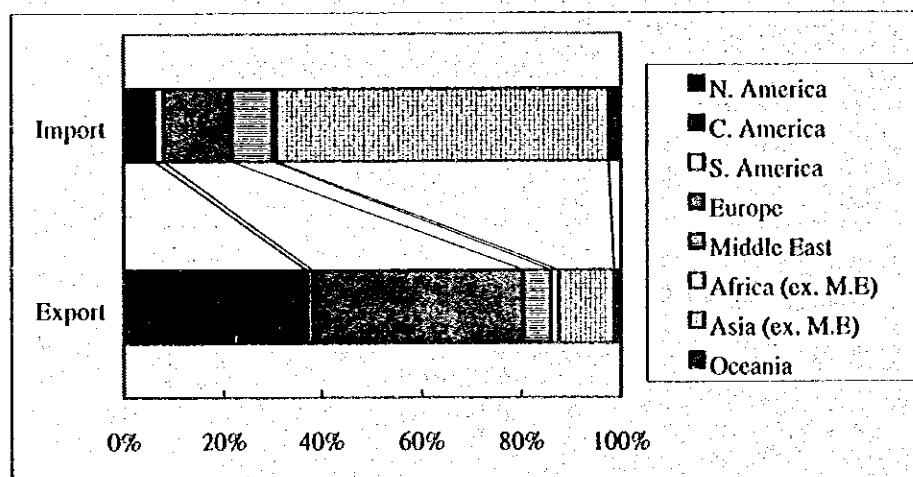


Fig. 2.2.7 Direction of Export and Import by Area in 1993/94

Table 2.2.8 shows cargo throughput statistics of the two seaports in Bangladesh. The total cargo throughput in recent ten years shows an average increase of 3.2% per annum, with exports showing a slightly higher annual growth rate (3.8%) per annum than that of imports (3.1%). The cargo throughput had fluctuated depending on the economic and industrial conditions, however, since it reached a 13 million-ton level in 1994/95, the ports have maintained that level with an increasing trend.

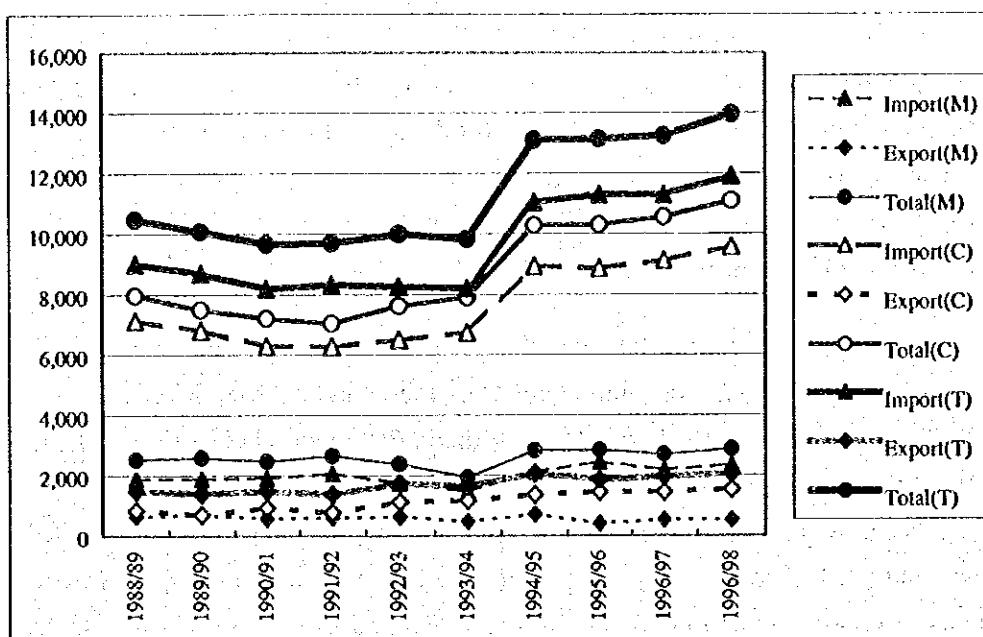
The cargo throughput of Mongla Port has not greatly increased, registering only 1.4% per annum, compared with 3.7% for Chittagong Port (see Fig. 2.2.8). Moreover, exports of Mongla Port have decreased, partly due to more than 50% reduction in exports of jute goods. It is assumed that Mongla Port has been losing its significant role as an export and import base, partly because the traditional industries in its hinterland have not adopted to modern world trade and partly because Mongla Port lacks efficient inland transport infrastructure to distribute its cargo to/from its hinterland.

Table 2.2.8 Cargo Throughput in Bangladesh Ports

(Unit: x 1000 Metric Tons)

Year	Mongla Port			Chittagong Port			Total		
	Import(M)	Export(M)	Total(M)	Import(C)	Export(C)	Total(C)	Import(T)	Export(T)	Total(T)
1988/89	1,882	637	2,519	7,122	836	7,958	9,004	1,473	10,477
1989/90	1,892	695	2,587	6,798	695	7,493	8,690	1,390	10,080
1990/91	1,904	557	2,461	6,282	919	7,201	8,186	1,476	9,662
1991/92	2,054	596	2,650	6,267	770	7,037	8,321	1,366	9,687
1992/93	1,758	621	2,379	6,496	1,120	7,616	8,254	1,741	9,995
1993/94	1,463	467	1,930	6,728	1,169	7,897	8,191	1,636	9,827
1994/95	2,120	706	2,826	8,925	1,354	10,279	11,045	2,060	13,105
1995/96	2,443	396	2,839	8,851	1,450	10,301	11,294	1,846	13,140
1996/97	2,171	521	2,692	9,117	1,437	10,554	11,288	1,958	13,246
1996/98	2,339	528	2,867	9,561	1,527	11,088	11,900	2,055	13,955

Source: Statistics of Mongla Port Authority and Chittagong Port Authority



Note: (M), (C) and (T) show Mongla Port, Chittagong Port and Total, respectively.

Fig. 2.2.8 Trend of Cargo Throughput by Port

2.3 Socioeconomic Framework

2.3.1 Review of Fifth Five Year Plan

The Fifth Five Year Plan (1997-2002) (hereinafter referred to as the "5FYP") was formulated in June 1997, as a vision-rich guide toward comprehensive development in Bangladesh. The main features of the 5FYP are described herein.

The 5FYP aims to achieve a target GDP growth rate of over 7% with an estimated outlay during the 5FYP period of TK 2,034 billion. Out of this, the public sector will contribute about 42% of the total outlay with the remaining 58% to be financed by the private sector. The 5FYP aims toward achieving a high degree of self-reliance. That is to say, about 74% of the total outlay will be financed from domestic sources.

The 5FYP will give priority to the agricultural sector so as to maximize its contribution to overall growth of the economy and food security. Next in priority is the industrial sector, the key to Bangladesh's entry into the 21st century as a modern growing economy.

Table 2.3.1 shows the scale of the Plan by the terminal year (2001/2002). The average annual growth rates during the 5FYP period are 7.3% for GDP, 1.36% for population, 4.1% for employment, and 5.5% for per capita GDP, respectively.

Table 2.3.1 Scale of the 5FYP (at 1996/97 Prices)

	1996/97	2001/2002	Annual Growth Rate (%)
GDP (million TK)	1,402,235	1,993,504	7.3
Agriculture	418,306	508,933	4.0
Industry	129,765	263,919	15.3
Construction	82,346	115,495	7.0
Power, Gas	30,834	94,099	25.0
Transport	158,040	225,048	7.3
Housing Services	134,117	165,109	4.2
Public Administration	79,048	98,508	4.5
Health	19,184	27,541	7.5
Education	58,685	83,566	7.3
Trade Services	125,799	179,137	7.3
Banking, Insurance	28,084	37,583	6.0
Prof. & Misc. Services	138,026	194,565	7.1
Population (million)	123.8	132.5	1.36
Employment (x1000 persons)	49,071	62,312	4.1
Agriculture	30,912	36,918	3.0
Industry	3,650	6,466	10.0
Power, Gas	103	238	15.0
Construction	1,015	1,323	4.5
Transport, Communications	2,196	2,904	4.8
Trade, Other Services	11,195	14,463	4.4
Per Capita GDP (TK)	11,494	15,045	5.5

Note : Base year of Employment is 1995/96 (from Labour Force Survey).

Per Capita GDP is calculated by the Study Team.

Source : The Fifth Five Year Plan 1997-2002

In the 5FYP document, the outlook for future population in the whole country is described as follows:

Table 2.3.2 Outlook of Population

	1996/97	2001/2002	2004/2005	2009/2010	2019/2020
Population (million)	123.8	132.5	137.8	147.1	166.5
Growth Rate (%)	1.75	1.36	1.32	1.31	1.25

Source : The Fifth Five Year Plan 1997-2002

2.3.2 Development Plans for Transport Sector

An adequate and efficient transport system is a prerequisite for both initiating and sustaining economic development. Investment in improving transport efficiency is the key to expansion and integration of markets. To achieve an average GDP growth rate of over 7% per annum and to transform from subsistence to a market-based economy, the transport sector growth rate would be expected to increase considerably by 8-9% per annum. This high growth in transport volume would necessitate a substantial improvement in the transport system for smooth operation.

One result of the strategy of striving for an optimal mix of the 'market integration approach' and 'poles of development approach' is that development efforts will be concentrated in five (5) main corridors:

- Dhaka - Chittagong Corridor
- Dhaka - Northwest Corridor
- Dhaka - Khulna Corridor
- Dhaka - Sylhet Corridor
- Khulna - Northwest Corridor

In particular, development efforts on the Dhaka - Chittagong, the Dhaka - Northwest, and the Khulna - Northwest arterial corridors are to be emphasized. The main development strategies planned to be conducted during the 5FYP period are as follows:

- "Arterial Corridors" will be re-designated as "Strategic Corridors" and the necessary investment made for the development of bridges, ferries and road on these corridors. Emphasis will be on the Khulna - Northwest Corridor to raise it to international standards capable of serving regional and inter-regional traffic.
- The two seaports, Chittagong and Mongla, will be further developed and linked to Dhaka, thereby connecting all the four major regions of the country.
- Railway linkages will be established between eastern and western Bangladesh.

Then, the relative items of priority investment programs or projects in the 5FYP are as follows:

- Completion of the Jamuna Multipurpose Bridge project along with access roads.
- Completion of Dhaka Eastern Bypass.
- Construction of three major road bridges: Rupsa Bridge at Khulna, the Paksey bridge on the Khulna - Northwest Corridor, and the Bhairab bridge at Ashuganj on the Dhaka - Sylhet Corridor.
- Completion of the Jamuna Railway project.
- Rehabilitation and completion of the construction of ongoing arterial roads projects including their maintenance.
- Development of the airports at Barisal, Khulna (or Bagerhat), Bogra, Rajshahi and Saidpur to accommodate larger aircraft, (among other targets).

Moreover, infrastructure development projects related to the Study area are as follows:

- Mongla Port Development
- Benapol and Bohmura Dry Port Development
- Paksey Bridge Construction
- Dhaka-Mawa-Khulna Road Development

Fig. 2.3.1 is the schematic illustration of development plans for transport sector in the Study area and its surrounding area.

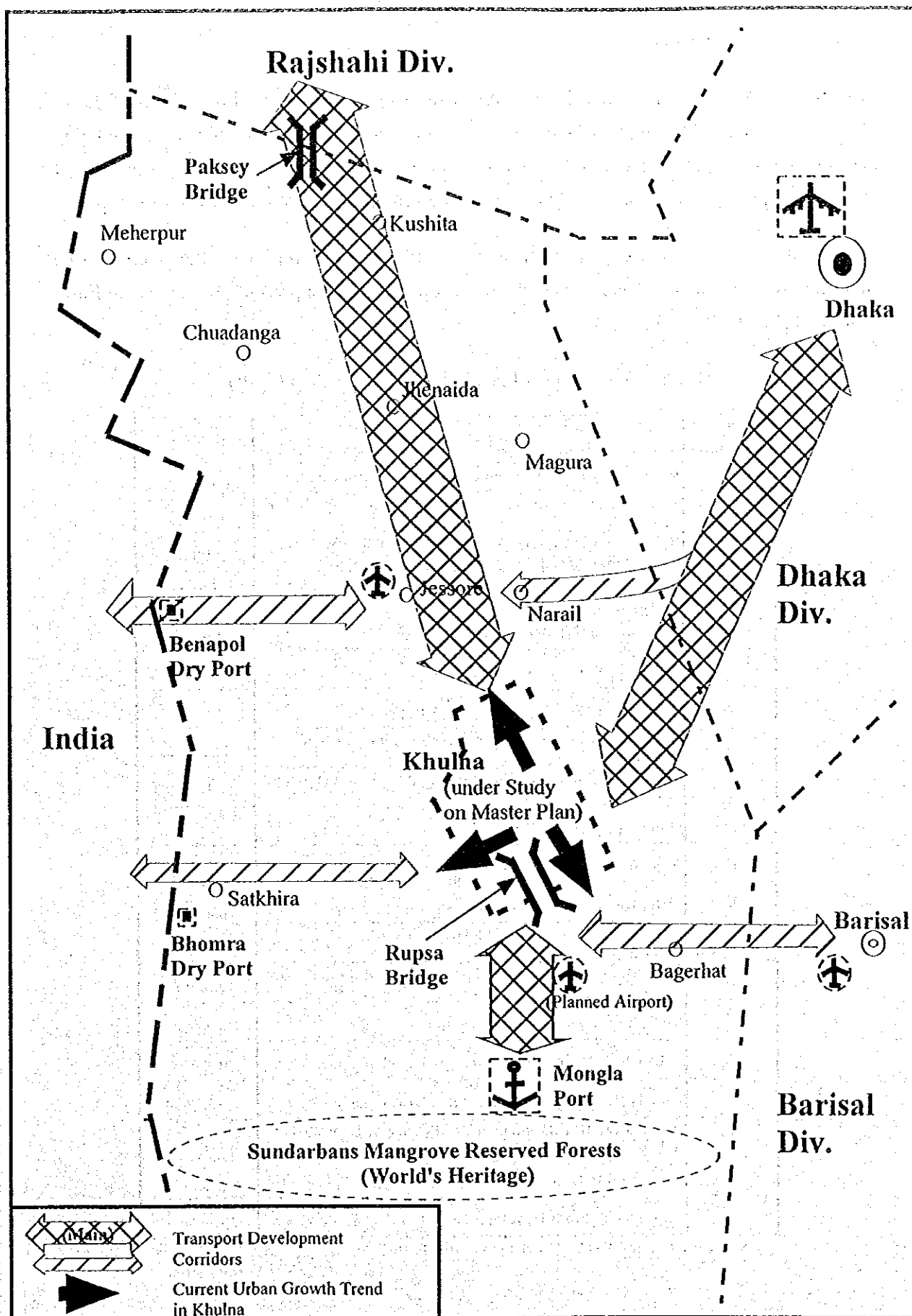


Fig. 2.3.1 Transport Development Strategies in Study and its Surrounding Area

2.3.3 KDA Master Plan

The Khulna Development Authority (KDA) is revising the outdated 1961 Khulna Master Plan. A revised Master Plan envisages the city to perform its role in stimulating metropolitan economic growth and socioeconomic development through the instruments of physical planning, water supply, and housing, as identified in the national development plan.

At present, the study of this plan is in progress, and the final report on the plan is to be submitted in November of 1999. The planned projects (draft) at present phase are as follows (refer to Table 2.3.3 and Fig. 2.3.2):

Table 2.3.3 Project Lists in KDA Master Plan (draft)

Reference No	Project Name	Remarks
①	Khulna City Bypass (from Fultala to Satkhira Road)	17.35 km, (ongoing)
②	Widening and Improvement of Jail Swarani-Kaya Bazar Road	6.90 km
③	Road Link from Inter-district Bus Terminal to W.D.B. Bhankment Road	2.00 km
④	Sonadanga Residential Area Development	121 acres (ongoing)
⑤	Rupsa Satellite Town Development	100 acres
⑥	Gallamari Residential Area Development	51 acres
⑦	Fulbari Gate Residential Area Development	20 acres
⑧	Ashanabad Residential Area Development (north of Khulna University)	150 acres
⑨	Sundarban Commercial/Residential Area Redevelopment (Khulna Textile Mill)	24.38 acres
⑩	Outer Bypass Road (Phase II)	(open)
⑪	Road from Shiromoni Market to Bhairab River	1.00 acres (ongoing)
⑫	Mirerdanga Low Cost Housing	42.54 acres (ongoing)
⑬	Mini-community Center at KDA Office Building Premises	(ongoing)
⑭	Establishment of Park and Rest House in Mujgunni Residential Area	(ongoing)
⑮	Rupsa Commercial Area Development	(proposed)
⑯	Labanchara Heavy Industrial Area Development	(proposed)
⑰	Atutala Housing Area/Green Tract Development	(proposed)
⑱	Resort Area Development at Confluence of Bhairab and Atai River	(proposed)
⑲	Shiromoni Industrial Area Development	(proposed)
⑳	Rupsa River Front Development	(proposed)

Source: KDA and KDA Master Plan Study Team

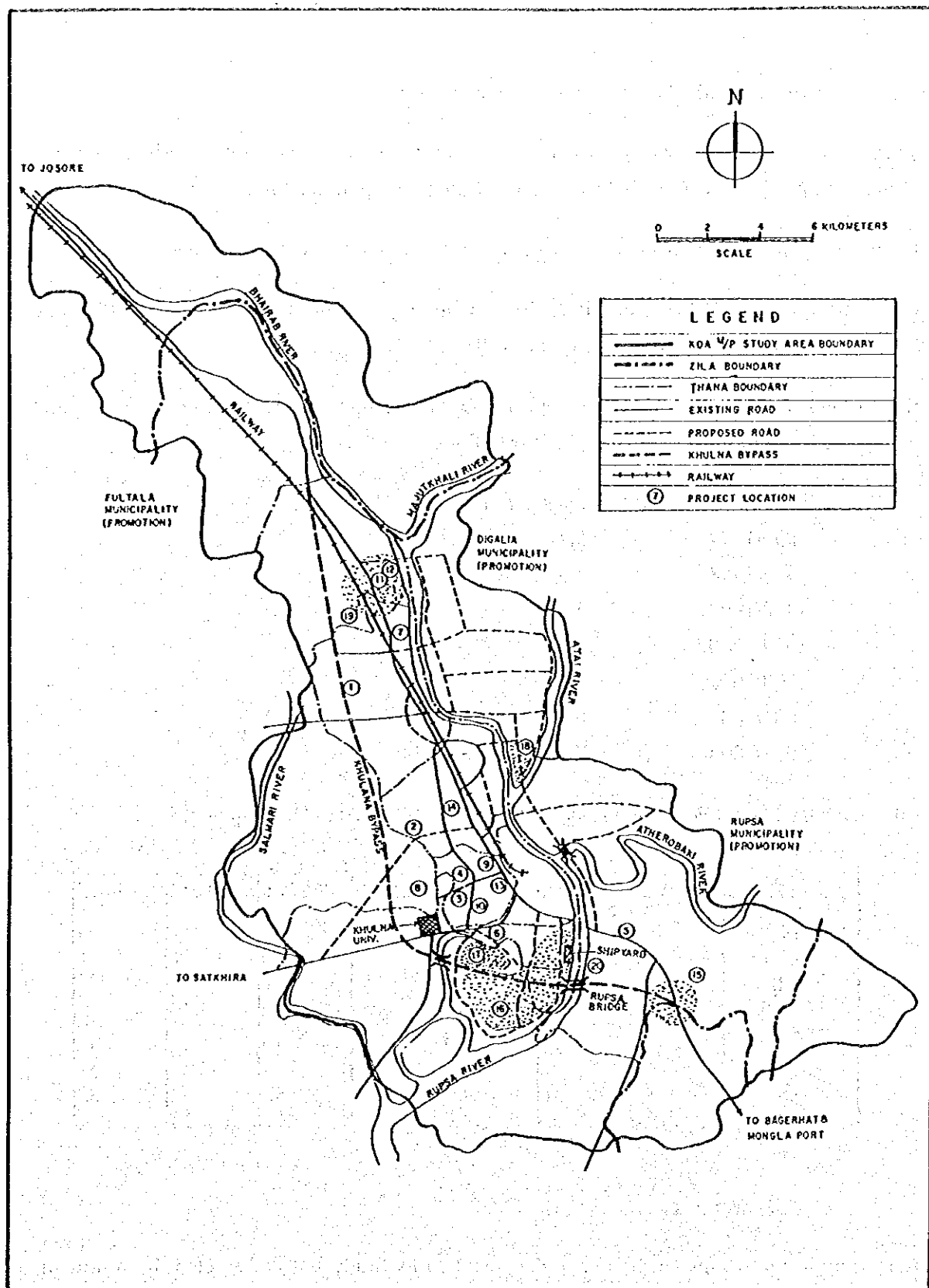


Fig. 2.3.2 Project Location in KDA Master Plan (draft)

2.3.4 Setting up of the Socioeconomic Framework

Taking the economic growth prospects as seen by various agencies into consideration, the socioeconomic framework in 2015 for Bangladesh is set up in this Study.

In this Study, the following documents are reviewed in order to set up the framework.

- (a) The Fifth Five Year Plan 1997-2002, Planning Commission, Ministry of Planning
Average Annual Growth Rate during 1997 - 2002 7.3%
- (b) Bangladesh Annual Economic Update 1997, Economic Performance, Policy Issues and Priority Reforms, Oct. 1997, The World Bank

GDP Growth Rate (%)

1996/1997	5.7
1997/1998	5.5
1998/1999	5.8
1999/2000	6.1
2000/2001	6.4
2001/2002	6.7
2002/2003	7.0

- (c) Country Economic Review, Bangladesh, Oct. 1997, Asian Development Bank

(Unit: %)

	1995/96	1996/97	Projections				
			1997/98	1998/99	1999/2000	2000/2001	2001/2002
Scenario A							
Real GDP	5.4	5.7	6.0	6.4	6.8	7.0	7.1
Agriculture	3.7	6.0	2.5	2.8	3.0	3.0	3.0
Industry	5.3	3.6	8.5	10.0	11.5	12.0	12.2
Services	6.5	6.2	7.2	7.1	7.2	7.2	7.2
Scenario B							
Real GDP	5.4	5.7	4.6	4.7	4.7	4.8	4.9
Agriculture	3.7	6.0	2.5	2.6	2.5	2.5	2.5
Industry	5.3	3.6	4.8	5.0	5.2	5.4	5.5
Services	6.5	6.2	5.7	5.7	5.7	5.8	5.9

Source: Country Economic Review, Bangladesh (Oct. 1997, ADB)

Note: Scenario A; Major structural reforms are implemented effectively and macroeconomic stability is largely maintained during the projection period.

Scenario B; Maintenance of the status quo.

According to the review of the above documents, this Study has constructed the following framework for economic growth until 2015.

- i) Annual average GDP growth prospects during projection period in each document were adopted as follows:

	Annual Average Growth Rate
- 5FYP:	7.3% (1997 - 2002)
- WB:	6.3% (1997 - 2003)
- ADB Scenario A:	6.7% (1997 - 2002)
- ADB Scenario B:	4.7% (1997 - 2002)

- ii) Using long term annual targets for GDP growth of 4.0 - 5.0% as suggested in the "Bangladesh Integrated Transport System Study (BITSS)" (Bangladesh Government, Planning Committee, June 1998), and considering the state of the Asian economy at present, an annual increase of 4.0% in GDP was applied.

- iii) In this Study, population estimates in the 5FYP were also applied.

The socioeconomic framework under consideration is illustrated in Table 2.3.4 and Fig. 2.3.3. Using 1996/97 as the base year, target average annual growth in GDP until 2015 is estimated as:

	Average Annual Growth Rate (1996/97-2014/2015)
- Based on 5FYP estimates:	5.5%
- Based on WB estimates:	5.0%
- Based on ADB Scenario A estimates:	5.2%
- Based on ADB Scenario B estimates:	4.4%

According to these figures, three possible economic frameworks for the future of Bangladesh can be considered; "high growth", "medium growth", and "low growth", as defined below.

	Average Annual Growth Rate of GDP (1996/97 - 2014/15)
- High growth case:	5.5%
- Medium growth case:	5.0%
- Low growth case:	4.4%

The "Medium growth" case as future economic framework was adopted for the forecast of cargo demand handling at Mongla Port and traffic demand forecast in the Phase 1 of this Study.

Table 2.3.4 Socioeconomic Framework

	1996/97	1997/98	1998/99	1999/00	2000/2001	2001/2002	2002/2003	2003/2004	2004/2005	2009/2010	2014/2015
The 5FYP											
Population (million)	123.8			129.0		132.5			137.8	147.1	156.5
Growth Rate (%)	1.75					1.36			1.32	1.31	
GDP (billion TK)	1402.58	1486.90	1594.94	1713.89	1847.18	1998.48	2144.36	2300.90	2468.87	3003.76	3654.53
Growth Rate (%)	5.7	6.01	7.27	7.46	7.78	8.19	7.3	7.3	7.3	4.0	4.0
WB											
GDP (billion TK)	1402.58	1479.72	1565.55	1661.04	1767.35	1885.76	2017.77	2144.89	2280.01	2773.99	3374.98
Growth Rate (%)	5.7	5.5	5.8	6.1	6.4	6.7	7.0	6.3	6.3	4.0	4.0
ADB											
(Scenario A)											
GDP (billion TK)	1402.58	1486.73	1581.89	1689.45	1807.72	1936.06	2065.78	2204.19	2351.87	2861.41	3481.34
Growth Rate (%)	5.7	6.0	6.4	6.8	7.0	7.1	6.7	6.7	6.7	4.0	4.0
(Scenario B)											
GDP (billion TK)	1402.58	1467.10	1536.05	1608.25	1685.44	1768.03	1851.13	1938.13	2029.22	2468.86	3003.74
Growth Rate (%)	5.7	4.6	4.7	4.7	4.8	4.9	4.7	4.7	4.7	4.0	4.0

Note: (1) Annual growth rates of GDP until 2004/2005 apply average annual growth rates during projection period in each scenario.

Average annual growth rates of GDP after 2004/2005 apply 4.0%.

(2) Boldfaced figures show the projected figures in each scenario. The other figures show the estimated figures by the Study Team.

Source: (1) The Fifth Five Year Plan 1997-2002

(2) Bangladesh Annual Economic Update 1997, Economic Performance, Policy Issues and Priority Reforms (Oct. 1997, The World Bank)

(3) Country Economic Review Bangladesh (Oct. 1997, Asian Development Bank)

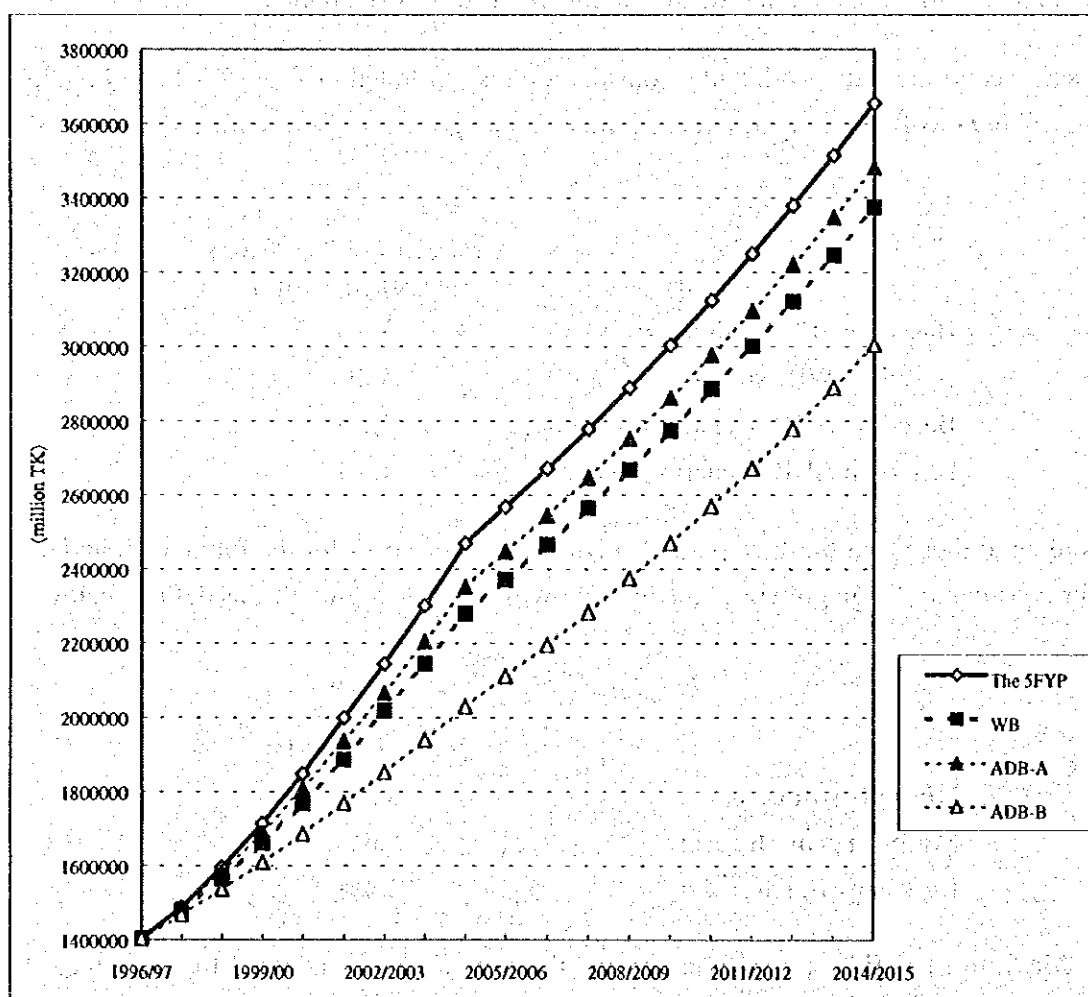


Fig. 2.3.3 GDP Estimates

Moreover, Table 2.3.5 shows the future socioeconomic framework for Khulna Former District forecasted based on the above national socioeconomic framework.

Table 2.3.5 Socioeconomic Framework for Khulna Former District

	1996/97	Estimate			Average Annual Growth Rate (%)		
		2004/05	2009/10	2014/15	2000-05	2005-10	2010-15
Population (million)	5.919	6.635	7.100	7.568	1.40	1.36	1.28
Khulna zila	2.501	2.931	3.205	3.490	1.85	1.80	1.71
Bagerhat zila	1.630	1.782	1.881	1.978	1.15	1.08	1.01
Satkhira zila	1.788	1.922	2.014	2.100	0.97	0.94	0.83
GDP (billion TK)	79.187	128.725	156.614	190.545	6.54	4.00	4.00

Note : GDP at 1996/97 prices

Source : Estimates by JICA Study Team

CHAPTER 3

ROAD TRAFIC CONDITIONS AND DEMAND FORECAST



CHAPTER 3 ROAD TRAFFIC CONDITIONS AND DEMAND FORECAST

3.1 Road Traffic Profile

3.1.1 Current Road Transport

(1) Modal Share in Transport Sector

Road transport plays important roles in transport sector in Bangladesh as progress has been made on road improvement through several Five Year Plans. Fig. 3.1.1 shows trends of modal share of transport sector in Bangladesh. Road transport has high growth of both passenger and freight movement shares in 1980s, while rail transport has decreased share in both passenger and freight during the same period.

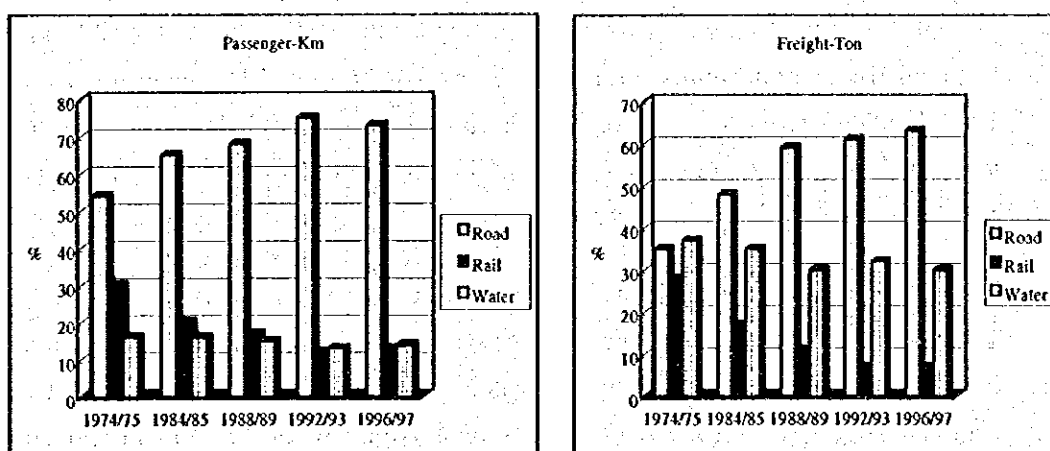


Fig. 3.1.1 Modal Share in Bangladesh

(2) Road Network

(a) Road Classification

The road network in Bangladesh is classified as national highways, regional highways, feeder roads (type A and B) and local roads. The definition of each highway and road is as follows:

- National highways connect the national capital with district headquarters, port cities and international highway.
- Regional highways connect different regions and district headquarters which are not connected by the national highways.

- Feeder road type A connects thana (lowest tier of administration) headquarters and important growth centers to the main arterial roads.
- Feeder road type B connects growth centers with other growth centers and thana headquarters.
- Local roads include municipal roads and rural roads.

The Roads and Highways Department (RHD), Ministry of Communications is responsible for construction, improvement and maintenance of national and regional highways and feeder road type A. Feeder roads type B and rural roads are built and maintained by the Local Government Engineering Department (LGED). Construction and maintenance of municipal and urban roads are charged with municipal bodies like city corporation and municipalities.

Area under the jurisdiction of RHD is divided into 7-Zones and 16-Circles for the present. The total length of road network under the RHD stands at 20,285 km. National Highway accounts for 14% or 2,862 km, Regional Highway for 8% or 1,565 km and Feeder Road-A for 78% or 15,860 km in Bangladesh. In addition to its road network, there is road length of 179,000 km that is under the LGED in collaboration with the local government bodies.

Road network administrated by RHD Khulna Circle is as shown in Fig. 3.1.2. Table 3.1.1 shows the road length under RHD. Road length in Khulna Circle occupied five (5) percents of that of whole county or 1,002 km, consisting of National Highway of 67 km (7%), Regional Highway of 125 km (12%) and Feeder Road-A of 810 km (81%). Khulna Circle has low percentage of road length, especially of National Highway.

Table 3.1.1 Road Length by Category and Circle under RHD in 1996/97

(Unit: km)

Circle	National Highway	Regional Highway	Feeder Road- A	Total
Dhaka	314 (23%)	66 (5%)	626+356*=982 (72%)	1,362 (100%)
Khulna	67 (7%)	125 (12%)	498+312*=810 (81%)	1,002 (100%)
Jessore	267 (20%)	228 (17%)	656+179*=835 (63%)	1,330 (100%)
Bangladesh	2,862 (14%)	1,565 (8%)	10,508+5,352*=15,860 (78%)	20,285 (100%)

Source: RHD

Note: Mark * shows new additional length as confirmed by divisional Executive Engineers

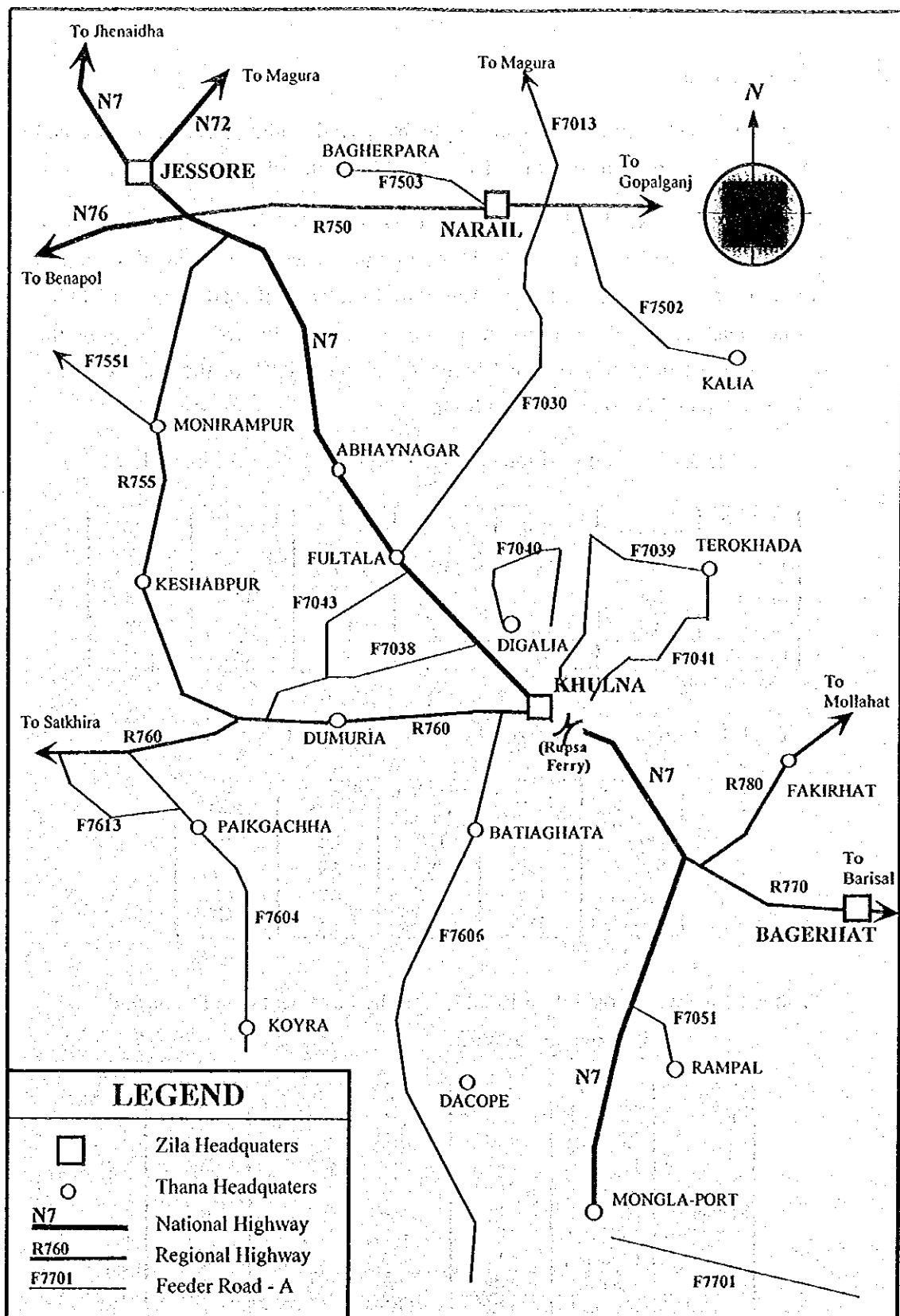


Fig. 3.1.2 Road Network in RHD Khulna Circle

(b) Road Conditions

As present road conditions, road length by paved width, pavement type and pavement conditions are shown in Table 3.1.2 to Table 3.1.4, respectively.

Road network in Khulna Former District comprises 13 % in length of 6.71 m wide or more, and 78 % in length of 3.66 m wide or less. It means three fourth of road network are one (1) lane. And more than 87 % of road length in Khulna Former District is assumed to be paved or surface treated. Regarding the pavement conditions of roads in Khulna Zone, about 82% of the road length is considered to be in good or fair condition.

Table 3.1.2 Composition of Road Length by Paved Width in 1992

Former District	6.71 m ~	6.71 m	5.49 m	3.96-5.18 m	3.66 m	~ 3.66 m
Dhaka	5%	33%	15%	2%	42%	3%
Khulna	10%	3%	8%	0%	60%	18%
Jessore	1%	12%	20%	4%	17%	46%
Bangladesh	2%	10%	28%	3%	40%	17%

Source: RHD

Table 3.1.3 Composition of Road Length by Pavement Type in 1992

Former District	Paved	HBB/Partly Paved	Gravel	Earthen
Dhaka	58%	17%	0%	25%
Khulna	59%	28%	5%	8%
Jessore	87%	7%	0%	6%
Bangladesh	55%	16%	1%	28%

Source: RHD

Table 3.1.4 Composition of Road Length by Pavement Conditions and RHD Zone in 1996/97

Zone	Road	Good	Fair	Poor	Bad
Dhaka	National	18%	36%	41%	3%
	Regional	26%	62%	10%	0%
	Feeder-A	21%	37%	34%	6%
	Total	21%	39%	33%	5%
Khulna	National	54%	36%	9%	0%
	Regional	47%	20%	26%	5%
	Feeder-A	49%	38%	12%	0%
	Total	49%	33%	15%	1%
Bangladesh	National	47%	33%	18%	2%
	Regional	40%	37%	21%	2%
	Feeder-A	30%	46%	22%	2%
	Total	35%	41%	21%	1%

Source: RHD

Note: Based on result of Road Census Survey which has surveyed total 12,524 km

3.1.2 Vehicle Ownership

(1) Current Vehicle Ownership

Number of registered motorized vehicles in Bangladesh was about 508 thousand in 1996. The growth rate during 1990 - 96 was 6.8% per annum, while that of microbus was the highest as 46.3% per annum during the same period. In this connection, that of car and jeep, truck and motorcycle was 5.2%, 4.6% and 5.9% per annum, respectively. (see Table 3.1.5 and Fig. 3.1.3) The level of ownership for total motorized vehicles in 1995 was 3.9 vehicle per 1,000 persons.

Fig. 3.1.4 shows the trend of motorized vehicle composition by type. In 1996, the share of motorcycle was the highest 38.6%, followed by 25.5% for car and jeep, 15.6% for auto-rickshaw, 9.6% for truck and 8.1% for bus/minibus/microbus.

The lack of an adequate system of "National Registration and Licensing" is hampering the development of a sound vehicle statistics database. Table 3.1.6 shows the situation of annual motorized vehicle registration in Khulna and Bagerhat zilas between 1990 to 1997 (up to August). The BRTA Khulna Office, however, does not have the accumulated data of registered motorized vehicles until now.

Table 3.1.5 Registered Motorized Vehicles in Bangladesh

Vehicle Type	(unit: vehicle)								Annual Growth Rate 90-96 (%)
	1989	1990	1991	1992	1993	1994	1995	1996	
Car/Jeep	90,150	95,293	99,135	100,821	103,854	108,605	116,216	129,451	5.2
Taxi	2,500	2,650	2,671	2,690	2,780	2,787	2,804	2,863	1.3
Bus/Minibus	24,600	25,655	26,449	26,946	27,469	28,463	29,484	30,428	2.9
Microbus	400	1,095	2,371	3,498	4,866	7,138	8,672	10,724	46.3
Truck	35,200	37,312	38,448	39,307	40,373	42,337	45,805	48,734	4.6
Trailer	2,000	2,200	2,304	2,325	2,350	2,354	2,370	2,385	1.4
Motorcycle	125,000	138,750	150,171	158,588	165,360	173,167	182,035	196,012	5.9
Auto-rickshaw	30,200	32,616	36,796	40,114	43,863	53,851	68,039	79,293	16.0
Tractor/Others	5,525	6,077	6,211	6,290	6,335	6,856	6,969	7,893	4.5
Total	315,575	341,648	364,556	380,579	397,250	425,558	462,394	507,783	6.8

Source : 1997 Statistical Yearbook of Bangladesh

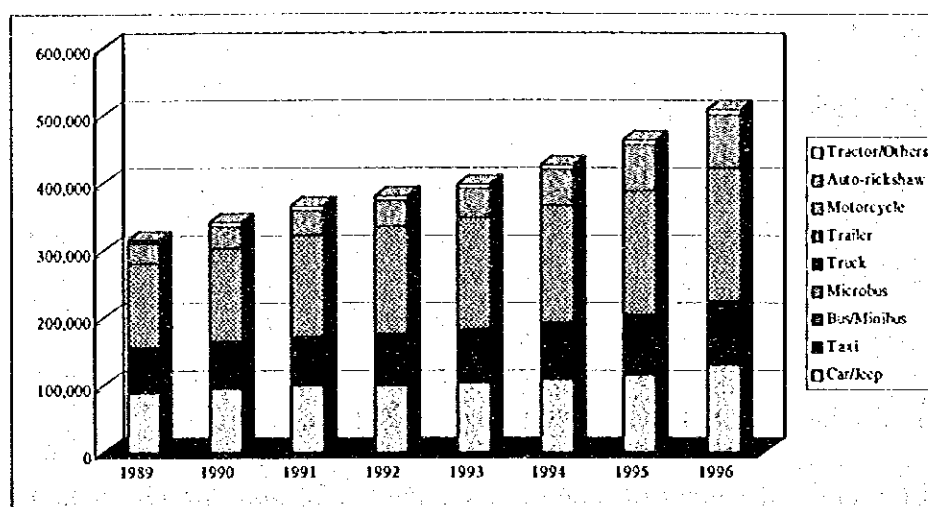


Fig. 3.1.3 Number of Registered Motorized Vehicles

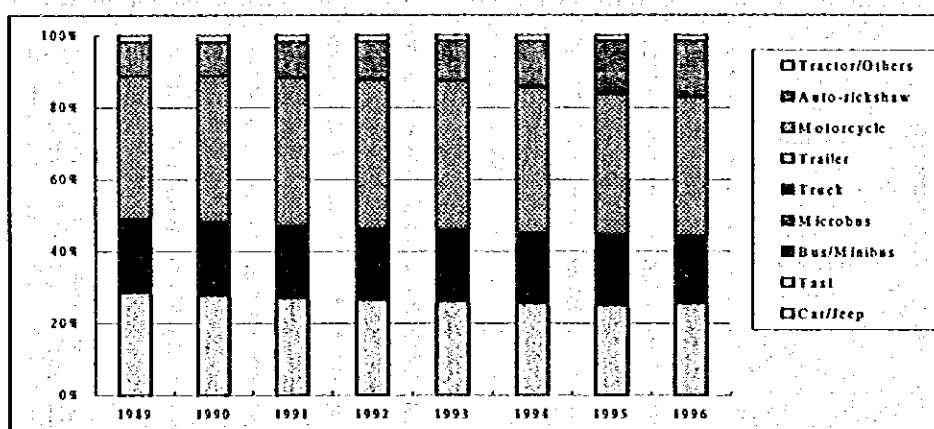


Fig. 3.1.4 Trend of Motorized Vehicle Composition by Type

Table 3.1.6 Number of Vehicle Registration in BRTA Khulna Office

Vehicle type	(unit:vehicle)							
	1990	1991	1992	1993	1994	1995	1996	1997
Motorcycle	521	298	415	817	557	695	584	497
Auto-rickshaw	7	18	117	41	67	139	145	107
Car/Jeep	24	36	23	32	55	78	114	75
Taxi	-	-	-	-	-	-	-	-
Bus/Minibus	23	5	8	17	33	48	27	32
Microbus	12	13	22	25	40	18	34	30
Truck	8	7	8	19	21	98	164	73
Trailer	-	-	-	-	-	-	-	-
Tractor/Others	-	-	-	-	-	-	-	-
Total	595	377	593	951	773	1076	1068	814

Source: Bangladesh Road Transportation Authority (BRTA) Khulna Office

In Bangladesh, rickshaws as non-motorized vehicles exceed the motorized vehicles in number of registration. The number of registered rickshaws in the whole country was approximately 507 thousand in 1996. The growth rate during 1990 - 1996 was 5.8% per annum, and it was approximately one percent less than that of motorized vehicles. The number of registered rickshaws in Khulna Former District was about 29 thousand. (see Table 3.1.7) The number of rickshaws per 1,000 persons in 1995 was 3.9 for the whole country and 4.6 for Khulna Former District, the level of Khulna was higher than that for the whole country.

Table 3.1.7 Number of Registered Rickshaws

		(unit:vehicle)							Annual Growth Rate 90-96 (%)
District	Area	1990	1991	1992	1993	1994	1995	1996	
Bangladesh	Urban	265,093	276,163	296,595	322,210	350,037	380,267	412,837	6.9
	Rural	84,478	86,024	87,598	89,201	90,786	92,399	94,040	1.5
	Total	349,571	362,187	384,193	411,411	440,823	472,666	506,877	5.8
Khulna Former District	Urban	14,601	15,874	32,812	18,107	19,671	21,370	23,200	6.5
	Rural	4,869	4,958	5,049	5,141	5,234	5,327	5,422	1.5
	Total	19,470	20,832	37,861	23,248	24,905	26,697	28,622	5.4

Source : 1997 Statistical Yearbook of Bangladesh

(2) Outlook of Vehicle Ownership

The motorized vehicle ownership is forecasted by the method of regression analysis based on the trend data of registered vehicles and per capita GDP.

The correlation of number of registered vehicles and per capita GDP in Bangladesh becomes clearly high. Based on the results of regression analysis, number of vehicles by type in the year 2015 is estimated. The results are shown in Table 3.1.8. From the forecast results, level of vehicle ownership will increase from 4.1 vehicles/1000 persons in 1997/98 to 10.0 vehicles/1000 persons in 2014/2015.

Table 3.1.8 Forecast of Vehicle Ownership by Type

(unit:vehicle)						
Year	Motorcycle	Autorickshaw	Car	Bus	Truck	All Vehicles
1989/90	125,000	30,200	92,650	25,000	37,200	310,050
1990/91	138,750	32,616	97,943	26,750	39,512	335,571
1991/92	150,171	36,796	101,806	28,820	40,752	358,345
1992/93	158,588	40,114	103,511	30,444	41,632	374,289
1993/94	165,360	43,863	106,634	32,335	42,723	390,915
1994/95	173,167	53,851	111,392	35,601	44,691	418,702
1995/96	182,035	68,039	119,020	38,156	48,175	455,425
1997/1998	236,000	99,000	141,000	51,000	57,000	584,000
1999/2000	267,000	121,000	155,000	58,000	63,000	664,000
2004/2005	414,000	222,000	221,000	95,000	90,000	1,041,000
2009/2010	506,000	286,000	263,000	117,000	107,000	1,279,000
2014/2015	614,000	360,000	312,000	144,000	127,000	1,558,000

Source: Forecasted figures are by JICA Study Team.

According to the experience of traffic survey at metropolitan area in developing country, a rise in the per capita income influences largely the selection of traffic modes. That is to say, the situation of private vehicle ownership changes such as from bicycle owner to motorcycle owner, and motorcycle to car in accordance with the increase of per capita income. Moreover, the selection of traffic modes is looked to differ in accordance with the difference of private income levels. Utilization rates of private cars in the group of high income are high. The group of low income uses more public traffic modes and the traffics on foot are also more. Motorcycles as the private traffic mode for the groups of upper-middle and lower-middle income are used more.

Figs. 3.1.5 and 3.1.6 represent an example of the traffic survey results in Jakarta metropolitan area (Indonesia).

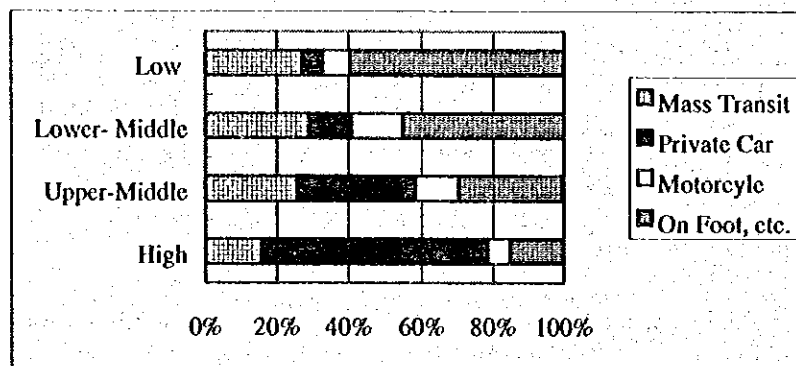


Fig. 3.1.5 Modal Composition by Income Group

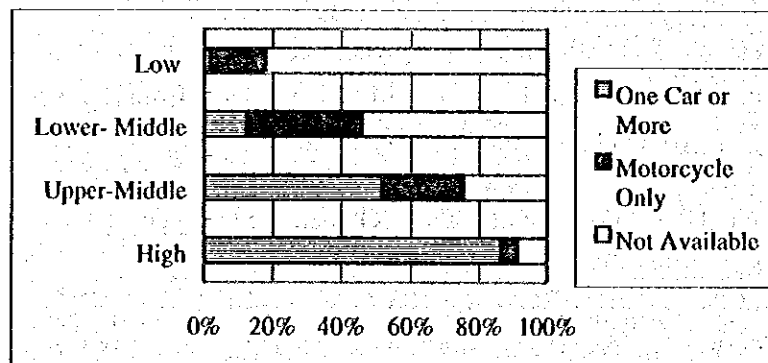


Fig. 3.1.6 Availability of Motorized Vehicle by Income Group

Source: The Arterial Road System Development Study
in Jakarta Metropolitan Area, Summary (Sep. 1987)

3.1.3 Road Traffic Conditions

(1) Traffic Volumes

The RHD conducted a traffic count survey in 1995 as the nation wide traffic census to reveal traffic situation on all roads under the RHD administration. Then, the RHD has been carrying out the survey every year for updating the data. Fig. 3.1.7 shows current road traffic volumes (pcu/day) counted by RHD in traffic census and JICA Study Team in the Phase 1 study.

From the RHD survey results, the salient features of road traffic in the Study area are summarized as follows:

i) Traffic volume of motorized vehicle

The highest traffic volume of 8,100 vehicles/day is observed in Khulna-Jessore road (National Highway No.7) in 1997/98. Other roads have traffic volume of more or less 3,500 vehicles/day. Traffic volumes on Khulna-Noapara and Noapara-Mongla sections are around 3,100 and 1,500 respectively.

ii) Traffic volume of non-motorized vehicle

Traffic volume of non-motorized vehicle, such as bicycle and rickshaw is very high, and there are many survey stations in Khulna Circle jurisdiction that it exceeds that of motorized vehicle.

iii) Heavy vehicle ratio

High percentage of heavy vehicle ratio, more than 25% is observed in road sections of Khulna-Jessore and Khulna-Satkhira.

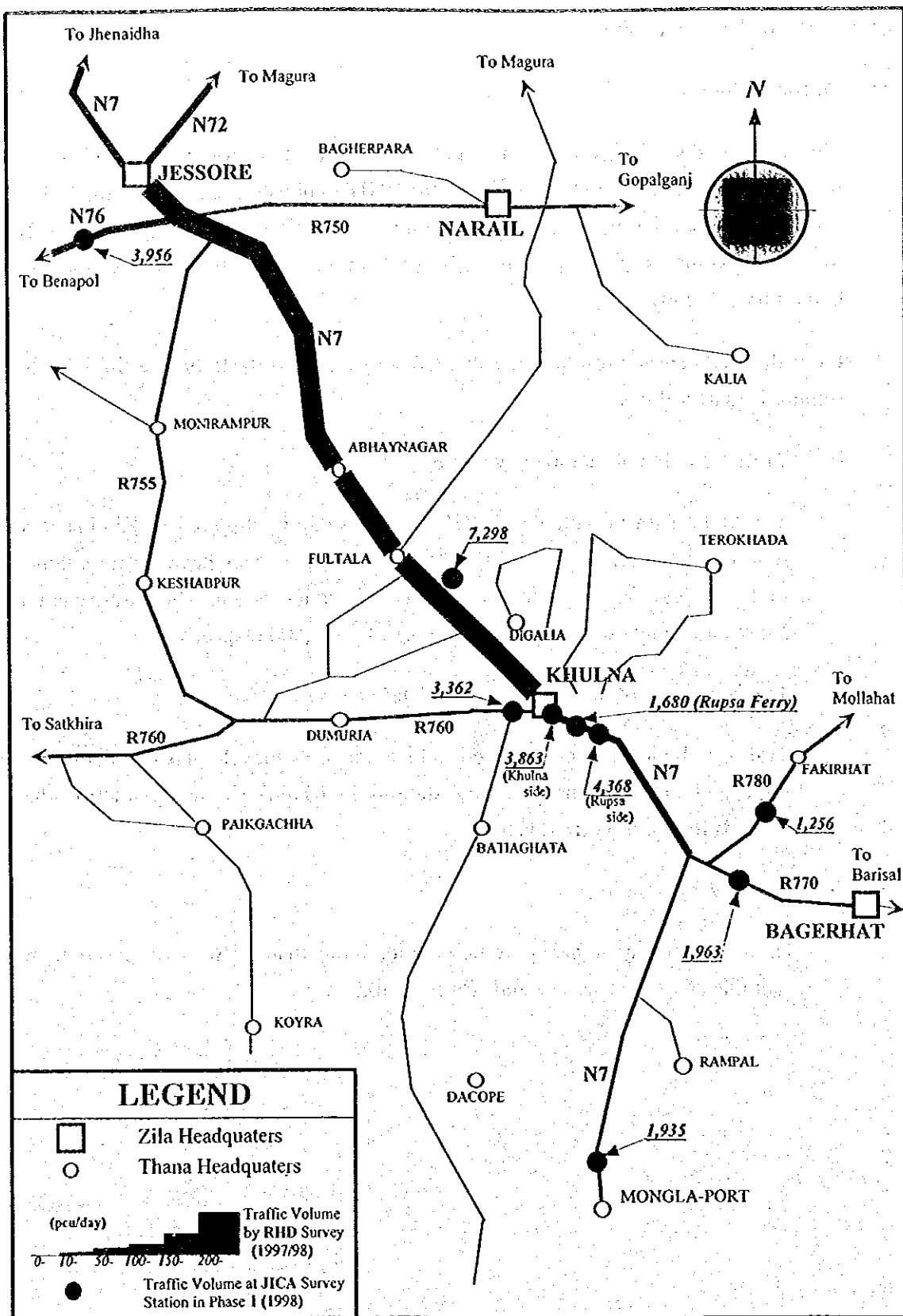


Fig. 3.1.7 Current Road Traffic Volume

(2) Situations of Rupsa Ferry

Rupsa ferry ghats exist on National Highway No.7 to form a part of Khulna-Mongla road, and they are located at the southern part of Khulna city crossing the 350 m wide Rupsa River. There are two ghats at both riversides to operate two ferry boats simultaneously, and five (5) ferry boats are always in operational conditions. Presently, Rupsa ferry transport is approximately as follows:

- | | |
|--------------------------------------|-----------------|
| - Annual motorized vehicle transport | Total 293,000 |
| Trucks----- | 70,000 |
| Buses----- | 40,000 |
| Passenger Cars--- | 167,000 |
| Motorcycles----- | 16,000 |
| - Daily Passengers | 50,000 - 60,000 |

Present situation related to Rupsa ferry operations are summarized as follows:

i) Tidal Fluctuation

Approximately three meters high tidal fluctuation takes place at Rupsa ferry. Ferry ghat is always inundated during spring tide, and it makes the traffic congestion worse. Furthermore, slope of approach piers and its related facilities face physical difficulties to cope with such high fluctuation, especially steep slope on approach piers. It sometimes causes to let over-loaded trucks or old vintage buses/cars get stuck on the way.

ii) Embarking and Disembarking

Mixed traffic of passengers and motorized vehicles share the same access piers and road. It is due to one access that entrance traffic should wait to embark until exit traffic should disembark completely. However, it is often observed at peak hours that both directions of traffic conflict on approach road or even on bridge, as neither traffic control nor enforcement is done.

iii) Approach Road and Terminal Plaza

There is a terminal plaza in the vicinity of ferry terminal. The terminal plaza has two access roads to connect to each ferry ghat respectively. Many shops and street vendors occupy space along access roads and terminal plaza. Moreover, number of rickshaws wait for passengers at terminal plaza. Such mixed traffic situation makes traffic congestion worse during peak hours.

3.1.4 Traffic Survey

(1) Survey Implementation

The results of traffic survey conducted during the Phase 1 Study, indicated the necessity to have the more detailed information on road traffic with a focus on road transport conditions. Accordingly, the supplementary traffic survey was carried out on the related roads in the surrounding area of the planned Khulna Bypass including Rupsa Bridge. The implemented items of the traffic survey are traffic count survey and roadside interview survey, with the survey methodology same as that in the Phase 1. The outline of implemented traffic survey is as follows:

- (a) Survey Station: Four (4) stations on the connecting roads to trunk roads that were surveyed in Phase 1 (see Fig. 3.1.8).
- (b) Survey Date: 19, 20 and 22, July 1999
- (c) Survey Time: Traffic count survey --- 24 hours (6:00-6:00)
Roadside interview survey --- 12 hours (6:00-18:00)

Roadside interview survey at survey station No.3 on the eastern dike road was not conducted, because motorized vehicles crossing the assumed cordon line could not pass on its road which was collapsed due to heavy rainfall just before the survey.

(2) Survey Results

(a) Traffic count survey

Table 3.1.9 and Fig. 3.1.8 show the results of traffic count survey. The traffic volumes at each survey station were counted to be around 1,500 – 5,900 vehicles/day (average of three days). However, those of motorized vehicles were about 470-670. Fig. 3.1.9 shows the composition of traffic volumes by motorized vehicle type. Over 85% of traffic volumes at station No.1 and No.4 accounted for motorcycle and autorickshaw traffic. On the other hand, the share of four-wheeled vehicles was comparatively high at station No.2 and No.3.

(b) Roadside interview survey

The desire lines drawn based on the results of roadside interview survey are shown in Fig. 3.1.10. The OD pairs of motorized vehicles passing through the survey station No.1 are almost occupied by the OD pair between Khulna C.C and

Batiaghata & Dacope thana, and those at station No.2 are almost the OD of intra-city in Khulna. Moreover, most OD pairs at station No.4 are the most OD pairs between Rupsa and Batiaghata thana.

Table 3.1.9 Summary of Traffic Count Survey

Station No.	Date	Direction	Motorcycle	Rickshaw	Car	Pickup	Microbus	Minibus	Bus	S. Truck	M. Truck	L. Truck	M. Vehicle	Rickshaw	Others
1 (Fannery Crossing) Batiaghata Road	19-Jul	1(N-S)	112	171	8	4	8	20	0	1	3	0	327	768	564
		2(S-N)	102	180	8	4	5	15	0	2	2	0	318	799	506
		Total	214	351	16	8	13	35	0	3	5	0	645	1567	1064
	21-Jul	1(N-S)	116	177	8	5	14	19	0	1	2	0	342	903	705
		2(S-N)	107	159	17	9	2	18	0	2	2	0	316	928	694
		Total	223	336	25	14	16	37	0	3	4	0	658	1831	1399
	22-Jul	1(N-S)	111	208	9	9	7	16	0	1	7	0	368	892	714
		2(S-N)	104	188	17	5	6	19	0	1	4	0	341	1003	810
		Total	215	396	26	14	13	35	0	2	11	0	712	1895	1524
	Aver.	1(N-S)	113	185	8	6	10	18	0	1	4	0	345	854	661
		2(S-N)	104	176	14	6	4	17	0	2	3	0	326	910	668
		Total	217	361	22	12	14	35	0	3	7	0	671	1764	1329
2 (Shipyard) Rupsa Stand Road	19-Jul	1(N-S)	94	33	57	14	19	0	3	8	31	0	259	1746	896
		2(S-N)	103	26	50	10	14	0	3	6	25	0	237	1837	935
		Total	197	59	107	24	33	0	6	14	56	0	496	3583	1835
	21-Jul	1(N-S)	91	21	46	6	11	1	7	12	39	0	234	1789	1151
		2(S-N)	99	20	39	8	11	1	6	14	38	0	236	1719	998
		Total	190	41	85	14	22	2	13	26	77	0	470	3508	2149
	22-Jul	1(N-S)	101	29	51	6	2	1	6	9	36	0	241	1539	947
		2(S-N)	80	32	50	5	4	0	6	5	29	0	211	1445	980
		Total	181	61	101	11	6	1	12	14	65	0	452	2984	1927
	Aver.	1(N-S)	95	28	51	9	11	1	5	10	35	0	245	1691	995
		2(S-N)	94	26	46	8	10	0	5	8	31	0	228	1667	972
		Total	189	54	97	17	21	1	10	18	66	0	473	3358	1970
3 (Lockpur Fish P.C.U.) Eastern Dike Road	19-Jul	1(N-S)	55	21	13	16	4	5	0	8	52	0	174	958	699
		2(S-N)	41	13	7	17	4	2	0	5	58	0	147	895	654
		Total	96	34	20	33	8	7	0	13	110	0	321	1853	1353
	21-Jul	1(N-S)	73	34	16	52	19	1	0	12	70	0	277	796	488
		2(S-N)	92	36	21	56	17	0	0	9	87	0	318	787	497
		Total	165	70	37	108	36	1	0	21	157	0	595	1583	985
	22-Jul	1(N-S)	66	39	20	38	19	1	0	7	58	0	248	782	585
		2(S-N)	68	35	22	42	16	2	1	7	66	0	260	698	536
		Total	134	75	42	80	35	3	1	14	124	0	508	1480	1121
	Aver.	1(N-S)	65	31	16	35	14	2	0	9	60	0	232	845	591
		2(S-N)	67	28	17	38	12	1	0	7	70	0	240	793	562
		Total	132	59	33	73	26	3	0	16	130	0	472	1638	1153
4 (Elashpur) Jabsha Road	19-Jul	1(N-S)	37	180	4	5	7	20	0	1	1	0	255	155	277
		2(S-N)	34	184	4	7	10	15	0	1	1	0	256	184	269
		Total	71	364	8	12	17	35	0	2	2	0	511	339	546
	21-Jul	1(N-S)	36	202	3	9	1	12	0	0	6	0	269	165	345
		2(S-N)	34	213	1	7	1	14	0	0	5	0	275	154	358
		Total	70	415	4	16	2	26	0	0	11	0	544	319	703
	22-Jul	1(N-S)	43	217	3	6	3	10	0	0	9	0	296	159	360
		2(S-N)	41	236	2	3	3	9	0	0	12	0	309	164	357
		Total	92	453	5	9	6	19	0	0	21	0	605	323	717
	Aver.	1(N-S)	40	200	3	7	4	14	0	0	5	0	273	160	330
		2(S-N)	37	211	2	6	5	13	0	0	6	0	280	167	328
		Total	77	411	5	13	9	27	0	0	11	0	553	327	658

Note: N, North S, South

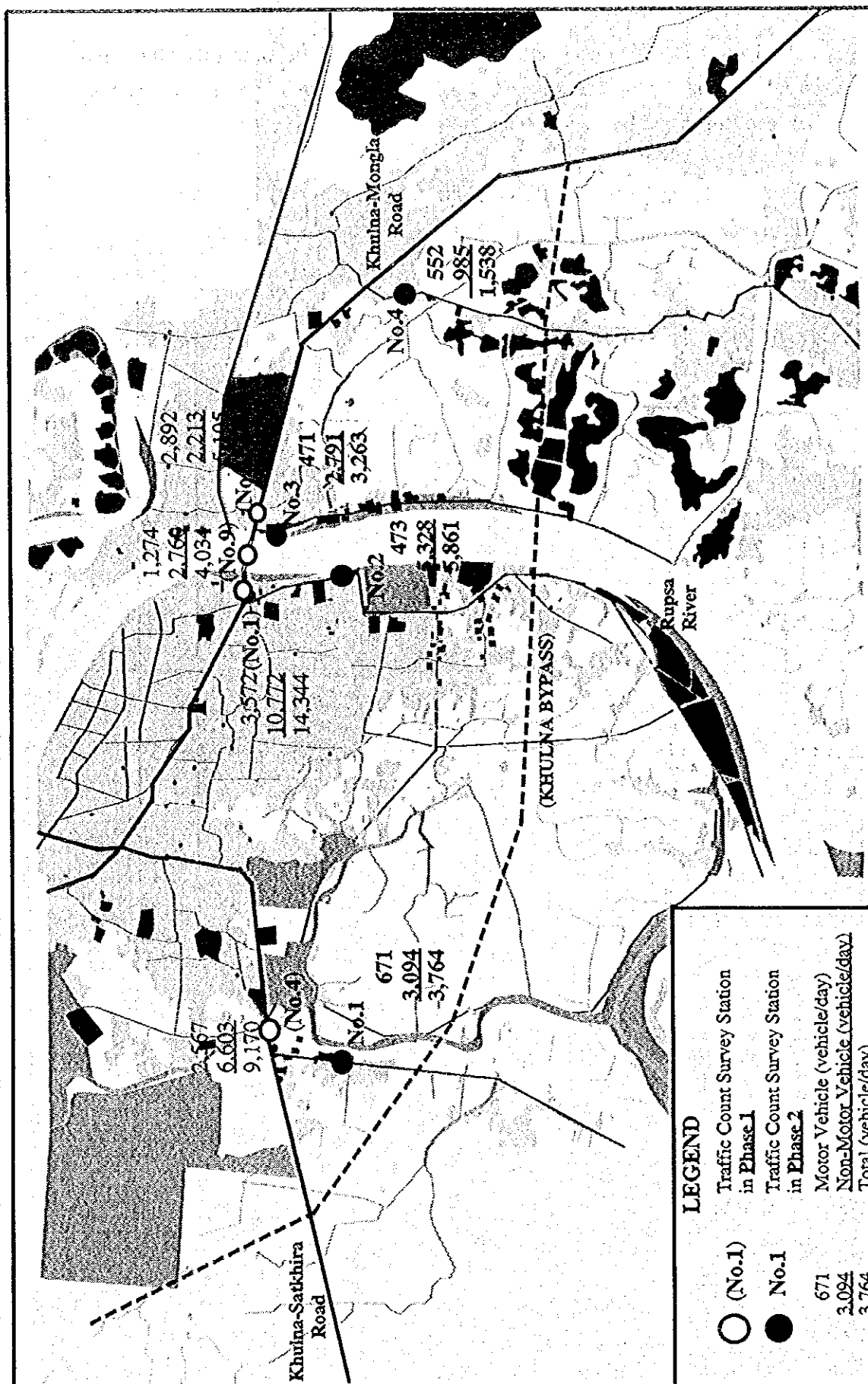


Fig. 3.1.8 Results of Traffic Count Survey

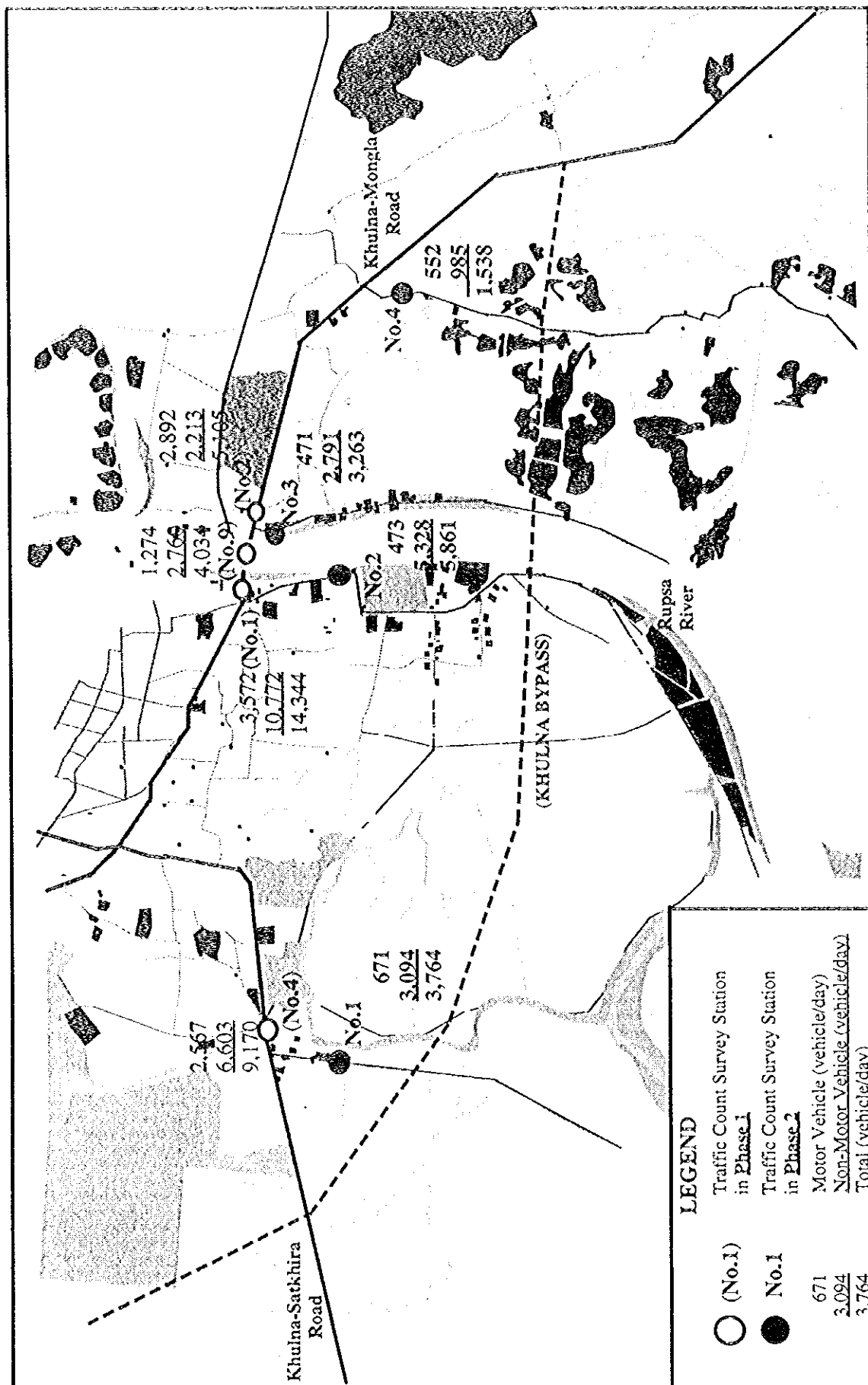


Fig. 3.1.8 Results of Traffic Count Survey

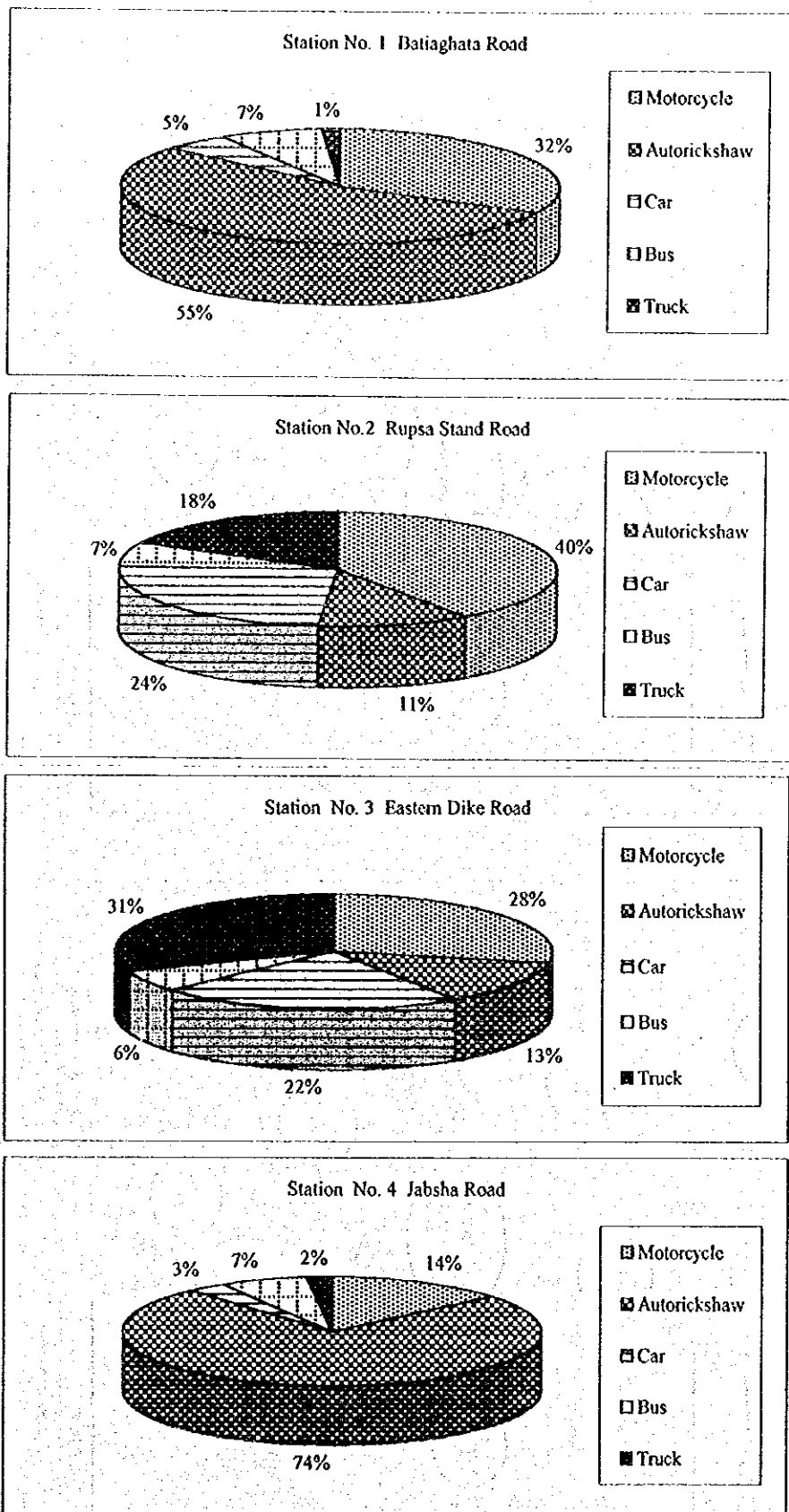


Fig. 3.1.9 Composition of Traffic Volumes

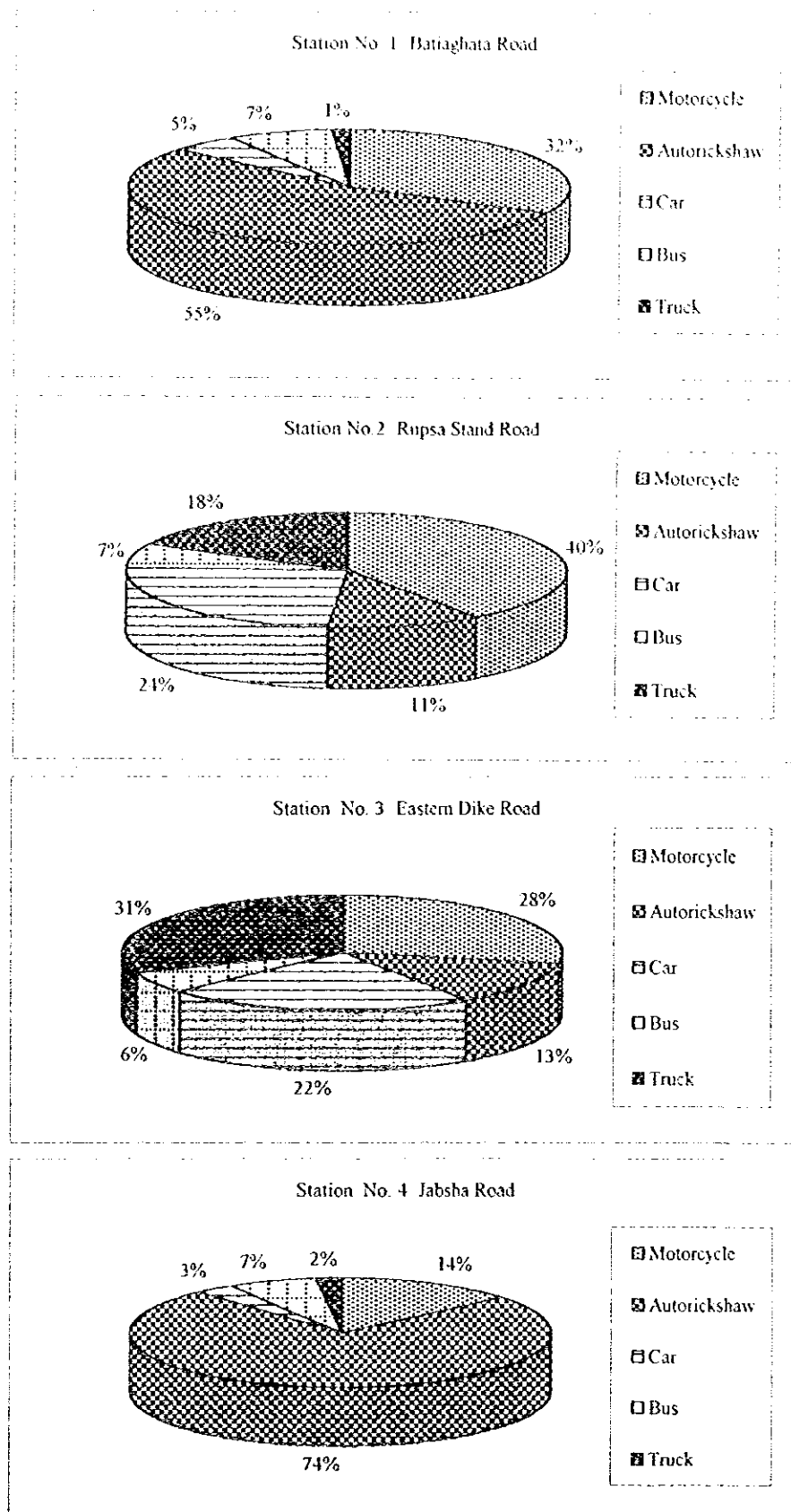


Fig. 3.1.9 Composition of Traffic Volumes

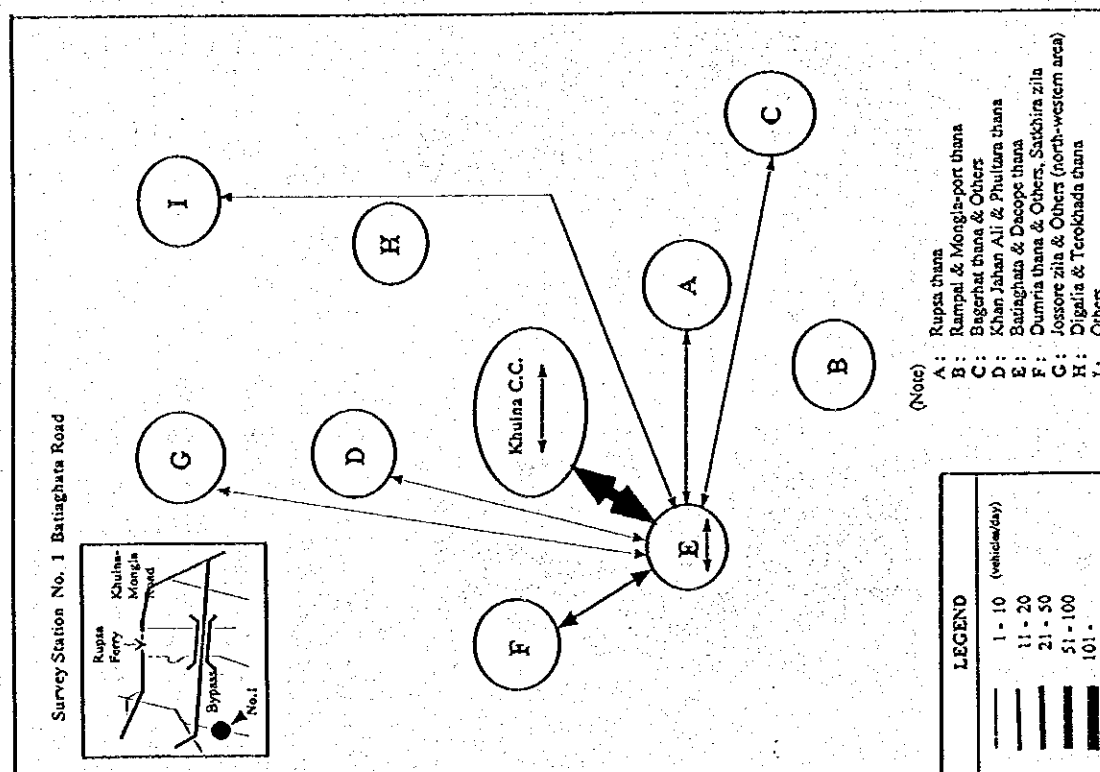
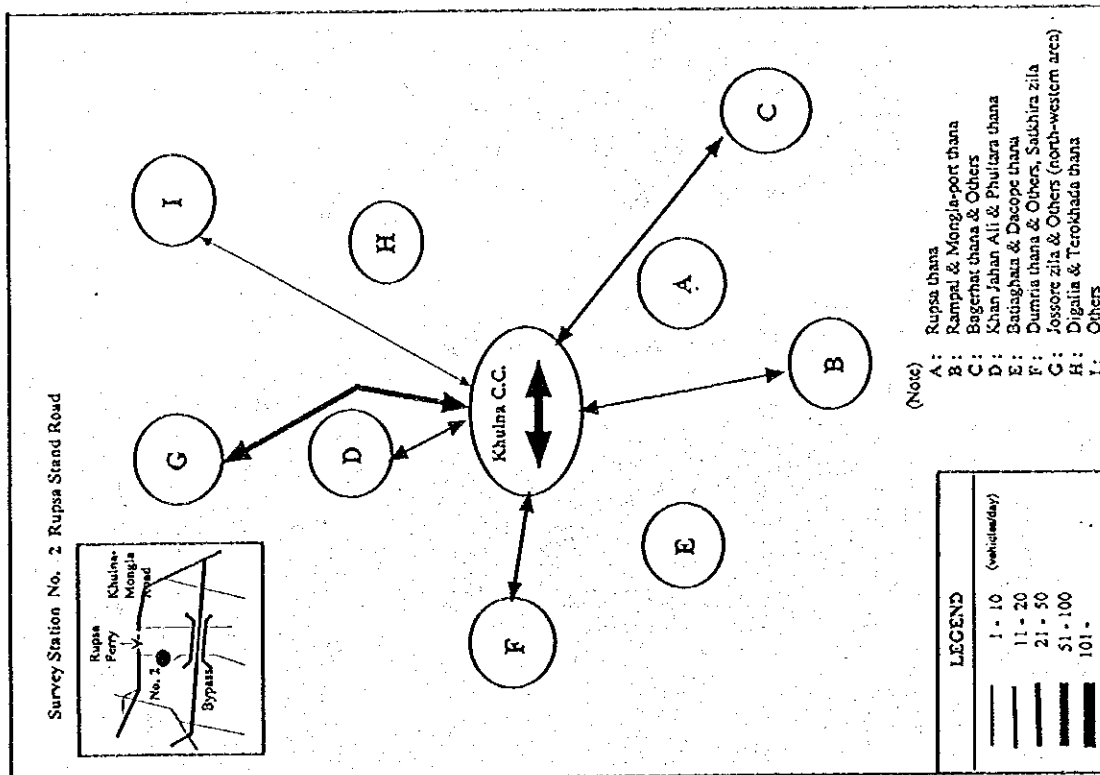


Fig. 3.1.10 Desire Line of Motorized Vehicle Passing Survey Station (I)

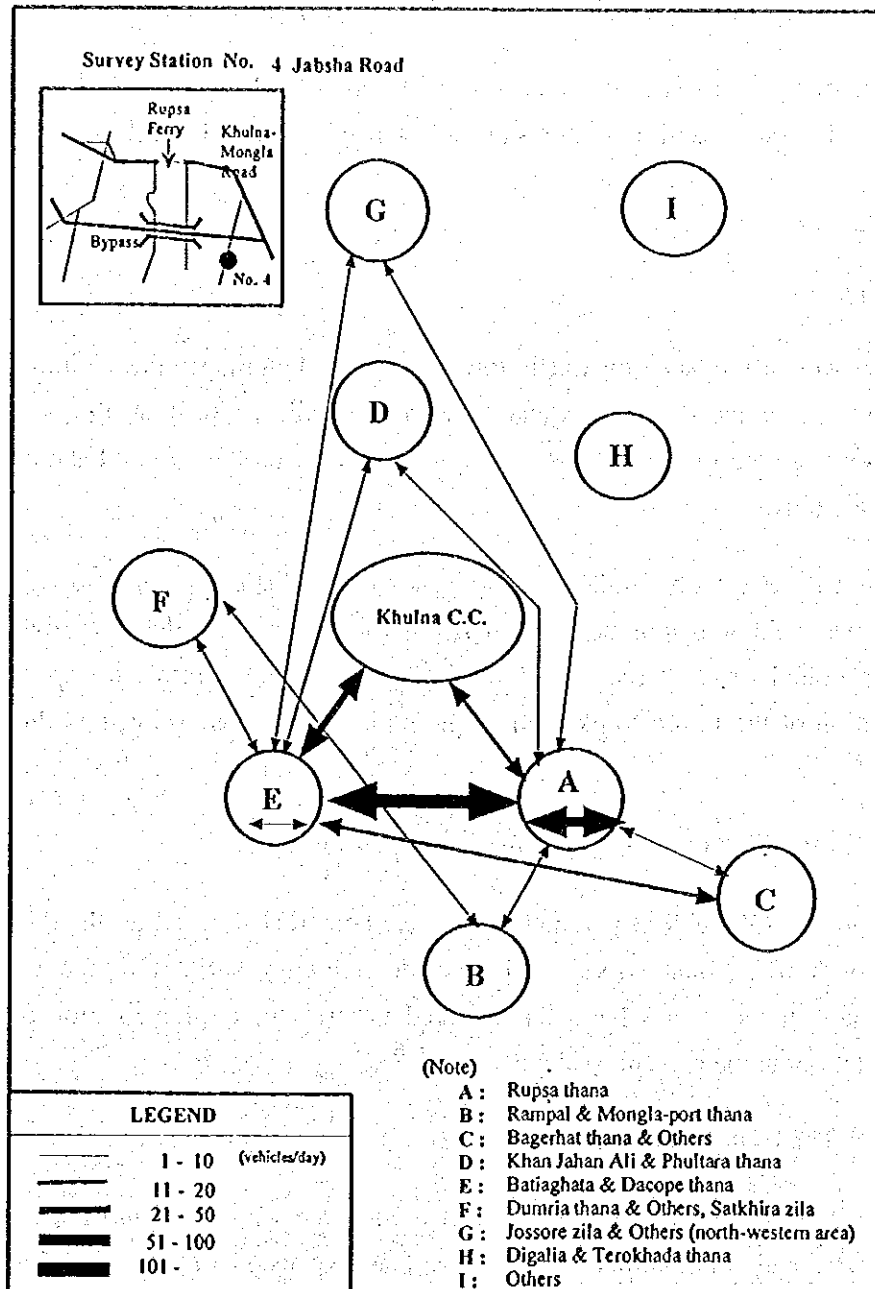


Fig. 3.1.10 Desire Line of Motorized Vehicle Passing Survey Station (2)