PLANNING OF PUBLIC BUS SERVICES IN RAJSHAHI CITY

By

S.M. ABDULLAH AL- MASUM

Thesis submitted in partial fulfillment of the requirements for the degree of

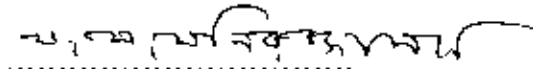## MASTER OF URBAN AND REGIONAL PLANNING

July, 2005

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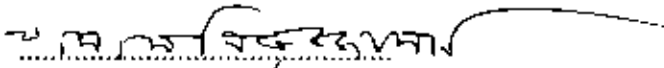
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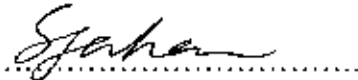Thesis approved as to the style and content by

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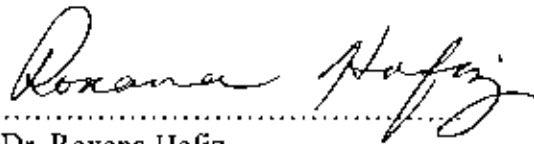Department of URP, BUET, Dhaka   Chairman (Supervisor)

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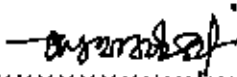
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Candidates Declaration

I hereby declare that this thesis has been prepared in partial fulfillment of the requirement for the degree of Master of Urban and Regional Planning at the Bangladesh University of Engineering and Technology, Dhaka and has not been submitted anywhere else for any other degree.

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July, 2005   **S.M. Abdullah Al-Masum**

Abstract

Rajshahi is an expanding urban centre of Bangladesh. The present population of Rajshahi City Corporation (RCC) is about four lakh in an area of 96.72 sq. km. The income level of the people in the city is very low in comparison with other cities of Bangladesh. Car ownership is therefore very low. In spite of its status as a divisional headquarter and the fourth largest metropolitan city of Bangladesh, there is no public bus service in the city. Rickshaw is the major public transport in the city. The modes of transport for the city people for their daily trips are mainly rickshaws and bicycles (about 50% of total trips). This study was an attempt to form an idea about the existing transport system of Rajshahi City and to explore possible public bus routes and stops. The study made preliminary investigation regarding feasibility of such a service. For this study all the transport data on Rajshahi were collected. The trip generation and distribution behaviour, modal choice behavior of the city dwellers of Rajshahi City were analyzed using information collected from the household interview survey by Development Design Consultants Limited (DDC) in 2003 for the Rajshahi Master Plan Project. At first all possible roads that may be used for the proposed bus routes were identified. The major roads were selected for this purpose. A total of thirty five bus stops were proposed for the bus service. The nearest suitable point from major traffic generating areas on the major roads were at first selected as bus stops. Other stops were then located on the basis of locational importance, proximity to major intersections and distance between consecutive bus stops. The bus routes were proposed considering mainly traffic flow characteristics. From the analysis of data it was found that about 15% of total traffic flow in or through Ward 12, which is the Central Business District (CBD). The service area of each bus stop was identified by generating buffers in a Geographical information System (GIS). Then the possible number of trips from each stop to all other stops was estimated. Three routes were been proposed in this research through analysis of alternatives and possible bus stops on the routes were identified. This study found that public bus service is feasible for the city from technical, financial and socio-economic perspectives. This study also recommended the construction of passenger sheds, terminal facilities and other facilities for the proposed bus services.

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ABBREVIATIONS AND ACRONYMS

BBS	Bangladesh Bureau of Statistics
BRTA	Bangladesh Road Transport Authority
BRTC	Bangladesh Road Transport Corporation
CBD	Central Business District
CPD	Center for Policy Dialogue
DAP	Detailed Area Plan
DDC	Development Design Consultants
GIS	Geographic Information System
GOB	Government of Bangladesh
HBB	Herring Bone Bond
LGED	Local Government Engineering Department
OD	Origin and Destination
PCE	Passenger Car Equivalent
PCU	Passenger Car Unit
RCC	Rajshahi City Corporation
RDA	Rajshahi Development Authority
RHD	Roads & Highways Department
RMP	Rajshahi Metropolitan Police
RMDP	Rajshahi Metropolitan Development Plan
RMPP	Rajshahi Master Plan Project
UDD	Urban Development Directorate
WBM	Water Bond Macadam

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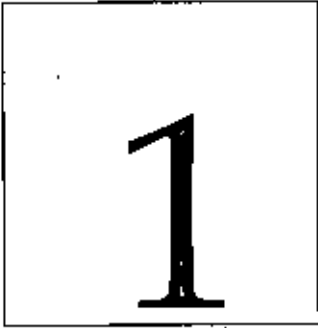
Chapter One:
Introduction

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1.1 Background of the Study

Transportation planning is one of the most critical and vital issues of urban planning. In our country traffic congestion is a severe problem and is a common phenomenon. Lack of sufficient, planned, well-managed public bus services is one of the major reasons for traffic congestion. For any populous city, appropriate planning of public bus services is essential because it reduces the travel time and cost of travel of the people, and also pressure on road space.

Rajshahi is the fourth metropolitan city and an expanding urban centre in Bangladesh. During the sixties, the city experienced rapid physical expansion and increase in population. But the rate of economic growth and the process of industrialization could not keep pace with it. Although Rajshahi was a Divisional Headquarter during British period, partition of India in 1947 and continuous rural-urban migration led to a sudden population boom in Rajshahi City and increased demand for infrastructural facilities and urban amenities

The present population of Rajshahi City Corporation (RCC) is about four lakh, which is less than Dhaka, Chittagong and Khulna metropolitan cities. The city has an area of 96 72 sq. km (BBS, 1993). The income level of the people in the city is very low in comparison with other cities of Bangladesh. Car ownership is therefore very low In spite of its status as a divisional headquarter, there is no public bus service in the city. Rickshaw is the major public transport in the city. The modes of transport for the city people for their daily trips are mainly rickshaws and bicycles. According to a working paper on transport of Rajshahi Master Plan Project, 2004-2024, for daily trips about 33.6% people use rickshaw, 22 2% people use bicycles, 29.1% people move on foot and the rest by others means. It is observed that only 1% people use baby taxis or tempos. Because of lack of public bus service rickshaws are increasing day-by-day. Although the number of registered rickshaws is 19,178, around 32,000 rickshaws operate in the city (DDC, 2003a) and create traffic congestion on different important roads and junctions, which causes inconvenience to the city dwellers. So, a need is felt to

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introduce public bus service in the city based on appropriate planning Introduction of public bus service will presumably increase local mobility and reduce cost of transport of the general public.

1.2 Objectives of the Study

The objectives of the present study are as follows,

1. To study the pattern of traffic and traffic flow characteristics of the city.
2. To assess whether a public city bus service can improve the transport system in a feasible manner.
3. To propose a suitable plan for a public bus service for the city, if feasible

1.3 Scope of the Study

No appropriate research or study has been done for feasibility study of public bus services in Rajshahi. This study was done to ascertain the present status of traffic flow, traffic movement, major traffic generating areas and city public transport facilities of Rajshahi City. This study will also give an idea about the possible city bus routes and stops for the city.

The study is based mainly on secondary data collected during the preparation of the Master Plan of Rajshahi City by the Rajshahi Development Authority during the period 2001-2004. To propose a suitable plan for city bus services more detailed study should be done which needs more time and resources.

1.4   Methodology of the Study

The methodology adopted for this study is presented in this section. The different step of the study is depicted in Fig 1.1
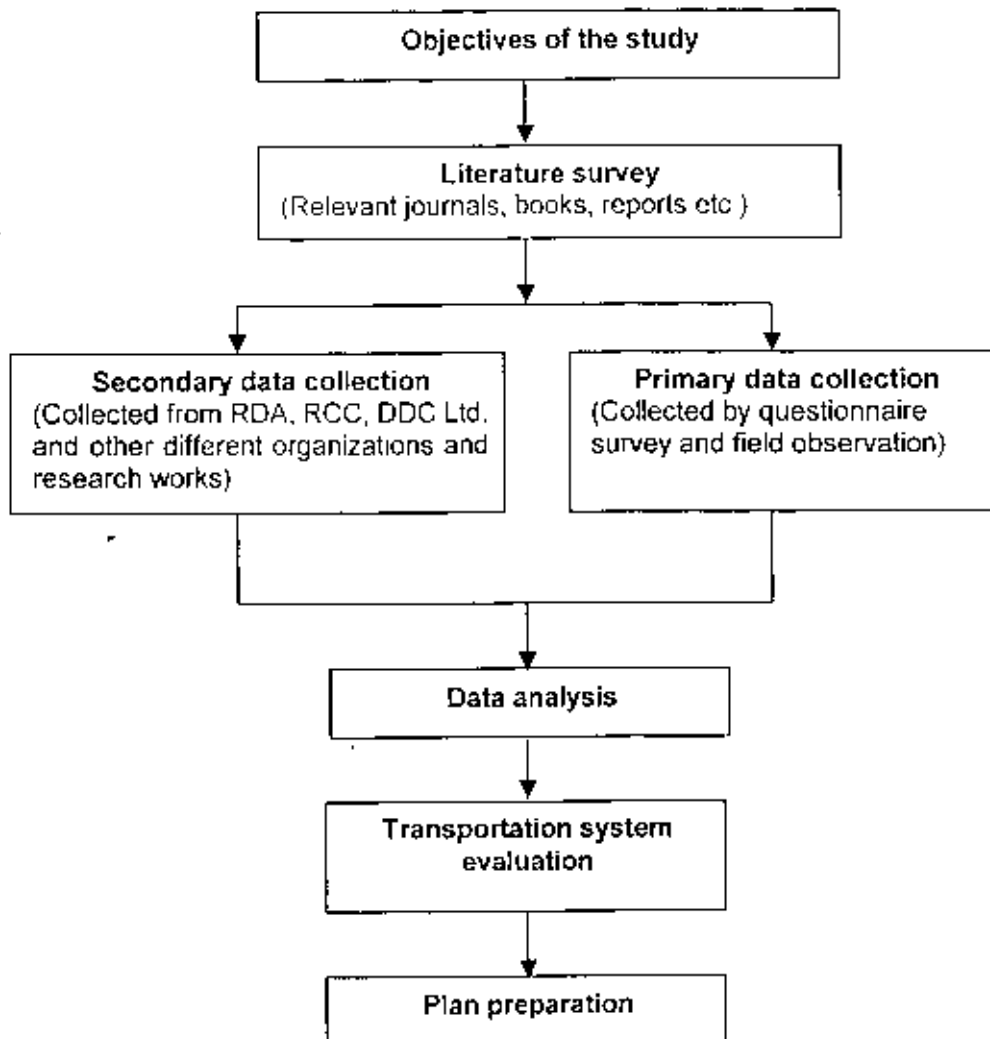
Fig. 1.1 Flow Diagram of Different Steps of the Study

1.4.1 Review of relevant literature:

An intensive literature survey was done to acquire relevant knowledge. Relevant literature like published and unpublished thesis, journals, books, relevant rules etc were reviewed with a view to assess the current level of knowledge regarding the issue.

1.4.2 Data collection

Though the study is based mainly on secondary data some primary data were also collected during field observation

i) Primary data collection

To learn about the passenger attitude regarding public bus services a sample questionnaire survey was done. As the total number of passengers is too large so, a small part of that has been taken as a sample. A total of 100 passengers from three major categories of passengers have surveyed Besides that to get an idea of overall transportation situation of Rajshahi City a two-day field observation or reconnaissance survey was done During field observation photographs on different transportation issues important for this study were collected.

ii) Secondary data collection

Recently a Master Plan has been prepared for Rajshahi City For this plan the core component was transportation planning. Road network analysis, road inventory, land use analysis have also been conducted for this Master Plan. For this plan different types of surveys such as traffic count survey, origin and destination survey, bus passenger survey, rail passenger survey etc. were conducted. An extensive household socio-economic survey was conducted for this Master Plan project. The household survey included some questions about the characteristics of the trip within the city. The questions, which were included in this survey, were mainly on the purpose of the trip, mode used for each trip, origin and destination of each trip, time and cost of the trips These survey data were collected and used for this research Besides, other data and information were collected from Rajshahi Development Authority (RDA) or from consultants of Rajshahi Master Plan Project

Different maps and planning reports were also collected from the Urban Development Directorate, RDA, and RCC etc. Reports, journals and theses related to the topic were collected from the libraries of Bangladesh University of Engineering and Technology (BUET), Khulna University, Center for Urban Studies (CUS) and from other relevant departments.

1.4.3   Analysis and findings

The collected data were analyzed in order to find out the major traffic generating areas, travel pattern, present land use pattern and present important routes and their traffic flow characteristics in the city. The major analyses for this study were as follows:

Trip generation analysis

Trip generation depends on land use, population and economic activity analysis. This was done on the basis of secondary data.

Trip distribution analysis

Trip distribution analysis estimates where the trip goes. The number of trips starting in each zone and ending in other zones was analyzed. This analysis was done on the basis of secondary data.

Modal split analysis

Modal split analysis is the process of assigning person-trips to available modes of transportation. This analysis was also done on the basis of the secondary data

Traffic (or network) assignment

Traffic assignment constitutes assigning the distributed volumes of trips, by mode, to individual network links. For this study a detailed analysis of traffic assignment was done

1.4.4 Transportation system evaluation

On the basis of the analysis and findings the total transportation system was evaluate for judging whether a public city bus service can improve the transport system in a feasible manner. Demand for public bus service was calculated on the basis of analysis of trip generation, trip distribution, modal split and traffic flow assignment. This procedure was identified the present system of public service, tentative routes of public bus services and analysed the feasibility of public bus service on these routes.

For financial assessment Walters' (1979) approach was followed to calculate total benefit of public bus service. According to Walters, total benefit of bus service can be derived from the summation of bus users' benefit and operators' benefit. Thus, as defined by Walters,

Total benefit = Bus users' benefit + Operators' benefit

1.4.5 Plan preparation

On the basis of the findings and transportation system evaluation a suitable plan for city bus service was prepared with proper designing and spacing of bus routes and stops.

1.5 Limitations of the study

Due to limitation of time and resources, no field survey was carried out for the research, although some data collected from field could potentially improve the scope and worth of the study.

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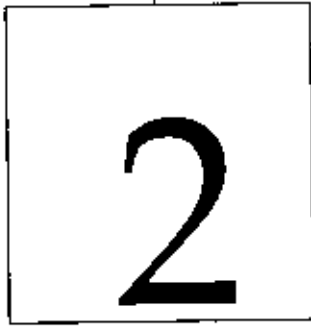
Chapter Two:
Literature Review
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2.1 Introduction

To understand what exactly public transportation is, it is necessary to become familiar with the terminology associated with its various components that consist of a variety of transportation modes. The various modes of transportation when integrated together to create a system for public transit, is called public transportation. The means that are used to carry transit passengers described by specific right of way, technology and operational feature are called transit mode.

Different relevant studies and literature have been reviewed in this chapter to get acquainted with up-to-date ideas, explanations, and theories in formulating the problem, elements and techniques. It also describes recent practices and trends observed for improvement of overall performance of public transportation system.

2.2 Review of the Literature

Some research have been performed to evaluate urban transportation system in Bangladesh. Still there are no proper studies on planning for urban mass transportation except for Dhaka City. Some studies, which are relevant to this present study, are reviewed and discussed here.

2.2.1 Process for public bus network planning

Black (1995) observed that a major part of the work of planning transit improvements is to forecast travel demand. The forecasting of travel demand depends on the assessment of trip generation, trip distribution, modal split and network assignment. According to him in most small cities, bus routes are radials converging on CBD. In medium size and large cities, the bus network is larger and more complex. He discussed the designing and spacing of bus routes. According to him bus route should follow arterial streets as much as possible and avoid minor streets. He also mentioned that the routes should be straight and direct. About spacing of bus stoppage he mentioned that the spacing of stops largely determines the average operating speed on a line, which affects the quality of the service perceived by travelers. Black noted that the frequency of service and route spacing are interrelated and that also depends on the number of passenger in peak hour and off peak hour. Black also described the

cost of services. According to him there is a strong pressure to make the bus the principle mode of mass transit. He argues that private firms never completely served the people through transit services. It appears that the private sector can play a limited role in transit but not a major one. Private firms need to make a profit; most transit riders are poor and it is difficult to make money serving the poor

2.2.2 Factors affecting trip generation

The following factors have been proposed for consideration in many practical studies to be included as the independent variable in a household based trip production model:

- Income
- Car ownership
- Household structure
- Family size
- Value of land
- Residential density
- Accessibility

The first four (income, car ownership, household structure and family size) have been considered in several household trip generation studies, while value of land and residential density are typical in zonal studies. The last one, accessibility, has rarely been used although most studies attempted to include it (Ortuzar and Willumsen, 2002)

2.2.3 Factors influencing the modal Choice

Bruton (1975) argued that three main factors are responsible for the choice of mode for personal trips. These are, first, characteristics of the journey that includes journey length and purposes; second, characteristics of the traveler which includes income and car ownership; and third, characteristics of the transportation system which includes relative travel time, relative travel cost, relative level of service and accessibility indices.

Case and Latchford (1981) further pointed out two cultural or social aspects as the influencing factors on choice of mode in countries of South East Asia. The first is the

status aspect for example, Philippinos prefer to travel by bus or jeepney even though they might be able to travel by motorcycle, however, to be a tricycle passenger is adjudged to be of high status. The second aspect relates to the fear of criminal assault Passengers therefore, are unwilling to share the vehicle with strangers

Ara (1983) investigated the factors that are responsible for the selection of a particular transportation mode. In particular, the author analyzed the travel behavior of a number of households from some particular localities in Metropolitan Dhaka.

In this study, total family income appeared as a very important factor determining transportation modes for different trip purposes. It was found that in high-income group, car is the most frequent mode for different purposes. In the middle-income groups, the rickshaw is the most frequent mode for different purposes Members of low-income families make most of their trips on foot.

Variation in age and sex also produced variation in choice of mode. For example, the use of bus is mostly avoided by aged people and young children, considering safety and convenience. Females avoid bus mostly because of inconvenience, lack of privacy and comfort. Female work force within upper and middle-income families usually avoid bus transportation because of its poor service quality. Working females without any private or official transportation usually use rickshaws for work purpose

The transportation pattern in the family has an influence on their travel pattern Families having private transportation are less interested in using public transportation like bus, minibus etc , which often lack comfort and convenience

2.2.4   *Traffic analysis zone*

Papacostas (1987) discussed the Traffic Analysis Zone which is the geographical unit of trip generation analysis. Traffic Analysis Zones (TAZ) are the most widely used zones in transportation planning applications. As such, transportation planners require information to support the creation, maintenance, and update of TAZs.   Further, planners require information to assist in link loading, placing a zone centroid (centre of activity) and in delineation of TAZ boundaries   Traffic Analysis Zones are used to connect and define land use values to transportation networks   Centroids are used to

identify center of activity within a zone and to connect that zone to the roadway facilities.

The configuration of the TAZ boundaries takes into account the following factors:

- Geographic features
- Access to major thoroughfare
- Land use uniformity
- Road network
- Number of trips produced
- Location of major activity centers

TAZs closer to the CBD are smaller than other areas, because of the population density. Therefore, they will generally be more useful and accurate in showing both the existence and location of concentrations of low-income populations. In the suburbs, where population is less dense, the TAZs are larger (Papacostas, 1987).

2.2.5 *Landuse and transportation*

For successful transportation planning land use analysis is an essential issue. Because those are interrelated to each other Johnson (2003) has suggested that transit use can be increased through transit-friendly land use planning. The results of his research suggest that there are three primary means available to planners to enhance transit ridership through land use planning: increase residential density in the areas near transit corridors, concentrate mixed-use development within an eighth mile of the transit corridors, and channel a greater proportion of the retail development within a quarter mile of transit lines. In fact, this analysis suggests that transport planners would increase ridership to a greater degree through catalyzing retail, mixed-use ad multifamily development than increasing transit service

2.2.6 *Efficiency of public bus services*

In our country different types of public bus services are operating. In the context of safety, conveyance and time the efficiency of different types of buses are different. Hasan (1996) noted that double decker buses play a significant role in the transportation system of Dhaka City by occupying an important share of the bus

services. According to him about eight percent of all passenger trips of motorized transit modes are made on double decker buses. Hasan also mentioned that at its early stages Bangladesh Road Transport Corporation (BRTC) was a well organized and profitable organization but it had been incurring losses in recent years. For this reason he identified the role of double decker services in order to justify the continuation of such services as well as considering the possible demand of such services. Hasan in his research used a set of basic operational performance. He analysed the cost and benefit of the double decker compared to single decker bus services. He compared the operational performance of the two bus depots at Mirpur and Kalyanpur and it was revealed that the performance of Kalyanpur bus depot was better. Producer surplus, in excess of the normal profit, was achieved in this depot. BRTC suffered losses in the other depots. Hasan observed that the passengers are willing to pay a higher fare for existing service of double deckers. This proved the existence of passengers' (consumers') surplus. He made an estimate of this surplus in the study.

Fjellstrom (2004) described the level of services or efficiency of public transport modes in Dhaka. He discussed issues related to the frequencies of bus services and support infrastructure situation of bus services. He observed that some buses have the starting and ending points of routes written on the bus, others have the route number only, yet others have the number and route, and many others have neither the route nor the route number written on them. These buses are known to the passengers through familiarity and through the conductor shouting the destinations when the bus approaches the stop. For this reason it is often very difficult to identify which route a particular bus is serving. In some cases some official bus routes have no buses operating on them. In other cases, for example at Rampura Bridge, more buses appear to be operating along the route than have been allocated route permits. It is observed that minibuses provide higher frequency of trips and in the context of maintaining schedule it is more reliable than large buses. The minibus routes predominantly have headway variations of less than 10 minutes, although some lower frequency routes such as Mohammadpur to Barpa had a high variation in waiting time. The number of passenger was calculated on the basis of the number of buses at peak hour and the occupancy of the vehicles of different type

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2.2.7 Bus as a user friendly public transport system

UNESCAP (2000) noted that public transport system in much of the ESCAP region are predominantly used by lower income groups. With few exceptions, services are overcrowded and irregular. A major problem for passenger is the large gap between ground level and the doorways of public transport vehicles. The problems that commonly beset public transport systems in the ESCAP region include user intensive planning, inadequate investment, poor management, inadequate revenue (due partly to revenue leakage), poor maintenance and deterioration of services. At the same time, users demands continue to grow simply because most low-income users have no alternative. The study revealed that there is an enormous potential growth market for public transportation in Asia and Pacific. Buses account for 90 percent of public transport movement in the world. In the ESCAP region, daily bus passengers, constitute a significant proportion of the total population using public transport. Moreover, buses have a low investment and fare cost advantage over other modes of public transportation. A recent ESCAP survey of the integration of non-motorized transport in the urban transport system of Dhaka revealed that the cost of passenger/km movement by bus is a quarter of that by auto rickshaw and under half that by rickshaw. The study suggested for gradual replacement by buses over their estimated average service life of 12-15 years.

2.2.8 Traffic management

For transportation planning traffic management is also a critical and vital issue. Different studies have been done on urban traffic management system and policies. Traffic Management Plan for Dhaka Zone 4 (1997) stated that the urban transport system of Dhaka are dominated or biased by non-motorized traffics. Rickshaws- the most common form of NMT dominant the system share about half of all vehicular person trips. The analysis of the plan in the area suggest that if improvement of the existing road network is undertaken then the current demand for NMV travel can be substantially reduced through introduction of suitable modes of public transportation. Considering the seriousness of the public transport issue, proposals for some roads suitable for public transport operation have also been included in the report. Loop routes for medium-capacity public transport have been identified to reduce the level

of existing dependency on rickshaws in the area. The circulation plan for Motijheel has identified secondary roads for NMV operation and the roads with NMV lanes (with soft separation). These NMV lanes have been suggested as interim measures. Once public transport is introduced around the area, and the secondary roads are in place, NMV restrictions can be applied on the main road in the medium to long term. The proposals and findings of the project suggest preparing medium to long-term local plans for new secondary road for bus operation

2.2.9 Sustainable transportation policy

Ahsan (2003) assessed the existing transportation system in Dhaka City, and suggested policy approaches that could mitigate environmental pollution, minimize traffic congestion and ensure mobility for different income groups. The transportation system needs to ensure mobility, affordable to all income groups, convenient and of course environmental friendly to be a sustainable transportation system. He concluded that environmental friendly modern and sophisticated high capacity bus services need to be introduced to meet the public transport demand and to ensure mobility for all income groups.

Fjellstrom (2003) made a case study of Bogotá, Colombia. Bogotá is a city of 6.4 million inhabitants, 15.2% of Colombia's population, in an area of 1,732 sq. km (173,000 ha); giving a high density of 3,695 per sq. km), the average commercial speed is 10 km/h. He noted that Bus Rapid Transit (BRT) is high quality, customer-orientated transit that delivers fast, comfortable and low cost urban mobility. BRT costs $1-10 million/km where Metros and rail cost $20-220 million/km. BRT stations help to catalyze new economic and employment opportunities by acting as nodes of development. Actually a city like Dhaka where a large portion of inhabitants have a problem of mobility and financial constraints make it difficult to opt for metro or rail-based solution, BRT can be an effective mechanism through which this serious crisis can be solved.

2.2.10 Problems and prospects of public transportation

Nepal (2001) reported that public transportation makes a significant contribution to travel in Katmandu city This offers a service to society and contributes to the

economy of the city. It provides a form of mobility for work, social and recreational needs of people. But public transportation in the city is rather disorderly and is far below the satisfaction level. The problems that she identified are inadequate number of vehicles, delay in travel, unsafe vehicles, and in appropriate stop locations, collection of fare, mixed traffic and narrow roads. Like Kathmandu City the current status of Dhaka City is quite alarming in absence of a well-organized system. The city is experiencing various problems in the public transport sector. The growth of small vehicles and simultaneously lack of improvement of the existing facilities and traffic management have resulted in disorganized movement of traffic thereby increasing congestion, accident and decrease in vehicle speeds affecting road capacity. At the same time, organizational deficiencies, lack of enforcement of law and order contributed considerably to slackening of movement of vehicles and pedestrians. Also due to financial constraints and poor quality and quantity of road network, introduction of different modes of transport could not be attained.

Ali (2003) recommended a sub-way system for Dhaka. He argued that the reason behind the accelerated growth of Dhaka's population is the substantial growth of the population of Bangladesh and thus migration. The number of cars, buses and trucks on the roads is increasing steadily in Dhaka at a much faster rate than one can imagine, with little or no construction of new roads. He pointed out that the sub-way system has long-term economic benefit and it will also solve the present problems.

2.2.11 Economic assessment for public transportation

For feasibility study of public transportation economic assessment should be done more accurately. A research by Walters (1979) on cost and scale of bus services related the economics and subsidies in bus business and the benefits of minibuses in Kuala Lumpur etc. He countered the conventional wisdom that large buses in large organizations with subsides to produce optimum frequencies are the best arrangement for urban road passenger transport. It was shown that in theory, small buses are often appropriate, giving the frequencies and speeds at satisfactory level with low average passenger waiting times. Direct observation of minibus services in a number of cities tentatively demonstrated the validity of the theory.

2.3 Conclusion

Public transportation is a major element for city development. This offers a service to the society and contributes to the economy of the city. It provides mobility for work, social and recreational needs of people. From the above discussion, it is revealed that some managerial measures and some techniques could improve the transportation system. From the discussion we got an idea about the major components or issues, which should be considered during urban mass transportation planning.

3

**Chapter Three:
General Description of
the Study Area**

> > >

3.1 Introduction

Rajshahi City is located in the northern region of Bangladesh (Figure 3.1). It is the fourth metropolitan city of Bangladesh and is located on the bank of the river Padma. Rajshahi City was simply a district town prior to 1947 that had become a divisional headquarters in 1947. Rajshahi town gained municipal status in 1876 during British reign and finally achieved the status of City Corporation in 1987. Over the years, it grew as the administrative headquarters of the Rajshahi Division, and lately it has flourished as a centre of learning. Although agricultural activities have grown substantially in the hinterland, the growth in industrial and commercial activities has been very limited. The situation is, however, expected to change due to the introduction of the new railway link with the capital across the Jamuna Bridge, Hatikamrul-Bonpara road (an important shortcut corridor to Dhaka) and expected extension of the gas pipeline up to Rajshahi.

3.2 Population

Rajshahi is a low-density agriculture-based city. The present (2001) estimated population of Rajshahi City (RCC Area) is about 3.4 lakh and the gross density is about 14 person per acre as calculated from demographic data of BBS (1993). There are 30 wards in RCC area. Ward 29 is the most densely populated ward as per the estimated population (2001), with a gross density of 27 persons per acre. However, the density is very low compared to other secondary cities of the country. In Khulna City the highest density ward-wise is 150 persons per acre (BBS, 1993). Rajshahi has about 30% of its land in agricultural use or lying vacant. It indicates that there is ample scope for densification within the existing city area. The lowest density areas of the city are Ward 27 with 7 persons/acre. Ward 3 with 8 persons/acre and Wards 2 and 20 with 9 persons/acre (Fig. 3.2)

3.3 Age-Sex Structure

The socio-economic survey conducted in the study area by DDC reflects the age-sex structure of the population. It is seen from the Table 3.1 that 23.45% of respondents belong to the age group of 15-24, 20.45% of them are in the age group of 0-14. 17.72% are in the age group of 25-34, 19.16% are in the age group of 35-49 and only
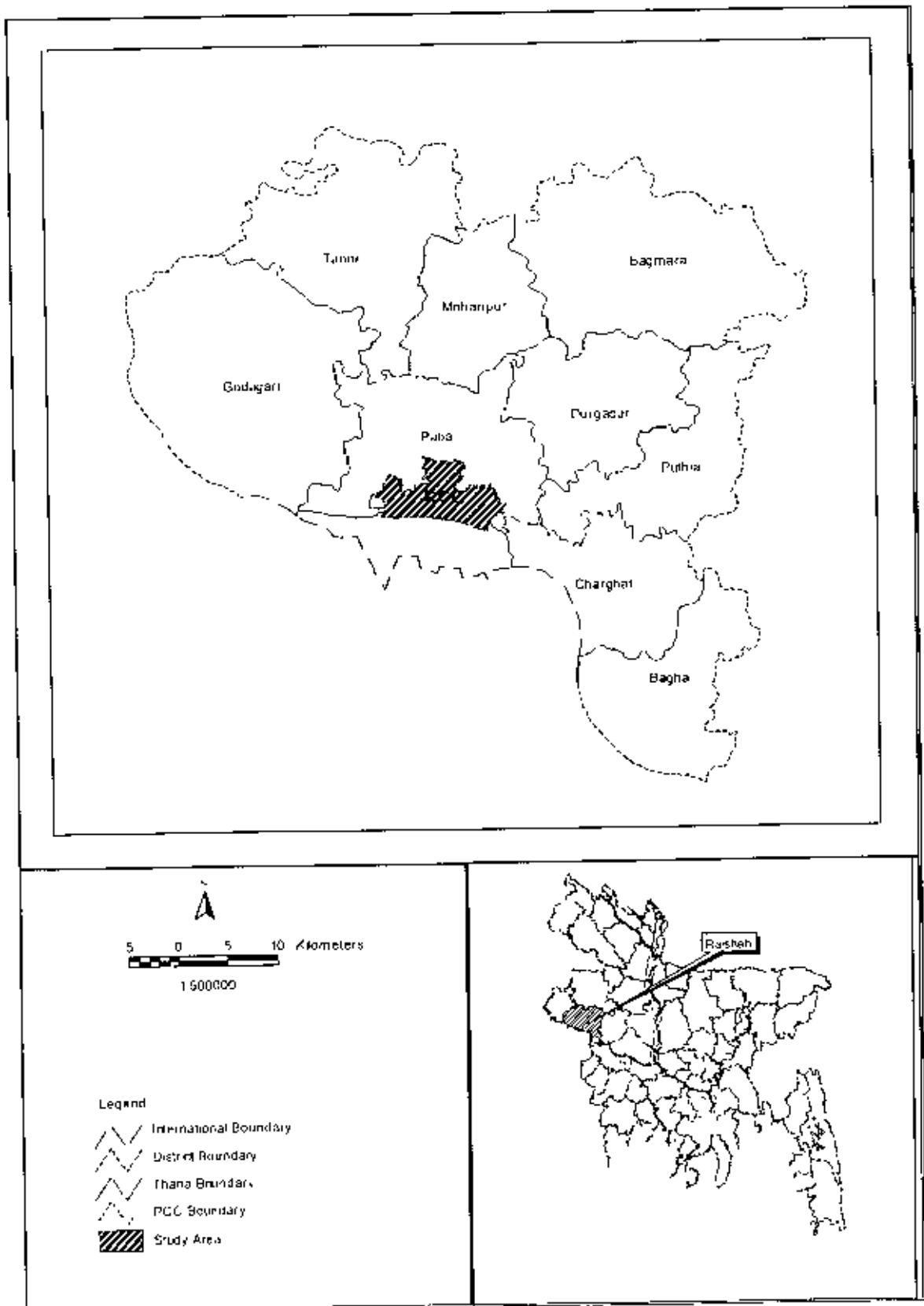
Fig. 3.1 Location of the Study Area

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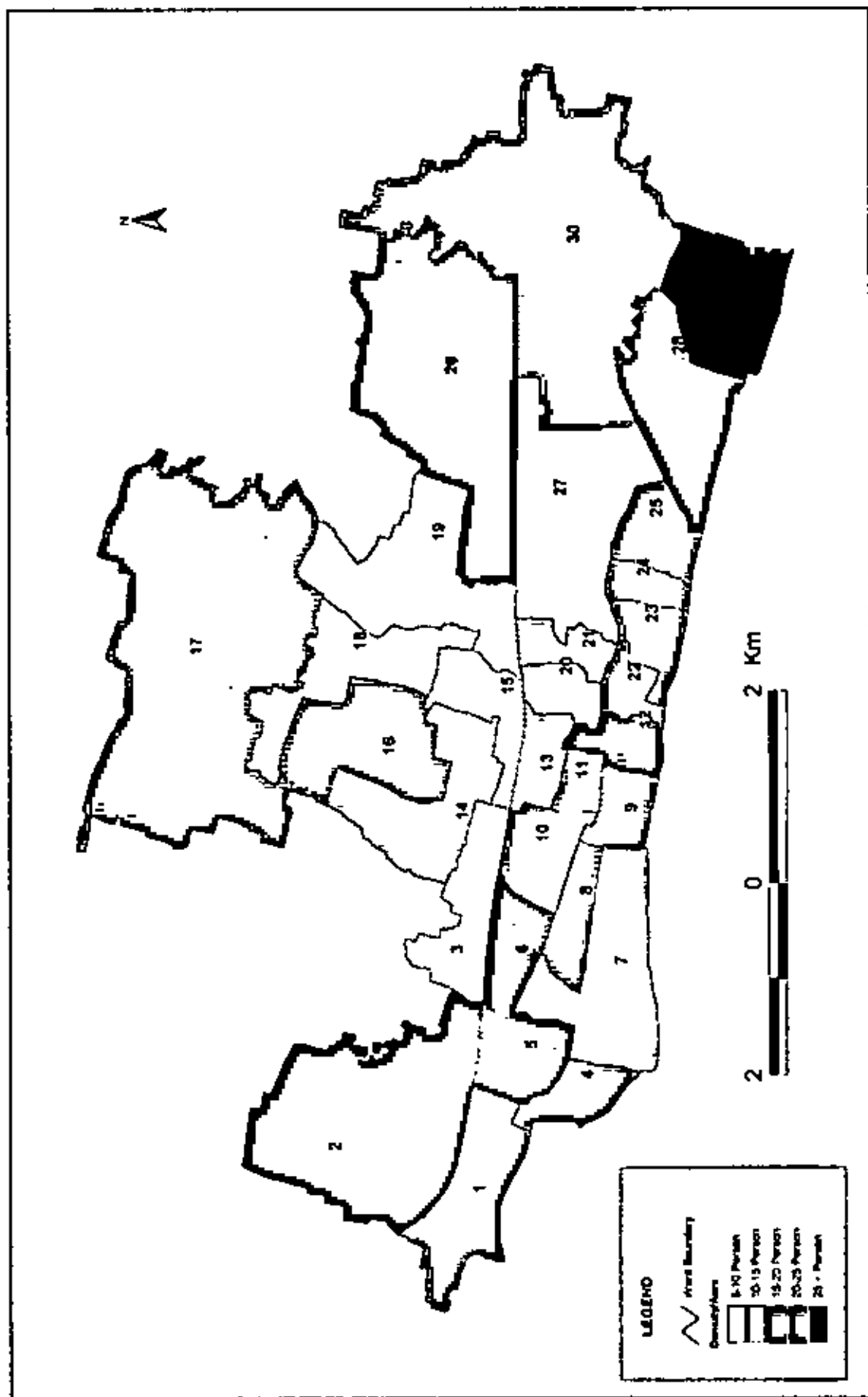
Fig. 3.2 Population Density of Study Area (2001)

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8.63% of respondents belong to the age group of 50-59 and the rest 17.72 % of them are in the age group of 60+ Within both sexes the most populated age group is 15-24 and males outnumber females in that group (females 24.91%, males 21 87 %).

Table 3.1 Distribution of Population by Age Group and Sex in the Study Area

| Age | Sex | | | | | |
| | Male | | Female | | Both Sexes | |
	Number	Percentage	Number	Percentage	Number	Percentage
0-14	2232	19 76	2327	21.16	4559	20 45
15-24	2470	21 87	2740	24 91	5210	23 37
25-34	1960	17.35	1989	18 09	3949	17 72
35-49	2197	19 45	2075	18.87	4272	19 16
50-59	893	7 91	617	5 61	1510	6 77
60+	1542	13.66	1250	11.36	2792	12 53
Total	11294	100	10998	100	22292	100

Source: Socio-economic survey by DDC, 2003

3.4 Education

From Table 3.2 it is observed that the literacy rate of the people is 91.03%. About 23 2% of the people have completed primary education, 24.5% people have below SSC level education, 10 9 % have completed junior high school level education, 9.4% have completed HSC level education, 7.9% have completed graduate level education, 5.3% people have a post graduate degree and the rest are in the 'other' categories

Table 3.2 Educational Status of the Population by Sex

| Educational Status | Male | | Female | | Total | |
	Number	Per.	Number	Per.	Number	Per.
Illiterate	725	6 4	1225	11 1	1950	8.7
Primary	2402	21 3	2773	25 2	5175	23 2
Below SSC	2548	22 6	2921	26 6	5469	24 5
SSC	1239	11.0	1200	10.9	2439	10 9
HSC	1138	10 1	953	8 7	2091	9 4
Degree	1183	10.5	567	5 2	1750	7 9
Medical/Engineer /Advocate	235	2 1	57	0 5	292	1 3
Masters/Higher	766	6 8	411	3 7	1177	5 3
Technical	71	0 6	09	0 1	80	0 4
Vocational Trade	09	0 1	05	0 1	14	0 1
Madrasa degree	65	0 6	10	0.1	75	0 3
Under age	880	7 8	844	7.6	1724	7 7
Others	33	0 3	23	0.2	56	0 3
Total	11294	100.00	10998	100.00	22292	100.00

Source: DDC (2003b)

3.5 Base of Economic Activities in the RCC area

Industries, informal sector, public sector institutions and service sector provide the major bases for economic activities in the study area. Markets are the important centres of economic activities in Rajshahi City.

Industrial Base

Rajshahi Textile Mill, Rajshahi Jute Mill and Rajshahi Sugar Mill are the major industries in the study area. The Bangladesh Small and Cottage Industries Corporation (BSCIC) industrial estate established at Sopura is an important industrial base in the study area.

Markets

Shaheb Bazar area, RDA market and adjacent areas, New Market and Hawkers' Market are the major shopping centres in the city Markets at Harogram, Talaimari and Binodpur and Katakhali are important local shopping centres. The shops in the city markets and shopping centres deal in all sorts of consumer goods, both durables and daily necessities. Major items are textile goods, ready-made garments, grocery articles, crockeries, stationeries and books, jewelleries, electronics and hardware. Many shops deal in fish, meat, eggs, poultry, vegetables and other kitchen goods

3.6 Occupation

The largest occupational category is reported to be student (31.7%). The second largest occupational category is household work (31.7%). The under-aged (below 6 years) members constitute the third largest occupational category (8.4%). Over 50% of female members are engaged in household works. The next important occupational category for female members is studentship (31.6%) (Table 3.3).

Table 3. 3 Distribution of Population by Occupation and Sex in Study Area

Occupation	Male		Female		Both Sexes	
	Number	Per.	Number	Per.	Number	Per.
Self-employed	106	0 9	11	0.1	117	0 5
Employment in Govt & Autonomous body	1657	14 7	258	2 3	1915	8 6
Business	2257	20	122	1 4	2408	10 8
Employment in Non-Govt. Organization	62	0 5	27	0 2	89	0 4
Rickshaw /Van puller	197	1 7	00	0 0	197	0 9

Occupation	Male		Female		Both Sexes	
	Number	Per.	Number	Per.	Number	Per.
Motor Driver	127	1.1	02	0.0	129	0.6
Skilled Mechanics	318	2.8	06	0.1	324	1.5
Industrial Labour	44	0.4	10	0.1	54	0.2
Day labour (Non-Farm)	172	1.5	07	0.1	179	0.8
Land Owner Farmer	47	0.4	06	0.1	53	0.2
Sharecropper	10	0.1	01	0.0	11	0.1
Day labour (Agri)	65	0.6	03	0.0	68	0.3
Household works	155	1.4	5524	50.1	5678	25.5
Unemployed	551	4.9	225	2.0	776	3.5
Students	3611	32.0	3477	31.6	7088	31.7
Underage	950	8.4	912	8.3	1862	8.4
Informal Activities	965	8.5	380	3.4	1345	6.0
Total	11294	100	10998	100	22292	100

Source: DDC (2003b)

3.7 Pattern of Monthly Household Income

Table 3.4 presents the pattern of monthly income of sample households. The majority of households in the study area are in the monthly income group of Tk. 2500- 6500. About 10.1% households belong to the lowest income group of Tk <1500-2500 and 13.7% households earn a monthly income over Tk. 12,000.

3.4 Table-Pattern of Monthly Household Income in the Study Area

Income Group	Number of Households (HH)	Percentage of Total HH	Average Income
Upto-1500	91	2.2	1211.59
1501-2500	332	7.9	2144.29
2501-3500	626	14.9	3104.30
3501-4500	519	12.4	4065.24
4501-5500	503	12.0	5056.47
5501-6500	392	9.3	6062.65
6501-8000	527	12.5	7442.20
8001-10000	406	9.7	9337.67
10001-12000	230	5.5	11369.70
12000+	574	13.7	19151.19
Total	4200	100.00	6894.53

Source: DDC (2003b)

3.8 Pattern of Household Expenditure

Table 3.5 shows the pattern of household expenditure. Sample households incurred expenditures against food, clothes, health care, transport, fuel and utilities. About 15.2% of the households in the study area reported a monthly expenditure of Tk. 2501-3500 level and Tk. 3501-4500 level each. The second most frequently reported level was Tk. 4501-5500 (14 % households). Only 1.06% of households reported a monthly expenditure below Tk.1500 and 9.2% households reported it in the range of Tk 1500-2500 About 13.4 % of households reported a monthly expenditure over Tk. 10,000

Table 3.5 Pattern of Monthly Household Expenditure in the Study Area

Income Group	Number of Households	Percentage	Average Expenditure
Upto-1500	69	1 6	1203 70
1501-2500	387	9 2	2103 65
2501-3500	639	15.2	3050 08
3501-4500	639	15 2	4010 41
4501-5500	589	14 0	5006.95
5501-6500	473	11.3	6031 81
6501-8000	507	12 1	7257 19
8001-10000	421	10 0	8994.57
10001-12000	217	5.2	10972 14
12000+	259	6 2	17046 61
Total	**4200**	**100.00**	**6567.71**

Source: DDC (2003b)

3.9 Existing Land Use Pattern of RCC Area

The Rajshahi City Corporation area is mainly the built up part of the urban area of Rajshahi. Though it is a municipal area a large part of it is used for agriculture purpose. The dominant land use of urban Rajshahi is residential followed by agriculture, vacant land, waterbody, education and research. Residential use cover over 33% of the urban space (Figure 3.3) Waterbodies like, river, pond, ditch etc. occupy 10.78%, while 18.74% land is still being used for agriculture. A little over 11% land is lying vacant. Road infrastructure covers 5 62% of the RCC area Education is an important use with 10.50% of the RCC area Industry and storage

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together comprise only 0.81%, while business and mercantile use constitute 1.98% of the total RCC area reflecting a low profile of economic activities in the city.

Table 3.6 Existing Land Use of Rajshahi City corporation (RCC) Area

Sl. No.	Landuse	Area in Acre	Area in Hectare	Percentage
1	Residential/ Homestead	3972 58	1608 33	33.46
2	Agriculture	2224 23	900.50	18 74
3	Educational and Research	1246 43	504 62	10.50
4	Business and Mercantile	235 40	95 30	1 98
5	Public Administration	52 43	21 22	0.44
6	Institution	22 18	8 98	0 19
7	Mixed Use	26 35	10 67	0 22
8	Industrial and Storage	96 59	39.11	0 81
9	Open Space	130 28	52.75	1.10
10	Assembly	43 65	17 67	0 37
11	Security/ Defence	239.24	96 86	2.02
12	Public Utilities, Communication & Transport	118 76	48 08	1 00
13	Road	667.45	270.22	5.62
14	Railway	39 83	16.13	0 34
15	Vacant Land	1316 79	533 11	11 09
16	Water Body	1279.74	518 11	10.78
17	Char Land	158 91	64 34	1.34
	Total	11870.84	4806.00	100.00

Source. Physical feature survey by DDC, 2003

Legend

RCC Boundary
Ward Boundary

Road
Residential
Agricultural

Educational
Business & Mercantile
Vacant
Water Body
Others

1 50000

2 Kilometers
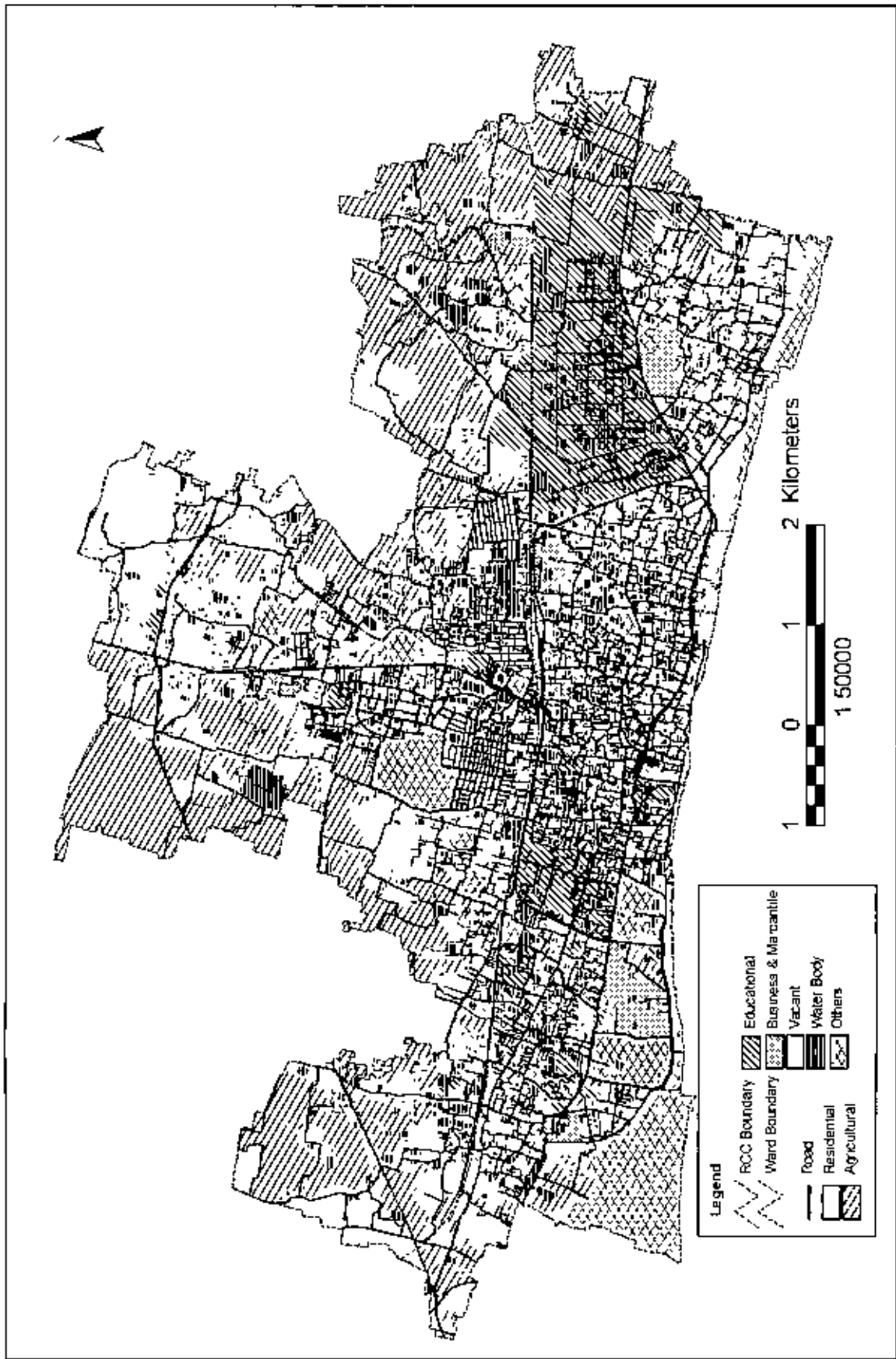
Fig. 3.3   Existing Landuse of the Study Area

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3.10 Growth of Vehicles

Almost all modes of transport are found to operate in Rajshahi, starting from push cart to modern cars and luxury buses. Rickshaws provide both door to door and feeder service to long distance buses and railways as there is no city bus service

Registered Motorized Vehicles

The numbers of motor vehicles registered in Rajshahi district during the period 1995-2000 according to Bangladesh Road Transport Authority (BRTA) are indicated in Table 3.7. In addition Table 3.8 indicates the number of vehicles, which were registered in other districts but endorsed by BRTA Rajshahi during the period 1995-2002.

Table 3.7 Number of Registered Motor Vehicles in Rajshahi District

Type of Vehicles	Year of Registration						Total
	1995	1996	1997	1998	1999	2000	
Motor Car	16	74	78	21	32	21	242
Jeep/St. Wagon/ Microbus	40	39	47	58	17	21	222
Taxi	-	-	-	-	-	-	-
Bus	4	-	4	4	3	16	31
Minibus	8	4	25	23	7	13	80
Truck	60	50	45	16	25	35	231
Auto Rickshaw/ Tempo/Misc.	110	119	92	35	40	13	409
Motor Cycle	455	900	744	650	700	592	4041
Others	10	50	45	50	45	16	216
Total	703	1236	1080	857	869	727	5472

Source: BRTA, Rajshahi, 2003

Table 3.8 Number of Vehicles Endorsed to Rajshahi District

Type of Vehicles	Year of Endorsement								Total
	1995	1996	1997	1998	1999	2000	2001	June 2002	
Motor Car	20	39	8	38	67	77	74	57	380
Jeep/St. Wagon/ Microbus	23	40	22	47	38	53	57	17	297
Taxi	0	0	0	0	0	0	0	0	0
Bus	7	8	4	3	0	1	6	2	31
Minibus	24	23	5	10	16	37	16	25	156
Truck	15	25	10	30	34	31	23	22	190
Auto Rickshaw/ Tempo	5	7	3	9	4	5	5	2	40
Motor Cycle	13	28	9	15	30	34	36	12	177
Others	6	3	0	0	2	1	1	1	14
Total	113	173	61	152	191	239	218	138	1285

Source: BRTA, Rajshahi, January 2003

Non-Motorized Vehicles (NMV)

According to Rajshahi City Corporation (RCC), registration of Non Motorized Vehicles (NMV) during last few years was as follows

Table 3.9 Number of NMV Registered by RCC

Type of Vehicles	Year of Registration							Total
	1987-95	1996	1997	1998	1999	2000	2001	
Rickshaw	12003	-	-	-	25	1500	1500	15028
Rickshaw & van	3500	-	200	200	100	-	-	4000
Private Rickshaw	-	-	-	25	-	-	-	25
Tom Tom	100	-	-	-	-	-	-	100
Push cart	25	-	-	-	-	-	-	25
Total	15628	-	200	225	125	1500	1500	19,178

Source: Tax & License Officer of RCC, January 2002.

Although the number of registered rickshaws is 19,178, around 32,000 rickshaws are operating illegally in Rajshahi Metropolitan City (DDC, 2003a).

4

**Chapter Four:
Existing Public
Transportation, Traffic
Flow Characteristics
and Need for Public
Bus Services**

> > >

CHAPTER FOUR: EXISTING PUBLIC TRANSPORTATION, TRAFFIC FLOW CHARACTERISTICS AND NEED FOR PUBLIC BUS SERVICES

4.1 Introduction

In this chapter at first existing public transport system, existing mode of public transport, existing road network, existing traffic flow characteristics and passengers' attitude towards public bus service have been analyzed. Then, on the basis of these analyses and socio-economic conditions the need for public bus services has been discussed.

4.2 Existing Public Transportation

As there is no public bus service in Rajshahi City, rickshaws play a vital role as a public transport. Most of the city people use rickshaws as the principal mode of their daily transport (DDC, 2003a). Besides, tempos, baby-taxis and buses provide a small share of public transportation. The roles of different modes of public transport in Rajshahi City are discussed below.

a) Rickshaws

The cycle rickshaw is by far the most common mode of transport in Rajshahi. There are about 32,000 rickshaws and around 124 rickshaw stands in Rajshahi City (DDC, 2003a), which are located on different city streets. About 20-25 rickshaws may be parked at each stand. In some of them, 40-50 rickshaws can be parked. About forty five percent of all vehicular passenger trips and a much higher proportion of goods trips, infact about 90% of all retail and wholesale food stuff in Rajshahi, are moved by rickshaw and most of the commuters and students use rickshaw for their daily movement (DDC, 2003a).

b) Tempos and baby-taxis

At present only three routes are used for tempo and baby-taxi services in the city of which two routes are used by tempo and one by baby-taxis. The two routes of tempo service are Noahata to Bindur Moar and Shaheb Bazar to Binodpur. On an average 15-20 tempos operate from Noahata to Bindur Moar every day and an average of 12-15 tempos operate from Shaheb Bazar to Binodpur every day. The average capacity of

a tempo is 10 persons. Baby-taxis ply from Barnali Mŏar to Court Station. About 10-12 baby-taxis operate on the route per day and the capacity of a baby-taxi is 6 persons.

c) Buses

There is no local public bus service in Rajshahi City. Only some inter-district buses serve a small share of the public transportation demand in the city. Inter-district buses operate each way along 12 routes daily. A certain number of trips of the commuters and students are made by this service.

4.3 Existing Road Network

In the national context, Rajshahi is well connected with the rest of the country, both by road and by rail. With the opening of Nalka-Haukamrul-Bonpara road, Dhaka is now only a 4.5 hours' journey away from Rajshahi. There is about 375.83 km of road network within Rajshahi City of which about 65% is *pucca*. The major roads are Natore Road, Old Natore Road, Chapai Nawabganj Road, Airport Road and Greater Road. These roads are mainly the arterial roads of the city. Besides, the Cantonment Road, City Bypass Road, Court Station Road and Ramchandrapur Road are the important roads of the city. These roads are managed by four different agencies namely Rajshahi City Corporation (RCC), Rajshahi Development Authority (RDA), Roads and Highways Department (RHD) and Local Government Engineering Department (LGED).

Table 4.1 Road within RCC Area

Agency	Asphalt Concrete (km)	Bitumen (km)	Water Bond Macadam (km)	Herring Bone Bond (km)	Total (km)
R.C.C.	4.3	204.63	40.34	85.68	334.95
RDA	0	5.78	0	0	5.78
RHD	0	16.50	0	0	16.60
LGED	0	18.50	0	0	18.5
Total	4.3 (1.15%)	245.41 (65.30%)	40.34 (10.73%)	85.68 (22.80%)	375.83 (100%)

Source: RCC, RDA, RHD & LGED, 2003

Information on all major roads within RCC area, including those, which provide external links to other major cities, were collected. The information includes length,

pavement width and condition, condition of shoulder/footpath, the right of way etc. These information were used in determining the capacity of the roads.

4.4 Regional Road Links:

Eastern and Southern Links: National Highway No 6 provides the most important links to Dhaka and Chittagong in the east, through both Bangabandhu Bridge and Nargarbari ferry, and also to Khulna in the south.

Western Link: Regional road no R680 provides the most important western link to Nawabganj, and to Sonamasjid, one of the most important border check posts with India in the west.

Northern Link: Regional road no. R685 provides the most important northern link to Naogaon. This road goes through a very rich agricultural belt which has potential for providing cash crops having a good market in Dhaka.

4.5   Major Traffic Generating Areas

There is an integral relationship between land use and traffic generation. From field observation and land use analysis it is observed that like any other urban centre, in Rajshahi, the transport nodes, commercial areas and work places are the major generators of traffic (Fig 4.1). The major traffic generating centres within the RCC area are described below.

a) Shaheb Bazar

It is the main activity area or CBD of Rajshahi City. Wholesale and retail markets of different communities such as textiles, household goods, electronics cosmetics, crockeries, groceries and fruits are located in this area About 1087 shops are located in this area and about 3117 people work in this area (DDC, 2003b).   Old Natore Road has passed through this area.

b) Monichattar

It is also located on the old Natore Road and is very close to Shahab Bazer area. It is a important nodal point of the city. New market, Malopara, Kadirganj, Rajshahi College are well linked with this area. Different types of shops and commercial centers are located in this area

c) Rajshahi Central Bus Terminal and Rajshahi Railway Station

This is an important place of Rajshahi City. Rajshahi central bus terminal and rail station are located opposite to each other. It is located on the Greater Road. All types of inter district bus services and local, mail and inter district trains operate from this place.

d) Kadirganj

It is an important wholesale market area of Rajshahi City. Rajshahi Newmarket are also located in this area which is well linked with Shaheb Bazar and Monichattar area

e) Binodpur Bazar

It is located near Rajshahi University area and serves as an important commercial centre of this area and its surrounding.

f) Laxmipur

It is also an important area of the city and is mainly famous for health facilities. Different types of hospitals, Clinics, diagnostic centres are located in this area. People from different parts of the city and from different areas of north Bengal come here for better medical treatment.

g) Rajshahi Court

It is located at Bhularpur area and on the old Chaipai Nawabgang Road. People from different area of Rajshahi district gather here for litigation-related work. Based on the court different activities have grown up in this area. Haragram Bazar is located in this area.

h) Barnali Moar

This is an important junction or nodal point where Cantonment Road, Hatem Kha Road and Greater Road meet each other. Some commercial centre and clinics are also located here.

i) Bindur Moar

This is also an important junction or nodal point where Airport Road, Newmarket Road and Greater Road meet each other. It is very close to Newmarket and central bus terminal.

j) Shalbagan

This is a big Katcha Bazar of Rajshahi City. It is a big market for diffrent types of vegetables, fishes, fruits etc. People from Upashahar Housing Estate, Sopura Industrial area and Choto Banogram area mainly come here to purchase vegetables, fishes, fruits and others different groceries

k) Talaimari

It is also a very important junction point where Greater Road meets Natore Road near Rajshahi University of Engineering and Technology (RUET). Some commercial activities are also generated in this area.

l) C&B Moar

It is also an important junction where Greater Road meets Natore Road near Rajshahi Radio Transmision Center and very close to I Badh of Padma River which is the major recreation centre of Rajshahi City.

4.6 Trip Distribution

Trip distribution is the process of distributing trips generated in each zone to all possible destination zones. In the RCC area the destination of a major portion of trips is Shaheb Bazar which is the Central Business District (CBD) of Rajshahi City. Court station, Lakshmipur and Sopura are also important destinations of trips. Based on the information about origin and destination of trips made on the day before the survey, a desire line diagram was prepared as shown in Fig. 4.2.

Legend

⟋⟍ Major Road

⟋⟍ Other Road

⟋⟍ RCC Boundary

■ Major Traffic Generating Area
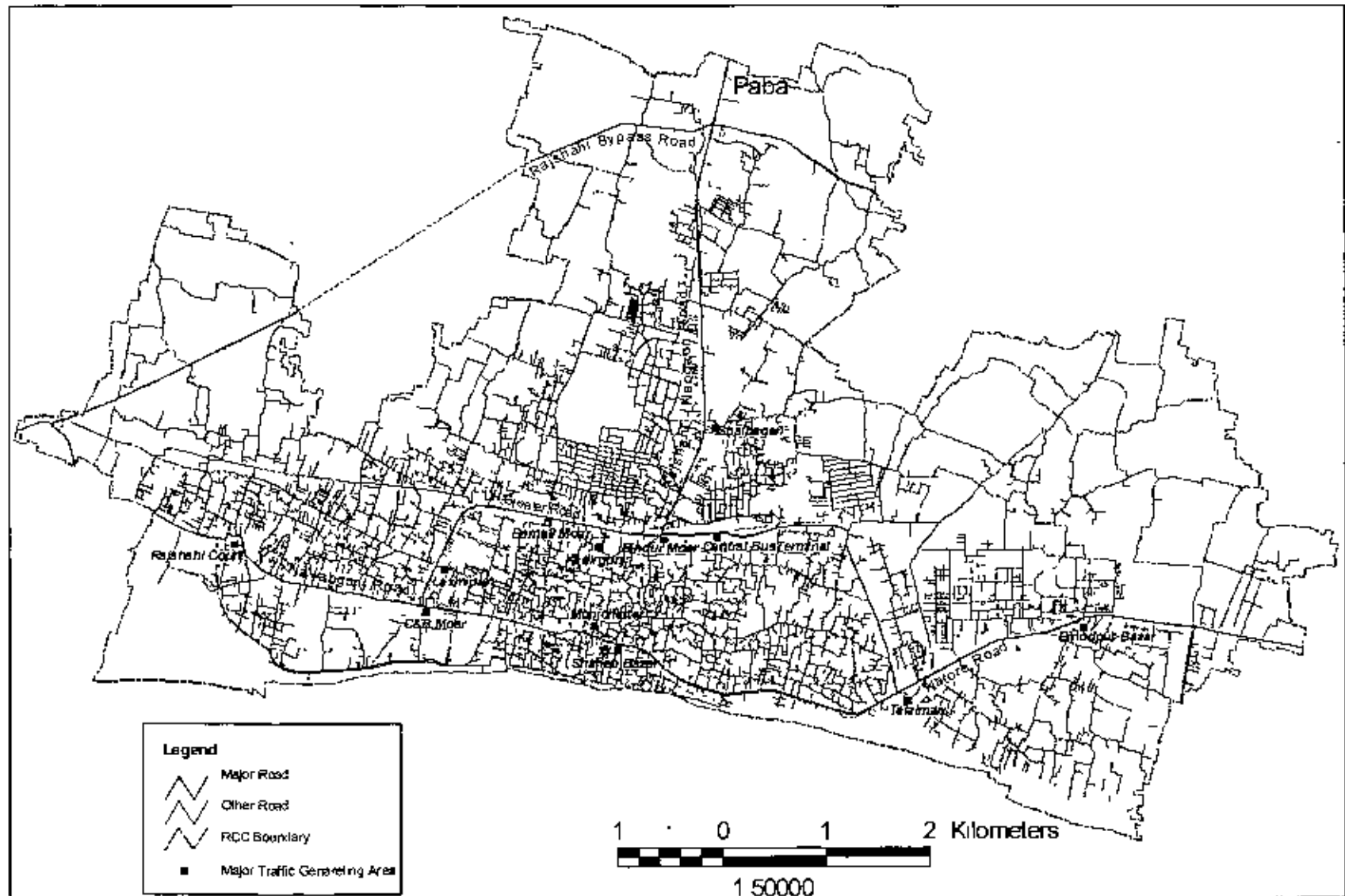
Fig. 4.1   Major Traffic Generating Areas and Road Network of the Study Area

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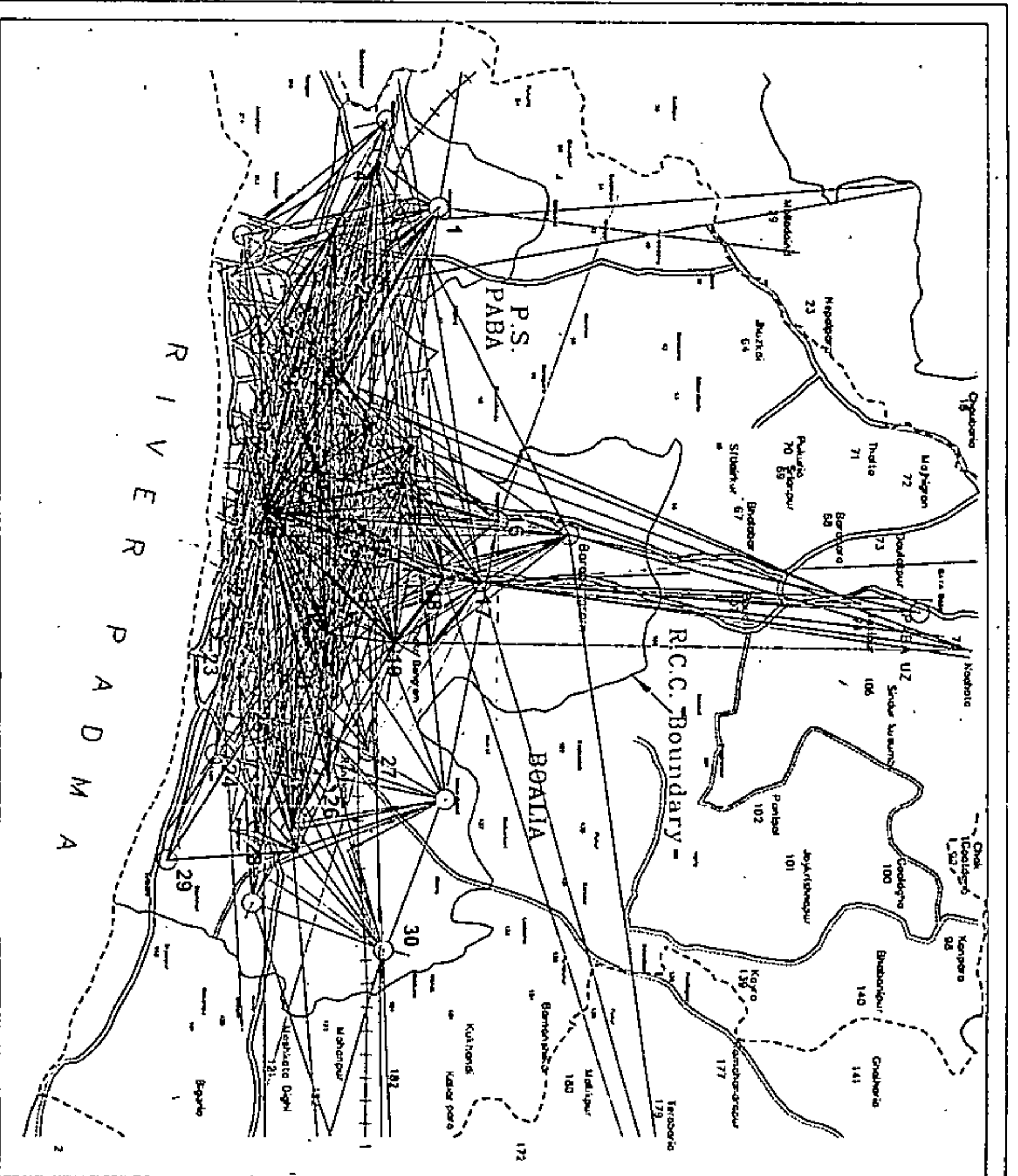
DESIRE LINE DIAGRAM OF DAILY TRIPS

Fig.4.2

Legend

+++++++	International Boundary
————	Project Area Boundary
– – – –	R. O. A. Boundary
··········	City Corporation Boundary
————	Metalled Road
=========	Railway Line
⊙	Ward Location
——	No. of Trips

Source: DDC(2003) Working Paper on
Transport, RMDP 2004-2024

R I V E R   P A D M A

P.S. PABA

R.C.C. Boundary

BOALIA

4.7 Mode of Trips

For any type of transportation study mode of trips is important. Within RCC area it was found that rickshaws are the most popular mode of transport and about 33.6% of the total population use rickshaw as a mode of transport, followed by walking, while bicycles are also used quite extensively. Table 4.2 provides the details of the mode of transport used by the people for their daily trips.

Table 4.2 Present Mode of Travel for Daily Trips by Household Members

Sl. No.	Mode of Transport used	No. of Trips	Percentage of Trips Made by different Modes
1.	Rickshaw/Van	3828	33.6
2	Cycle	2527	22.2
3	Motor Cycle	501	4.4
4	Car/Jeep/Microbus	245	2.1
5	Bus	742	6.5
6.	Baby Taxi/Tempo	109	1.0
7	Train	40	0.4
8	On Foot	3321	29.1
9.	Others	88	0.8
. Total	By all modes	11401	100.0

Source: Socio-economic survey by DDC, 2003

From the table it is observed that among all trips 6.5% are made by bus. Bus services are used mainly by the university students and by people going out of or coming into the city. Trains are used only by people going out of or coming into the city. The modes of choice for trips made by the people are different in different wards. In Wards 7, 12, 16 and 17 trips made on foot constitute the largest modal share whereas in Wards 10, 13, 20, 22 and 24 the distinction belongs to trips made by rickshaws (Appendix 3)

4.8 Purpose of Trips

It was found that nearly 69% of all trips made were related to either home or work, 15% were made to school/colleges/universities, 2.8% were made for social/recreational/sports purposes, 2.5% were made for shopping, only 1.3% were made to change travel mode and the rest for other different purposes (Table 4.3).

Table 4.3 Purposes of the Trips in the Study Area

Trip Purpose	Frequency	Percentage
Work	3443	30 2
School/College/University	1676	14 7
Shopping	285	2 5
Social/Recreational/Sports	319	2 8
Home	4389	38 5
Change of Travel Mode	148	1.3
Others	1140	10
Total	11401	100

Source: Socio-economic survey by DDC, 2003

4.9 Distance of trips

From table 4.4 it is observed that 17.81% of trips by all modes flow within a 2-3 km. distance and 11.14% below a one km. distance. Only 7.81% of trips flow within a 1.1-2.0 km. distance, 10.71% of trips are made within 3.1-4.0 km., 16 40% of trips within 4.1-5.0 km. distance, 8 86% of trips within 5.1-6.0 km. distance, 9.47% of trips within 6.1-7.0 km. distance and about 17.81% of trips go beyond 7 km distance.

Table 4.4 Distance of Trips in the Study Area

Distance in Km.	Frequency	Percentage
0 2-1.0	1270	11.14
1.1-2 0	890	7.81
2 1-3.0	2030	17.81
3 1-4.0	1221	10.71
4 1-5.0	1870	16.40
5 1-6.0	1010	8.86
6 1-7.0	1080	9.47
7+	2030	17.81
Total	11401	100.00

Source: Socio-economic survey by DDC, 2003

Within the study area it is found that the distance of trips varies with the mode of trips. It is observed that most trips on foot range within 3 kms, while trips made by tempos and cars/jeeps go above 4 km distance. Table 4.5 provides the details of distance of the trips by mode of travel.

4.5 Distance of Trips in Context of Mode of Trips

Mode of Trips	Distance in Km.								
	0.2-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0	5.1-6.0	6.1-7.0	7+	Total
Rickshaw /Van	253	319	750	580	710	375	390	451	3828
Cycle	222	191	550	339	410	201	179	435	2527
Motor Cycle	0	0	22	77	89	107	119	87	501
Car/Jeep /Microbus	0	0	0	0	0	12	11	222	245
Bus	0	0	25	35	63	60	135	424	742
Babi Taxi /Tempo	0	0	0	0	30	04	20	55	109
Train	0	0	0	0	11	0	0	40	40
On Foot	795	380	683	168	537	251	226	281	3321
Others	0	0	0	22	31	0	0	35	88
Total	1270	890	2030	1221	1870	1010	1080	2030	11401

Source: Socio-economic survey by DDC, 2003

4.10 Duration for Trips

As Rajshahi is a low density and traffic congestion free area the travel time for the trips are low 26.55% of trips take 15-30 minutes and about 73% of the total trips end within 60 minutes Only 13.48% of total trips take above 60 minutes. Table 4.6 provides the details of duration for the trips made by the city people.

Table 4.6 Duration of Trips in the Study Area

Duration in Minutes	Frequency	Percentage
5-15	2427	21 29
15-30	3027	26 55
30-45	2910	25.52
45-60	1500	13.16
60+	1537	13 48
Total	11401	100.00

Source. Socio-economic survey by DDC, 2003

4.11 Traffic Flow Characteristics

On the basis of the location and land use around that location, traffic flow varies over different hours of the day (Fig 4.4). Depending on the land use and socio-economic characteristics of the city, there can be one or more peak hours in a day (Appendix 3) Sometimes this peak can span periods are more than an hour A detailed study was undertaken by DDC to count traffic flow on different major roads For this study the

traffic flow of different major roads were counted and converted to Passenger Car Equivalent (PCE) value. The PCE values of different modes, are shown in the Table 4 4

Table 4.7 Passenger Car Equivalent (PCE) Values

Sl. No.	Type of Vehicles	P.C.E Values
1.	Bus/Truck	3
2.	Car/Jeep/Microbus	1
3	Auto Rickshaw	1
4	Motor Cycle	0.25
5	Rickshaw/Rickshaw Van	0.50
6.	Bicycle	0 15
7	Animal Cart/Thela	3
8	Tom-tom	1

Source: DOC (2003a)

From Table 4.4 we get a clear idea about the traffic flow in Passenger Car Equivalent (PCE) at both peak hour and off peak hour on different major roads of Rajshahi City. From the table it is observed that the highest volume of traffic flows from Dhaka Bus Stand to Bindur Moar, the second highest volume of traffic is observed on Bhadra to Dhaka Bus Stand link.

Another important analysis undertaken was to determine the traffic composition during peak hour at certain intersections. Depending on the relative importance of the road link, whether it forms part of a regional or local route, and the type of land use around the intersection, traffic composition varies. But in Rajshahi City, the traffic composition on all major roads are about the same. Rickshaws and bicycles were found to be the most dominating modes of transport in the whole of Rajshahi City. Airport Road is one of the important and major roads of Rajshahi City. On Bindur Moar-Airport Road, rickshaws and bicycles formed 67-72% of the traffic, buses and trucks formed 13-18 % of the traffic, only 8 % of the traffic were formed by auto rickshaws and the rest by other modes (Figure 4.3).

Table 4.8 Peak Hour Flow and 14 Hour total Flow (in PCE) of Traffic

Name of Road	Name of Link	Direction of Flow	Peak Hour Flow	14 Hour Total Flow
Rajshahi - Natore Road	Talaimari - Natore Road	W-E	1092	9849
		E-W	896	7980
		bothway	1988	17829
Old Natore Road	Talaimari - Shaheb Bazar	E-W	372	2750
		W-E	394	4384
		bothway	766	7134
Greater Road	Talaimari – Bhadra	To S-N	741	7039
		To N-S	855	7380
		bothway	1596	14419
Greater Road	Bhadra - Dhaka bus stand	E-W	1191	10122
		W-E	711	10911
		bothway	1902	21033
Greater Road	Bindur Moar - Dorikharbona	E-W	741	7330
		W-E	803	8690
		bothway	1544	16020
Greater Road	Dhaka bus stand - Bindur Moar	E-W	1134	10469
		W-E	886	11625
		bothway	2020	22094
Greater Road	Dorikharbona – Barnali	E-W	733	6676
		W-E	577	7486
		bothway	1310	14162
Greater Road	Barnali - Lakshmipur	E-W	624	7303
		W-E	614	6937
		bothway	1238	14240
Greater Road	Lakshmipur - C & B Junction	N-S	430	4206
		S-N	397	3931
		bothway	827	8137
Airport Road	Bindur Moar - Airport	N-S	1521	12022
		S-N	762	10069
		bothway	2283	22091
Court Station Road	Lakshmipur - Court Station	E-W	363	4547
		W-E	458	4149
		bothway	821	8696
Old Natore Road	C & B - Court Bazar	E-W	800	5611
		W-E	913	6664
		bothway	1713	12275
Old Natore Road	C & B - Moni Chattar	W-E	688	7612
		E-W	789	7603
		bothway	1477	15215
Old Natore Road	Moni Chattar - Shaheb Bazar	W-E	653	7528
		E-W	677	6033
		bothway	1330	13561

Source: DDC (2003a)

Airport - Bindur Moar (17-18)

Bicycle 11%

Cycle Rickshaw 56%

Truck 11%

Bus 7%

Car 4%

Auto Rickshaw 8%

Motor cycle 3%

Legend:
- Truck
- Bus
- Car
- Auto Rickshaw
- Motor cycle
- Cycle Rickshaw
- Bicycle

Bindur Moar - Airport

Bicycle 8%

Truck 6%

Bus 7%

Car 5%

Cycle Rickshaw 54%

Auto Rickshaw 8%

Motor cycle 2%

Legend:
- Truck
- Bus
- Car
- Auto Rickshaw
- Motor cycle
- Cycle Rickshaw
- Bicycle
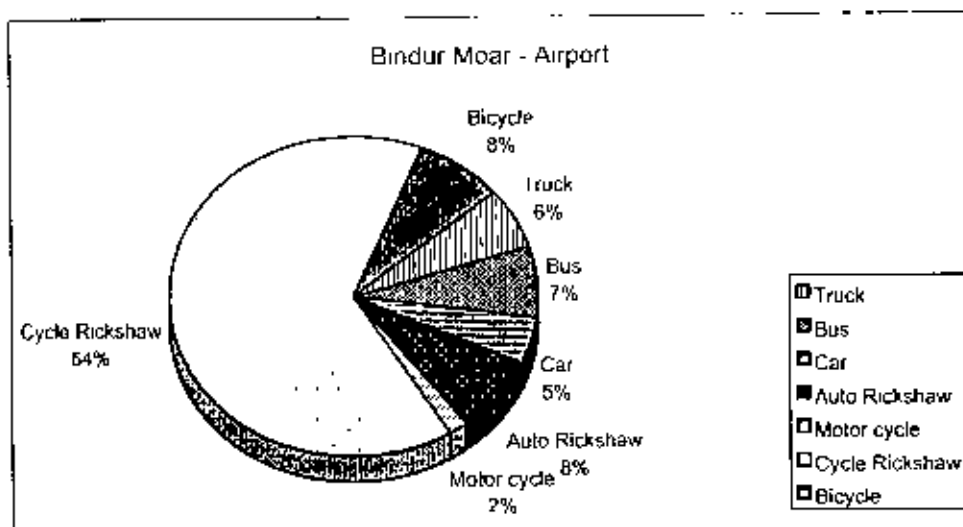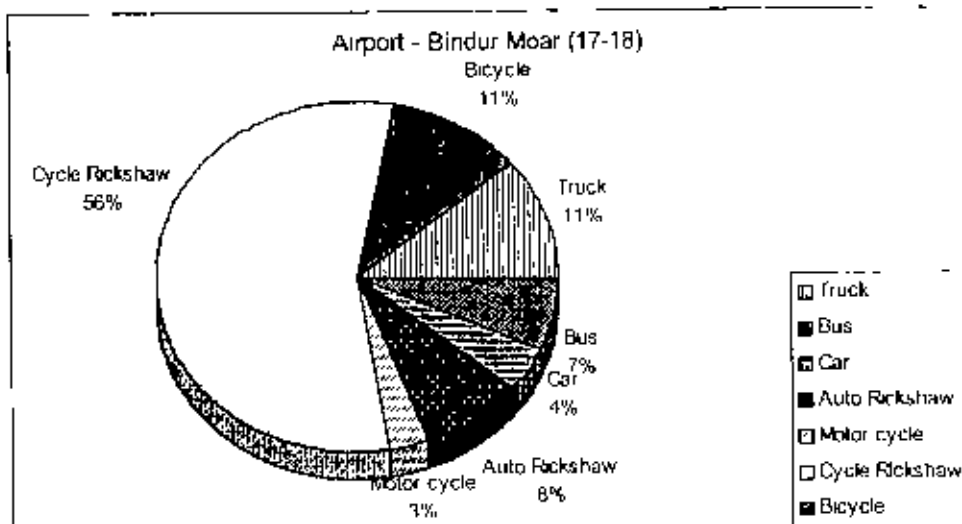
Fig. 4.3 Traffic Composition During Peak Hour along Airport-Bindur Moar Road.
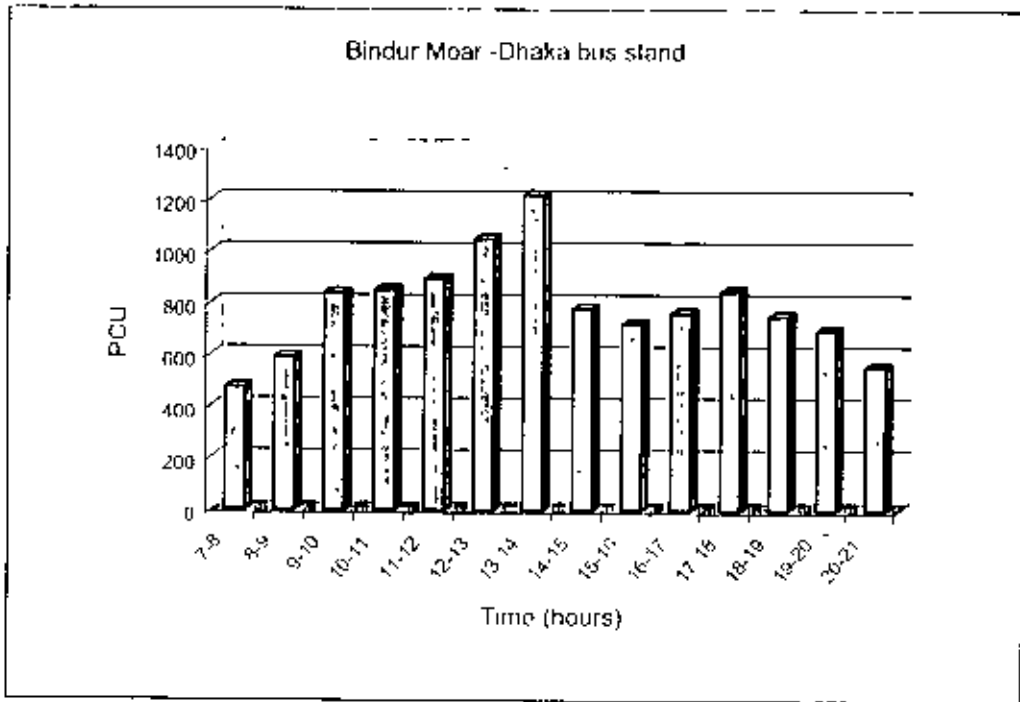
Figure 4.4 Fourteen Hour Traffic Flow along Bindur Moar-Dhaka Bus Stand Road.

4.12 Passenger Attitude Towards Proposed Bus Services

A small survey was conducted to learn about passenger attitude towards a city bus service. 100 passengers of three major modes were surveyed. The sample distribution is shown in Table 4.9.

Table 4.9 The Sample Distributions of Passenger Attitude Survey

Sl. No.	Mode	No. of Passenger	Percentage
1.	Rickshaw/Van	40	40
2	Cycle	30	30
8	Pedestrian	30	30
Total		100	100

From the survey it is observed that about 87% passengers of Rajshahi City think that there is a necessity for public bus service. About 68% (27 out of 40 passengers) rickshaw passengers think that if public bus service is introduced they will prefer the service to their existing mode. The reasons for their preference are stated in the Table 4.11.

Table 4.10 Reasons for Preference of Public Bus Services by the Rickshaw Passengers

Reasons	Frequency	Percentage
Cheaper than present mode	24	88.89
Will reduce time of trip	15	55.56
Safer than present mode	11	40.74
More convenient than present mode	6	22.22
Other	3	11.11

Source : Field Survey 2005

Among the passengers who use bicycle as a mode of transport, about 57% (17 out of 30 passengers) think that if public bus service is introduced they will prefer the service to their existing mode. The reasons for their preference are stated in the Table 4.12.

Table 4.11 Reasons for Preference of Public Bus Services by the Bicyclists

Reasons	Frequency	Percentage
Will reduce time of trip	11	64 71
Safer than present mode	15	88 24
More convenient than present mode	12	70 59
Other	2	11 76

Source: Field Survey 2003

About 43% (13 out of 30) pedestrians think that if public bus services are introduced they will prefer the service to their existing mode. The reasons for their preference are stated in the Table 4.13.

Table 4.12 Reasons for Preference of Public Bus Services by the Pedestrian

Reasons	Frequency	Percentage
Will reduce time of trip	13	100 00
Safer than present mode	4	30.76
More convenient than present mode	9	69 23
Other	1	7.69

Source : Field Survey 2003

To introduce public bus service waiting time for the service is also a big consideration. From the survey it is observed that more than half of the total passengers may wait for the bus for 10 to 20 minutes. 31% passenger may wait for the service for less than 10 minutes, 12% passenger may wait for the service 20-30 minutes and only 2% passenger may wait for the service for more than 30 minutes.

Table 4.13 Waiting Time for Public Bus Services by the Passengers

Time	Frequency	Percentage
>10 Minutes	31	31
10-20 Minutes	55	55
20-30 Minutes	12	12
30+ Minutes	2	2
Total	100	100

Source : Field Survey 2003

From the passenger attitude survey the passengers' willingness to pay for the services was also identified. About 42% passenger are willing to pay up to 1.00 Tk/ km travel, 16% passenger are willing to pay up to 0.50 Tk/ km travel, 36% passenger are willing to pay up to 1.50 Tk/ km travel and only 6 % passenger are willing to pay more than 1.50 Tk/ km travel.

Table 4.14 Passengers Willingness to Pay for Public Bus Services/ Kilometer

Taka	Frequency	Percentage
Upto .50 Tk	16	16
Upto 1.00 Tk	42	42
Upto 1.50 Tk	36	36
>1.50 Tk	6	6
Total	100	100

Source : Field Survey 2005

4.13 Need for Public Bus Services

Planned and effective public transportation is a major element for city development. Buses are the most prominent public transport in our country and all over the world they account for 90 percent of public transport movement in the world (UNESCAP, 2000). In the ESCAP region, daily bus passengers constitute a significant proportion of the total population using public transport. Moreover, buses have a low investment and fare cost advantage over other modes of public transportation. ESCAP survey on the integration of non-motorized transport in the urban transport system of Dhaka revealed that the cost of passenger/km movement by bus is a quarter of that by auto rickshaw and under half that by rickshaw. Rajshahi is the 4th largest metropolitan city of Bangladesh with the analysis of the socio-economic condition, population and travel character of the city we can find out a strong logic towards necessity of public bus service. The logic towards the necessity for the public bus services in Rajshahi City is described below:

Being the fourth largest Metropolitan City and a growing urban center of the country there is a large number of daily passengers. At present as there is no city bus service they are traveling by different other modes of transport. From passenger attitude

survey it was observed that about 87% of total passenger think that there is a necessity of public bus service.

As the income level of people of the city is low so there is a demand for the cheapest mode. As there is no public bus service or another different inexpensive mode it is difficult to move for the city people from one place to another for different purposes. University students of Rajshahi City mainly depend on the scheduled bus of the university. If a public bus service introduced the mobility of the students and other sections of the community will increase.

Speed of transport is also another consideration for the choice of mode. From the analysis it is observed that more than fifty percent of total trips made go above 4 km which is not very convenient for waking and time consuming on foot or by rickshaw. The people of the fringe area need more money and time to come into the CBD area of the city without a public city bus bus service

The urban transport system of Rajshahi is dominated by or biased towards non-motorized traffic. Rickshaws the most common form of NMT dominate the system and from more than half of all vehicular person trips. Rickshaws are increasing day by day and creating traffic congestion in the city. If a public bus service is introduced NMV can be substantially reduced and thus traffic congestion will reduce.

As a public bus service is safer, more secured and convenient than other modes there is a need for this service in the city. At present rickshaws and bicycles are the main modes of daily trips made by the people of Rajshahi City, which are not safe, secured or convenient. As they have no alternative, people are forced to walk or ride rickshaws. If bus service is introduced it will increase the safety, security and convenience of the people.

Besides, if a public bus service is introduced, the increased mobility of the people will increase economic activity. A number of people will find employment in the transport sector, which will also gear up the present level of economic activity.

4.14 Conclusion

From the analysis of the existing situation of public transportation, traffic and traffic flow characteristics, it is observed that there is a necessity for public bus services in the city and if it is introduced it will change the existing transportation system and will provide mobility for work, social and recreational needs of the people.

5

Chapter Five: Designing of Bus Stops and Routes

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CHAPTER FIVE: DESIGNING OF BUS STOP'S AND ROUTES

5.1 Introduction

Designing a transit network involves determination of spacing between routes. For a grid pattern (typical of bus systems), this means the spacing between parallel lines. For a city with an irregular road network, it involves selection of a number of major arteries. For designing of bus routes and stops in any city, analysis of major road links, trip generation, trip distribution and traffic flow assessment is important factors, which should be taken into consideration.

5.2 Selection of Roads for Bus Routes

At first all possible roads, which may use for the proposed bus routes are identified. For that the major roads are selected for using as future routes. The major roads of Rajshahi City are Natore Road, Old Natore Road, Chapai Nawabganj Road, Airport Road and Greater Road. The bus routes have been selected on the basis of traffic flow characteristics and on major roads. The details of bus routes have been discussed in section 5.6 of this chapter.

5.3 Selection of Bus Stops

All the bus stops are proposed on the selected roads for bus routes. For selection of bus stops major traffic generating areas, locational importance, nodal/junction points and distance between the nearest two stops are taken into consideration. At first the nearest point of twelve identified major traffic generating areas (Shaheb Bazar, Momchattar, Bindur Moar, Laxmipur Moar etc.) on the major roads are selected as bus stops (Fig 5.1a). Other stops are selected considering the locational importance, nodal/junction points and distance between the nearest two stops (Fig 5.1b). The stops are proposed in such a way that the distance between two stops will be about half kilometer. Table 5.1 shows the locations of the proposed bus stops for Rajshahi City.

Table 5.1 The Location of Proposed Bus Stops

Stop number	Location	Stop number	Location
1	* Binodpur	19	City bypass Moar
2	RU Main gate	20	Medical Bandogate
3	Kazlagate	21	* Barnali Moar
4	* Talaimari	22	* Dorikharbona Moar
5	Baze Kazla	23	* Bindur Moar
6	Ramchandrapur	24	* Dhaka Busstand Moar
7	Ahmedpur	25	Petrol pump Moar
8	Kalponar Moar	26	Vudra
9	* Shaheb Bazar-Zeropoint	27	Debisingpara
10	* Monichattar	28	WDB Moar
11	Sheikpara	29	* Shalbagan
12	JailKhanar Moar	30	BDR
13	* C&B Moar	31	Ferozabad
14	Betiapara	32	Shahmakdum Thanar Moar
15	Rajpara Moar	33	Postal Academy
16	* Court Station	34	Rod Nawdapara
17	Gumpara	35	By pass Moar
18	* Laxmipur Moar		

Note * = Bus stop near major traffic generating areas

5.4 Trips Served by the Stops

To identify the number of trips that may be served by each stop, a GIS based locational proximity analysis was done. Similar type study was done by Anderson (1987). He used buffers of bus stop with population data to identify the best locations for bus stops. A buffer zone was created for each potential bus stop. The population density within this buffer was then calculated. A set of bus stops was identified which maximized the overall population catchment areas.

There are thirty wards in RCC area. The number of trips generated by sample households in each ward was identified. By GIS analysis 35 thiessen polygons were been made for 35 stops (Fig. 5.2). In this analysis it is assumed that the polygon made for each stop is the catchment area for that stop.

To identify the number of trips covered by each stop, the trips made by the catchment areas have been estimated. For that, the area covered by the polygon from each ward is calculated (Table 5.2). The number of trips generated in each ward is redistributed among the bus stop catchments polygon according to the proportion of the ward area included in that polygon (Table 5.3). The total number of trips covered by each stop is shown in Table 5.4
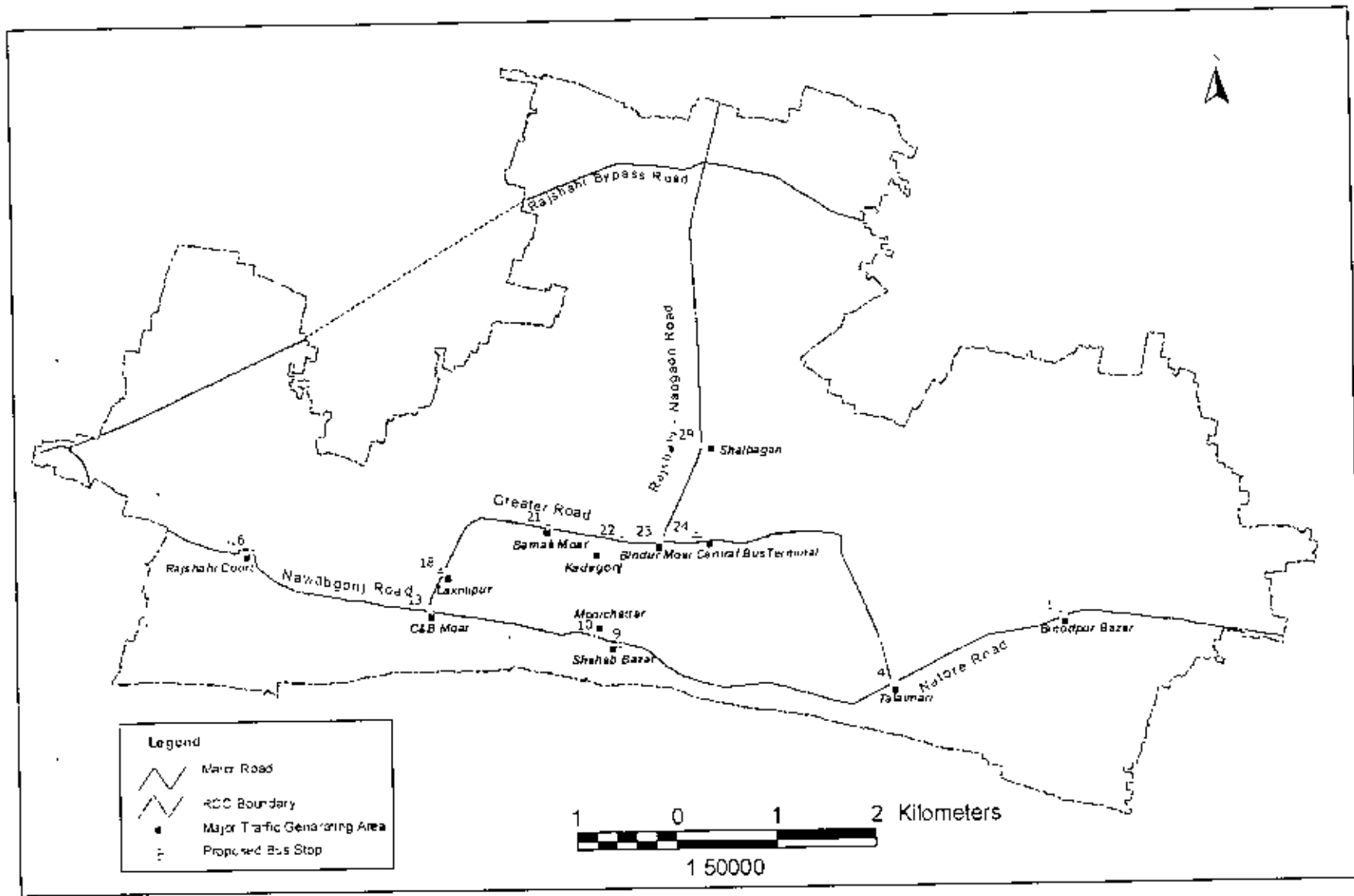
Fig. 5.1a   Proposed Bus Stops on the Basis of Major Traffic Generating Areas
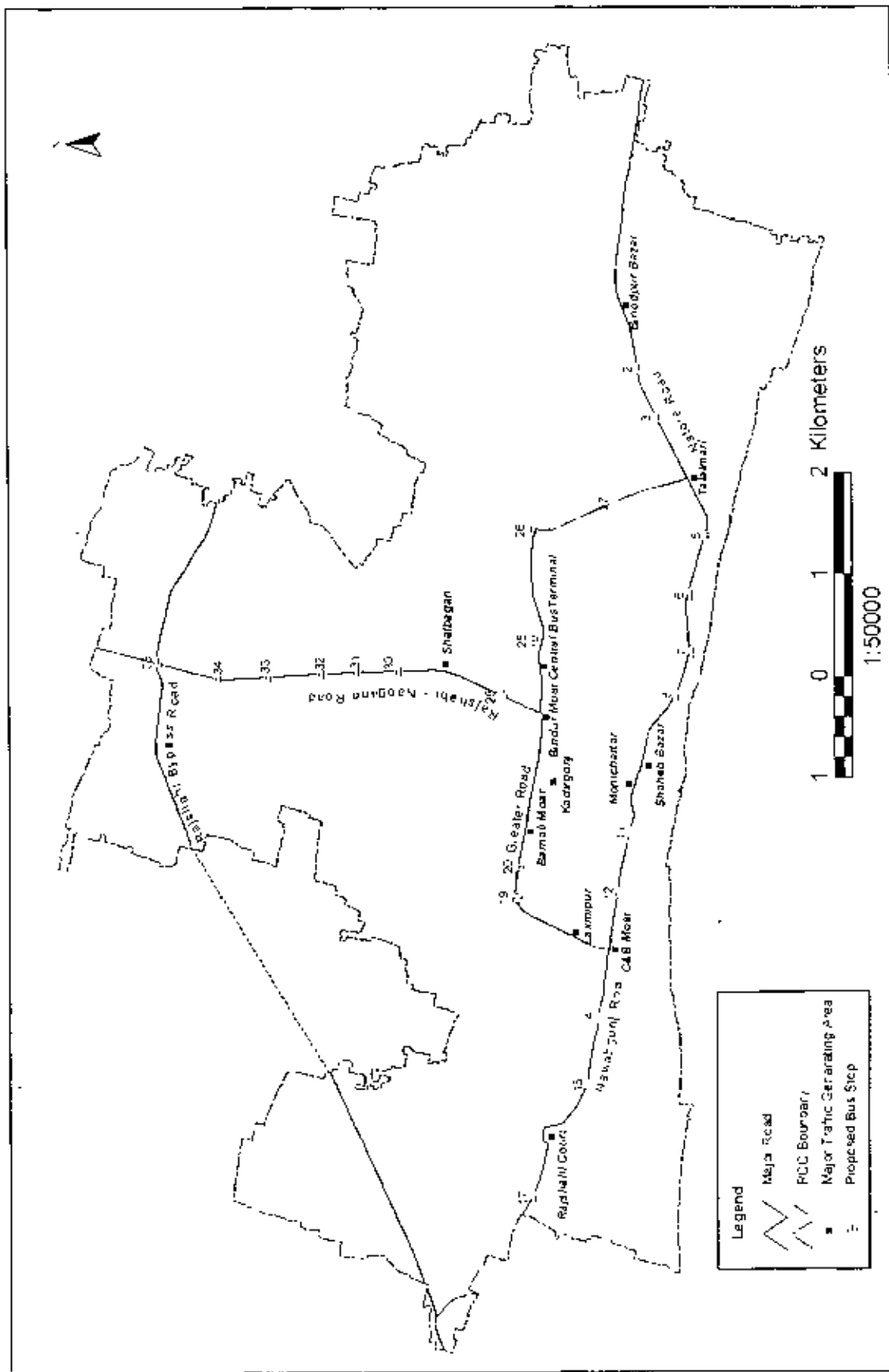
Fig. 5.1b Proposed Bus Stops on the Basis of Locational Importance, Nodal Points and Distance

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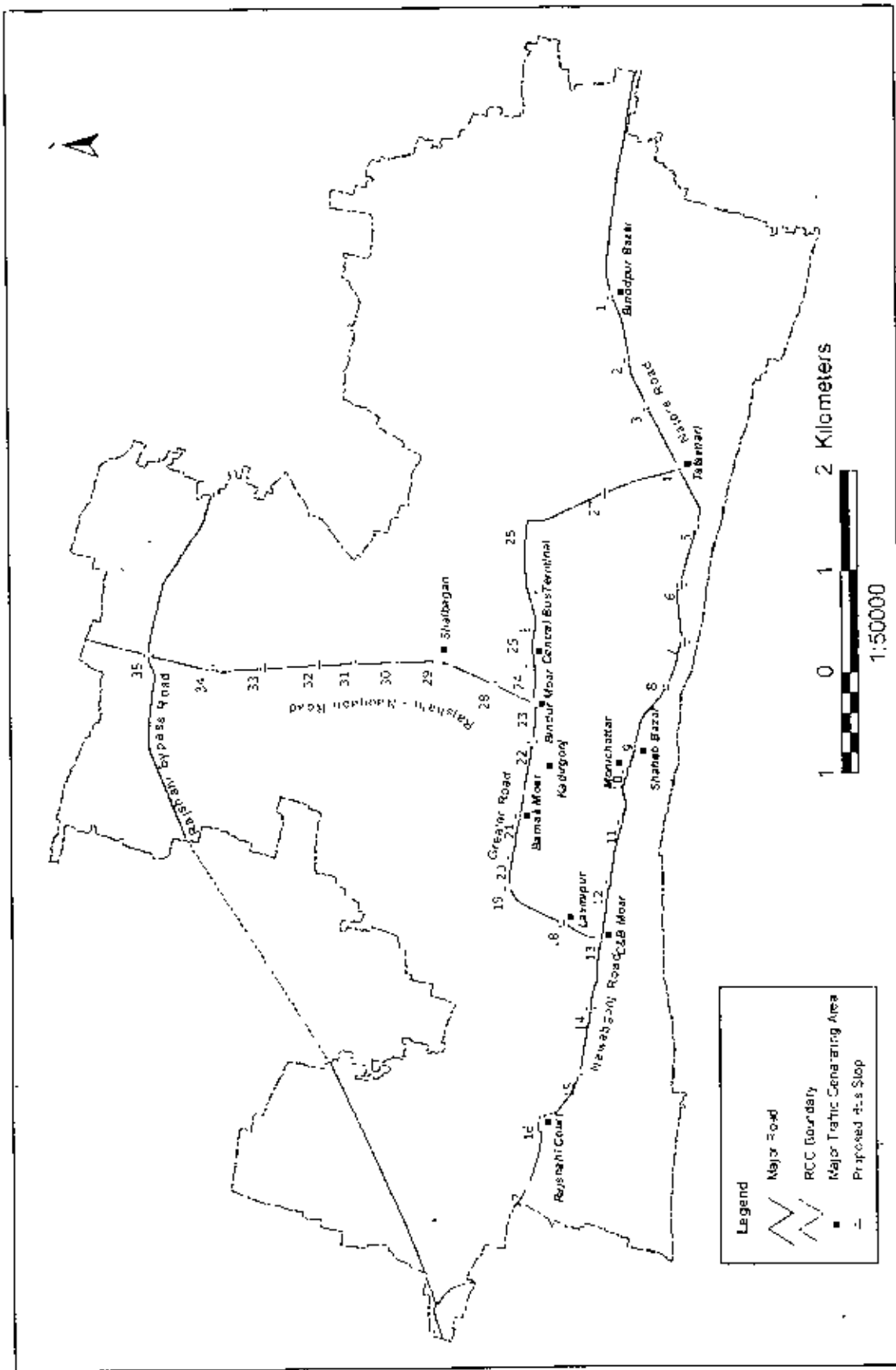
Fig. 5.1c   Proposed Bus Stops for Rajshahi City
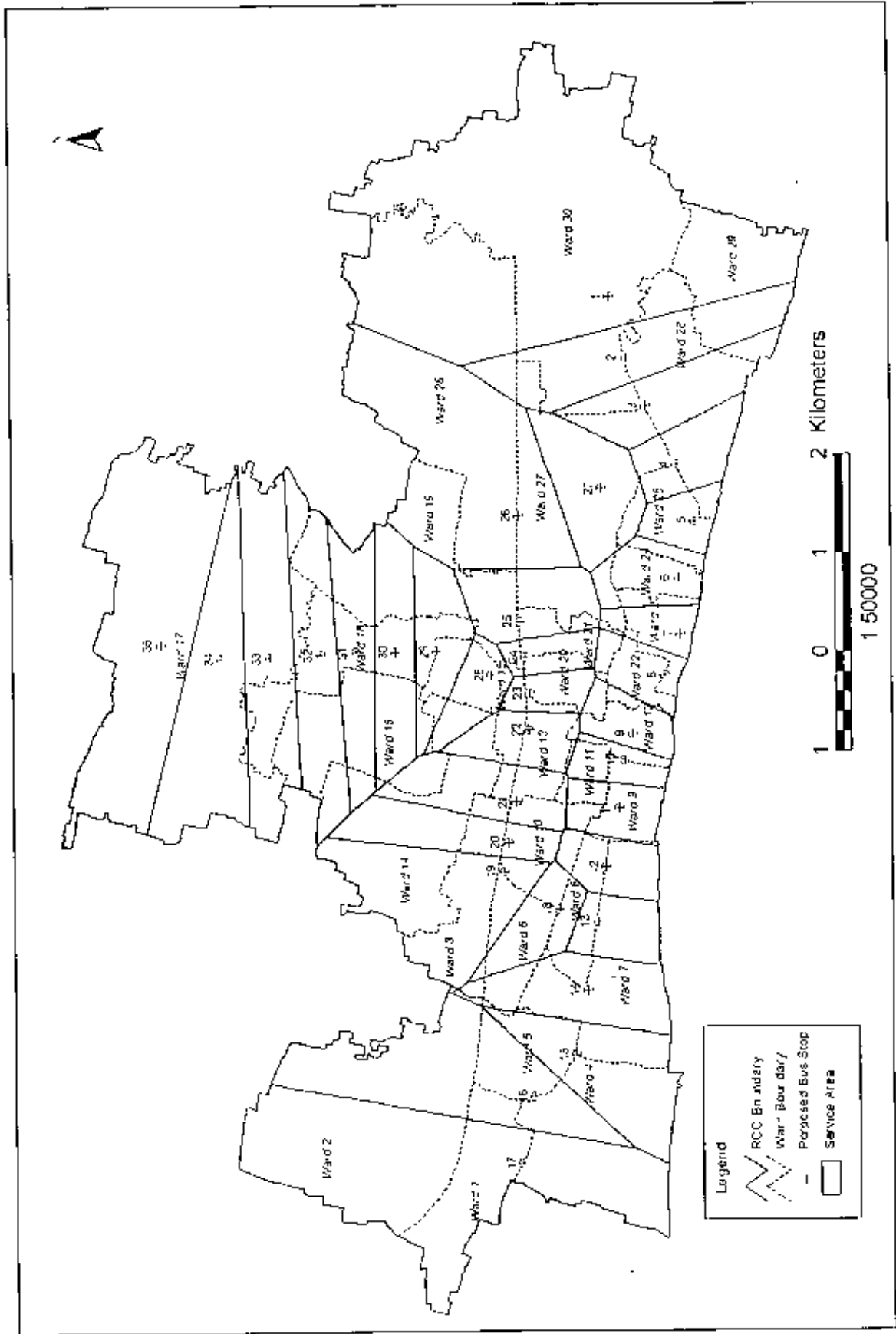
Fig. 5.2   Proposed Bus Stops and it's Service Area

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Table 5.3 Shares of Different Wards Covered by each Stop

Stops No.	Portion Covered
01	*26 (47%), *28 (12%), *29 (59%), *30 (84%)
02	*26 (8%), *27 (6%) *28 (25%), *29 (30%), *30 (12%)
03	*27 (7%), *28 (30%), *29 (11%), *30 (4%)
04	*25 (24%), *27 (5%), *28 (29%)
05	*25 (46%), *28 (4%)
06	*23 (22%), *24 (100%), *25 (16%), *27 (5%)
07	*23 (61%), *27 (3%)
08	*21 (22%), *22 (82%), *23 (17%)
09	*12 (75%), *20 (20%),*22 (18%)
10	*9 (32%), *11 (52%), *12 (20%)
11	*9 (68%), *10 (13%), *11 (36%)
12	*7 (19%), *8 (34%), *10 (15%)
13	*7 (24%), *8 (22%)
14	*6 (25%), *7 (39%), *8 (20%)
15	*4 (38%), *7 (18%), *5(47%)
16	*1 (16%), *2 (39%), *4 (18%), *5 (53%)
17	*1 (84%), *2 (61%), *4 (44%)
18	*6 (52%), *8 (24%), *10 (18%)
19	*3 (74%), *6 (23%), *14 (36%), *10(17%)
20	*3 (16%), *10 (20%), *14 (20%)
21	*3 (10%), *10 (17%), *11 (7%), *13 (29%), *14 (16%), *16(12%)
22	*11 (5%), *12 (5%), *13 (59%), *14 (8%)
23	*13 (12%), *20 (48%)
24	*19 (3%), *20 (32%), *21 (40%)
25	*19 (19%), *21 (38%), *27 (18%)
26	*19 (23%), *26 (45%), *27 (22%)
27	*25 (14%), *27 (34%)
28	*14 (7%), *15 (58%), *19 (2%)
29	*14 (2%), *15 (42%) *16 (7%), *18 (18%), *19 (15%)
30	*16 (28%), *18 (22%) *19 (13%)
31	*14 (4%), *18 (19%), *19 (14%) *16(20%)
32	*14 (7%), *16 (25%), *17 (4%) *18 (21%), *19 (11%)
33	*17 (21%), *18 (20%),*16(5%)
34	*17 (29%)
35	*17 (46%)

Note: * — Ward number

Table 5.4 Shares of Trips of Different Wards Covered by each Stop

Sl No.	Trips Covered by the Stop	Total Trips	Percentage
01	*26 (156), *28 (53), *29 (124), *30 (300)	633	5 55
02	*26 (26), *27 (14),*28 (111), *29 (63), *30 (43)	257	2 25
03	*27 (17), *28 (133), *29 (23), *30 (14)	187	1.64
04	*25 (27), *27 (12), *28 (128)	167	1. 16
05	*25 (52), *28 (18)	70	0 61
06	*23 (88), *24 (219), *25 (18), *27 (12)	337	2.96
07	*23 (245), *27 (7)	252	2.21
08	*21 (90), *22 (403), *23 (68)	561	4 92
09	*12 (335), *20 (85), *22 (89)	509	4 46
10	*9 (118), *11 (71) *12 (89)	278	2 44
11	*9 (252) *10 (43), *11 (49)	344	3 02
12	*7 (52), *8 (134), *10 (49)	235	2 06
13	*7 (66), *8 (87)	153	1 34
14	*9 (92), *7 (107), *8 (79)	278	2 44
15	*4 (74), *7 (50), *5(213)	337	2 96
16	*1 (69), *2 (90), *4 (35), *5 (241)	435	3 82
17	*1 (361), *2 (142),* 4 (86)	589	5 17
18	*6 (191),* 8 (95), *10 (59)	345	3 03
19	*3 (269), *6 (84), *14 (359), *10 (56)	768	6 74
20	*3 (58), *10 (65), *14 (199)	322	2 82
21	*3 (36), *10 (56), *11 (10), *13 (59), *14 (159), *16(15)	335	2 94
22	*11 (7), *12 (22), *13 (120), *14 (80)	229	2 01
23	*13 (24), *20 (204)	228	2.00
24	*19 (24), *20 (136) *21 (164)	324	2.84
25	*19 (154), *21 (156), *27 (43)	353	3.10
26	*19 (187), *26 (149), *27 (52)	388	3.40
27	*25 (16), *27 (81)	97	0.85
28	*14 (70), *15 (143), *19 (16)	229	2.01
29	*14 (20) *15 (104), *16 (9), *18 (103), *19 (122)	358	3.14
30	*16 (36), *18 (126), *19 (106)	268	2.35
31	*14 (40), *18 (109), *19 (114),*16(26)	289	2 53
32	*14 (70) *16 (32), *17 (32) *18 (120) *19 (89)	343	3.01
33	*17 (170), *18 (115),*16(10)	295	2.59
34	*17 (235)	235	2.06
35	*17 (373)	373	3.27
Total		11401	100.00

Note: * = Stop

5.5 Characteristics of Trip Flow

From Table 5.5 it is observed that in Rajshahi City the residence of Wards 17 and 19 produce the share number of trips, 7.11% and 7.13% respectively. On the other hand the population of Ward 11 (1.20%) and Ward 25 (.99%) produce the lowest numbers of trips. In Rajshahi City, mainly Ward 12 attracts trips, which is the CBD . It is observed that among all trips that flow between different wards of the city, the highest share of trips flow to Ward 12 (15.60%) whereas only 0.99% of trips flow to Ward 29 (Table 5 6). The second highest numbers of trips flow to Ward 13 (7.31%). About 10.55% of total trips flow within the ward and only 3.03% trips go outside the ward. From the study it is observed that trips made by the different wards are mainly to the CBD area (Ward 12) The other wards that attract trips are Ward 13 (New Market-Kadirganj area), Ward 4 (Court Bazar area), Ward 6 (Laxmipur area) and ward 15 (Shalbagan –Bindur Moar area) (Appndix 4).

To propose the bus services the flow of trips from one stop to another is very essential. In the present study the flow of trips form one stop to another different stops was calculated in three steps. In the first step the portion trips of different wards covered by each stop was calculated. Then their flows to other different wards were distributed among different wards and finally the distributed trips among the other bus stop catchments polygon according to the to the proportion of the ward area included in that polygon were calculated. The details of flow of trips from one stop to other different stops are shown in Appendix 5 and the summary of trip flow is shown in Table 5.7. From the table it is observed that Stop 1 will attract the highest number of produced trips (5.55%), 4.92% trips by Stop 8 and 4 46% by Stop 9 and rest by other different stops. On the basis of the existing trip flow characteristics and proposed bus stop an extensive analysis was done to identify the expected pattern of flow between the stops. The study reveals that the highest numbers of trips flow to the Stops 9 (16 96%), 10 (4.75%), 13 (3.85%), 16 (4.03%) and 23 (4.89%)

Table 5.5 Trips Generated by Different Wards of the Study Area

Ward Number	Number of Daily Trips Generated by Sample Household	Percentage
1	430	3 77
2	232	2 03
3	363	3 18
4	195	1 71
5	454	3 98
6	367	3.22
7	275	2.41
8	394	3.46
9	370	3.25
10	327	2 87
11	137	1 20
12	446	3 91
13	204	1 79
14	996	8 74
15	247	2 17
16	128	1.12
17	811	7.11
18	573	5.03
19	813	7.13
20	426	3.74
21	410	3.60
22	492	4 32
23	402	3 53
24	219	1 92
25	113	0 99
26	331	2 90
27	237	2 08
28	442	3 88
29	210	1.84
30	357	3.13
R.C.C. Area	11401	100.00

Source: Socio-economic survey by DDC, 2003

Table 5.6 Trips between Different Wards of the Study Area

Flow of Trips from Different Wards to the Following Wards	Number of sample trips	Percentage
Ward-1	114	1.00
Ward-2	169	1.48
Ward-3	138	1.21
Ward-4	551	4 83
Ward-5	215	1.89
Ward-6	266	2 33
Ward-7	137	1 20
Ward-8	324	2.84
Ward-9	260	2 28
Ward-10	446	3 91
Ward-11	59	0 52
Ward-12	1778	15.60
Ward-13	833	7.31
Ward-14	271	2 38
Ward-15	393	3 45
Ward-16	148	1.30
Ward-17	277	2.43
Ward-18	347	3.04
Ward-19	185	1 62
Ward-20	470	4 12
Ward-21	337	2.96
Ward-22	391	3 43
Ward-23	218	1.91
Ward-24	175	1.53
Ward-25	258	2.26
Ward-26	180	1.58
Ward-27	400	3.51
Ward-28	156	1.37
Ward-29	112	0.98
Ward-30	244	2 14
Within the ward	1203	10 55
Outside RCC	346	3 03
Total	11401	100.00

Source: Socio-economic survey by DDC, 2003

Table 5.7 Trips between Different Stops of the Study Area

Flow of Trips from Different Stops to the Following Stops	Stop Location	Number of Sample Trips	Percentage
Stop-1	Binodpur	106	0 93
Stop-2	RU Main gate	131	1.15
Stop-3	Kazlagate	165	1 45
Stop-4	Talaimari	248	2:18
Stop-5	Baze Kazla	148	1.30
Stop-6	Ramchandrapur	175	1.53
Stop-7	Ahamedpur	95	0.83
Stop-8	Kalponar Moar	276	2.42
Stop-9	Shaheb Bazar-Zero point	1934	16 96
Stop-10	Monichattor	542	4 75
Stop-11	Sheikpara	263	2 31
Stop-12	Jailkhanar Moar	133	1.17
Stop-13	C&B Moar	439	3.85
Stop-14	Beliapara	166	1.46
Stop-15	Rajpara Moar	338	2.96
Stop-16	Court Station	460	4.03
Stop-17	Guripara	77	0 68
Stop-18	Laxmipur Moar	332	2 91
Stop-19	City bypass Moar	322	2 82
Stop-20	Medical Bandogate	179	1 57
Stop-21	Barnali Moar	252	2.21
Stop-22	Donkharbona Moar	347	3.04
Stop-23	Bindur Moar	557	4 89
Stop-24	Dhaka Busstand Moar	348	3 05
Stop-25	Petrol pump Moar	295	2.59
Stop-26	Vadra	247	2.17
Stop-27	Debisingpara	247	2 17
Stop-28	WDB Moar	160	1.40
Stop-29	Shalbagan	335	2 94
Stop-30	BDR	248	2 18
Stop-31	Ferozabad	54	0 47
Stop-32	Shahmakdum Thanar Moar	73	0.64
Stop-33	Postal Academy	55	0 48
Stop-34	Rod Nawrapara	35	0 31
Stop-35	By pass Moar	70	0 61
Trips not served by stops		1549	13.69
Total		**11401**	**100.00**

Source: Socio-economic survey by DOC, 2003

5.6 Planning of Routes

On the basis of analysis the possible flow of trips between different proposed stops on bus routes are designed. There are three major regional road links in Rajshahi City and the growth of the city has been influenced by these roads. From the study it is observed that most trips coming from the fringe areas of the city flow to the' old part of the city (Shaheb Bazar area) For the designing of the routes the trip flow characteristics are the main consideration. The trip flow characteristics indicate the volumes of trips in different areas, which is another important consideration. The spacing between routes is also considered for designing of the routes On the basis of consideration of all the issues which are discussed above two alternative plan may be proposed for Rajshahi City for the public bus service routes which are as follows.

Alternative 1:

Route 1 (Up & Down): Binodpur -Kazla -Talaimari - Shaheb Bazar - C& B Moar - Court Station- Guripara (Fig. 5.3a)

Route 2 (Up & Down): Bypass Moar- Shalbagan - Bindur Moar -Bhadra Moar - Talaimari Moar -- Shaheb Bazar- C&B Moar —Laxmipur- Barnali-Bindur Moar- Shalbagan- Bypass Moar (Fig. 5.3b).

Route 3 (Up & Down): Bindur Moar- Laxmipur Moar - C& B Moar -Bhadra Moar Shaheb Bazar-Talaimai Moar- Bindur Moar (Fig.5.3c).

Alternative 2:

Route 1 (Up & Down): Binodpur -Kazla -Talaimari - Shaheb Bazar - C& B Moar - Court Station- Guripara (Fig. 5.4a).

Route 2 (Up & Down): Bypass moar- Shalbagan - Bindur Moar - Shalbagan- Bypass Moar (Fig. 5 4b)

- *Route 3 (Up & Down):* Bindur Moar- Laxmipur Moar - C& B Moar -Bhadra Moar Shaheb Bazar-Talaimai Moar- Bindur Moar (Fig. 5 4c).

In each alternative three routes are proposed. Routes 1 and 3 are identical in both alternatives. Only Route 2 is different. Evaluating the two alternatives based on the criteria convenience(judged subjectively by the researcher) the two alternative options, Alternative 1 appear more suitable because in this plan people can come to the CBD area form the fringe area without break of journey. In Alternative 2 Route 2 is a small distance route for the bus service and in this alternative there is a break of journey within a short distance. So, Alternative 1 is proposed for the city.
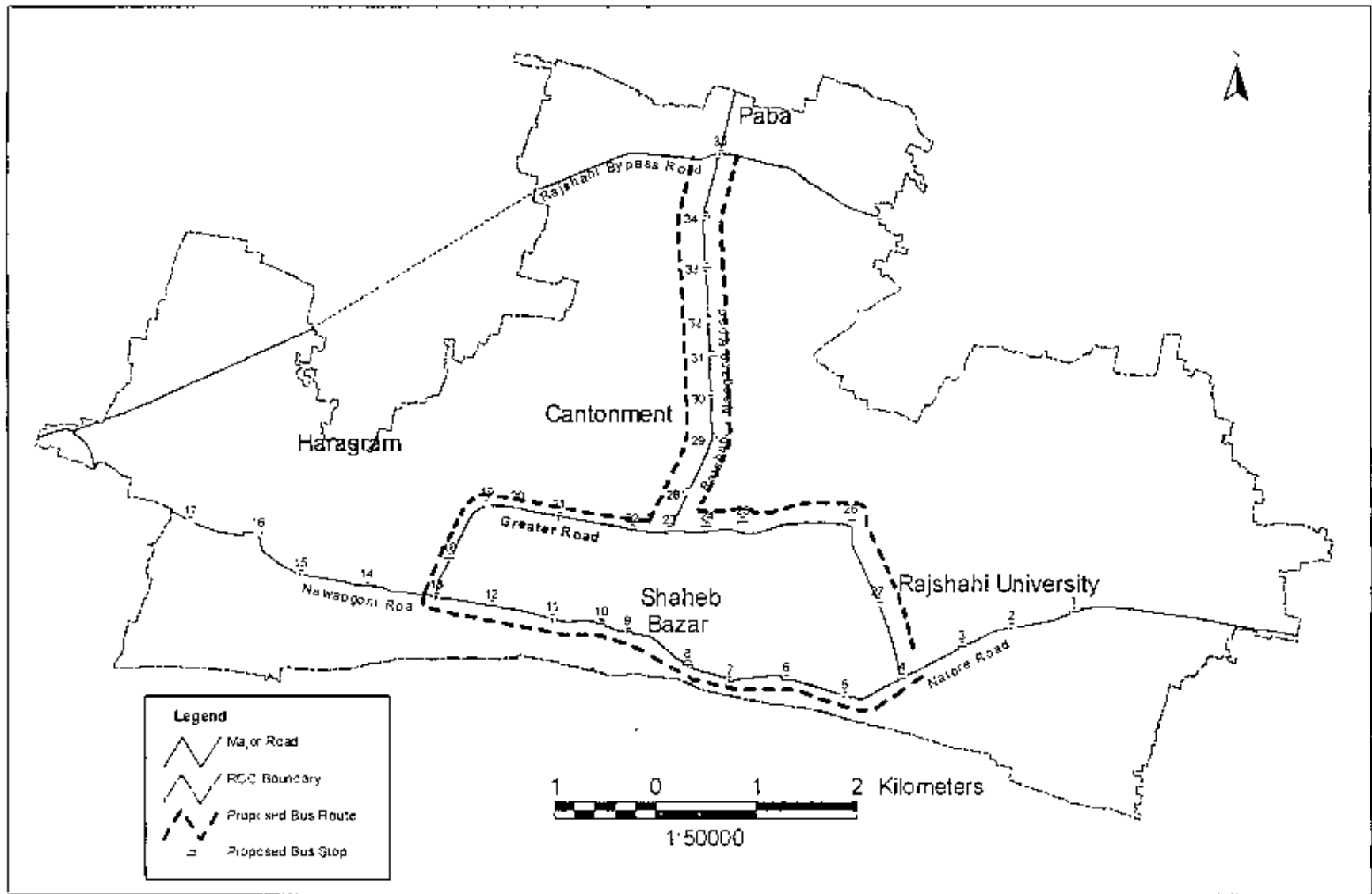
Fig. 5.3a   Proposed Bus Routes for Rajshahi City (Allternative 1, Route 1)

Fig. 5.3b Proposed Bus Routes for Rajshahi City (Allternative 1, Route 2)

Legend

Major Road
HCC Boundary
Proposed Bus Route
Proposed Bus Stop

1:50000

1   0   1   2 Kilometers

Rajshahi University

Shaheb Bazar

Cantonment

Paba

Haragram

Greater Road

Rajshahi Bypass Road

Rajshahi - Naogaon Road
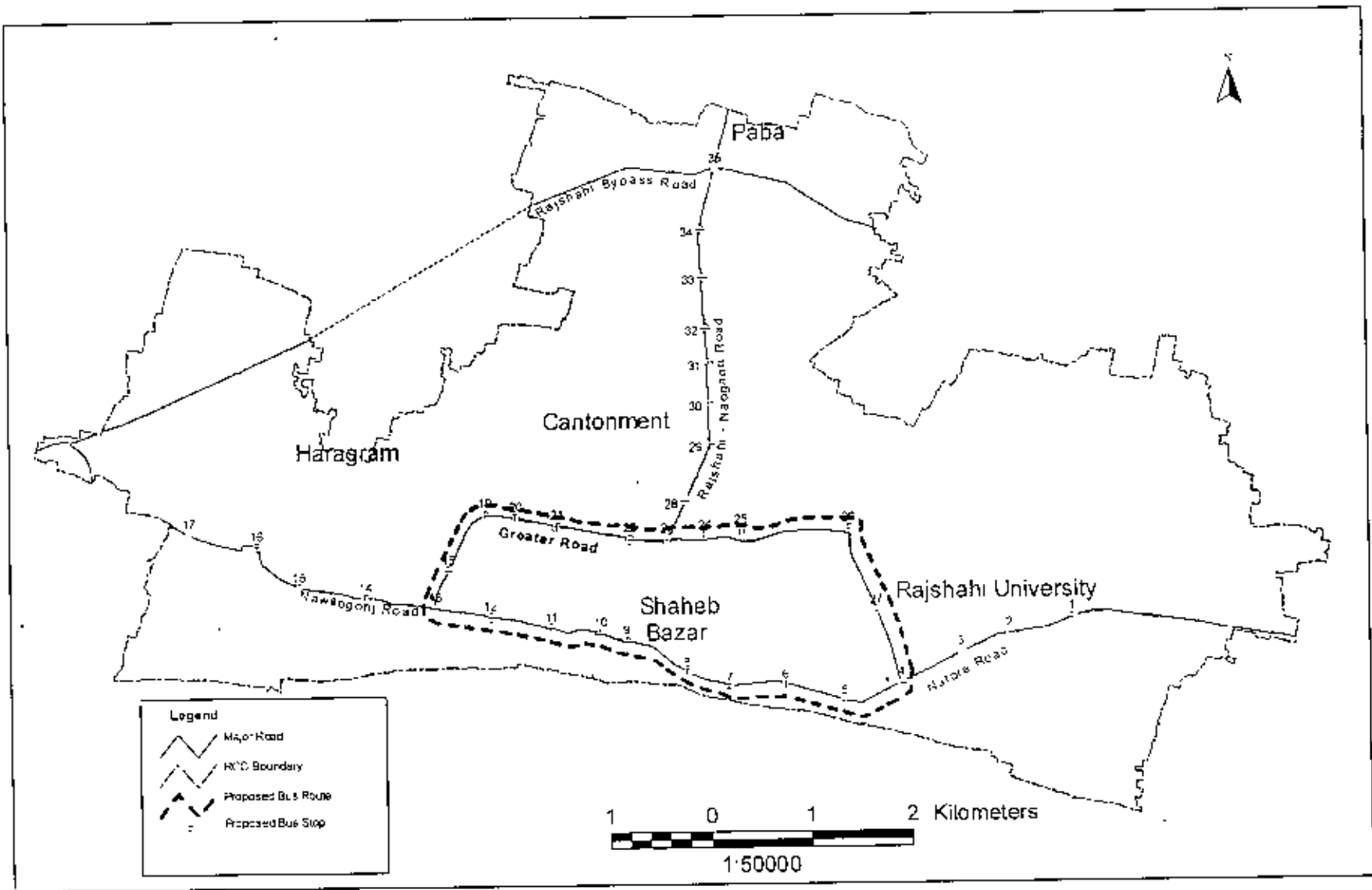
Fig. 5.3c Proposed Bus Routes for Rajshahi City (Allternative 1, Route 3)
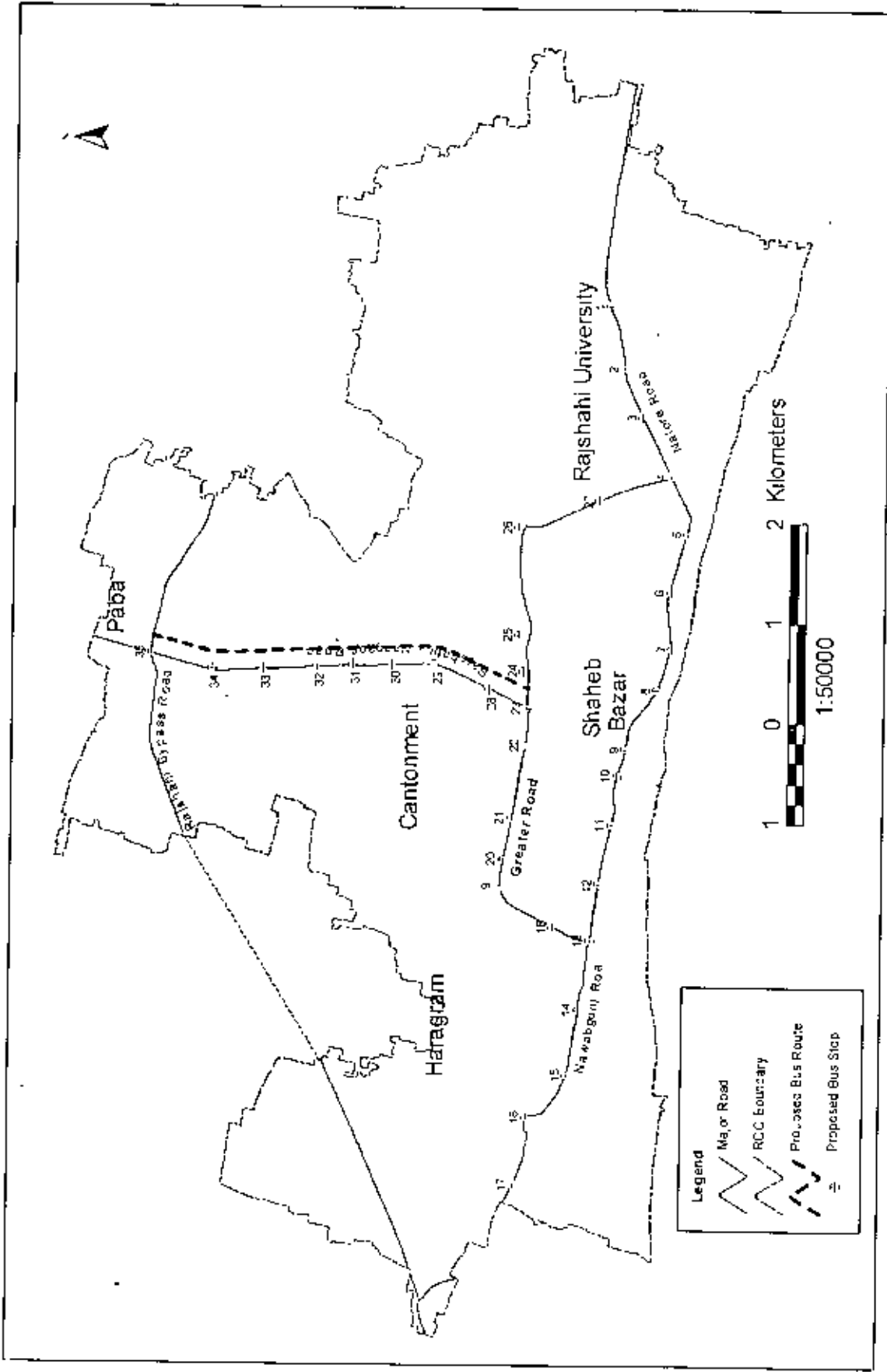
Fig. 5.4a   Proposed Bus Routes for Rajshahi City (Allternative 2, Route 1)

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Fig. 5.4b Proposed Bus Routes for Rajshahi City (Allternative 2, Route 2)

Fig. 5.4c Proposed Bus Routes for Rajshahi City (Alternative 2, Route 3)

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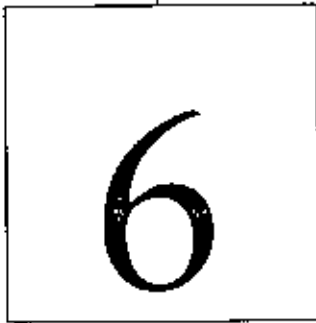
Chapter Six: Feasibility Assessment

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6.1 Introduction

As there is no public bus service in Rajshahi City today, there is a need to study the feasibility of the new service in the context of technical, financial and socio-economic perspectives. This study gives some very preliminary idea about the feasibility of the services because for detailed feasibility analysis an extensive survey and analysis is essential which requiring more resources and time.

6.2 Technical Feasibility

Technical feasibility indicates the condition and capacity of the roads proposed for bus routes. The bus routes for Rajshahi City have been proposed on the five major roads of the city which are Natore Road, Old Natore Road, Chapai Nawabganj Road, Airport Road and Greater Road. A study was done by DDC to identify the capacity and adequacy of the existing roads. Table 6.1 reveals that all of the roads have adequate capacity and the average spare capacity of the roads is 40% of the total capacity.

Table 6.1 Adequacy of Existing Roads

Sl. No.	Road Name	Links of the Roads	Peak Hour Flow (both ways) in PCE	Pavement Width in Meters	Design Capacity for Mixed Traffic in PCE	Remarks on Adequacy
1.	Natore Road	Talaimari-Natore Rd.	1988	11.89	2400	Capacity Adequate
2	Old natore Road	Talaimari-Shaheb Bazar	966	9.76	1800	-Do-
		Shaheb Bazar- Monichattar	1330	21.95	4000	-Do-
		Monichattar- C & B Junct	1477	10.98	2400	-Do-
3	Greater road	Talaimari-Bhadra	1596	15.63	3000	-Do-
		Bhadra-Dhaka Bus Stand	1902	15.63	3000	-Do-
		Dhaka Bus Stand-Bindur Moar	2020	15.63	3000	-Do-
		Bindur Moar-Dorikharbona	1544	19.51	3000	-Do-
		Dorikhar-Barnali	1310	13.41	2400	-Do-
		Barnali-Lakshimpur	1238	12.80	2400	-Do-
		Lakshimpur-C & B Junction	827	14.33	2400	-Do-
4	Airport Road	Bindur Moar-Airport	2283	15.85	3000	-Do-
5	Chapai nawabga -nj Road	C & B Junct -Coart Bazar	1713	10.06	2000	-Do-
		Court Bazar-Kasyadanga	493	12.19	2400	-Do-

Source: DDC (2003b)

If the bus service is introduced in an appropriate way it will improve efficiency of road usage, because people will use the new motorized mass transport, which will reduce the number of non-motorized vehicles.

6.3 Financial Feasibility

For planning any type of public bus service financial assessment is a vital issue. According to Walters (1979), total benefit of bus service can be derived from the summation of bus user's benefit and operator's benefit. Thus, as defined by Walters,

Total benefit = Bus users' benefit + Operators' benefit.

a) Operators' benefit

Analysis of the benefit of the operators depends on the number of passengers who may use the service. From the study it has been found that about 40% of the trips involve more than 4 km of distance and the average distance for trips is 4 km. About 33.6% of the total trips are made by rickshaw, 22.2% trips are made by bicycles, 29.1% on foot and other by different modes.

To estimate the total numbers of passengers per day it is essential to estimate the total numbers trips made by the city people.

Total numbers of trips = Total number of households* Number of trips in sample households / Sample size

Table 6.2 shows ward wise total estimated numbers of trips. From the table it is observed that the total number of household in RCC area is 64134 and a total of 173769 trips are generated by those households

Table 6.2 Daily Trip by the People of the Study Area

Ward	Total No. of Households (2001)	Sample Size	Number of Daily Trips Generated by Sample Households	Estimated Total Trips/Day
1	2396	160	430	6439
2	1893	125	232	3513
3	2449	160	363	5556
4	1781	115	195	3020
5	2415	160	454	6853
6	3083	200	367	5657
7	2209	145	275	4190
8	1761	115	394	6033
9	921	60	370	5680
10	1184	75	327	5162
11	1362	90	137	2073
12	1831	120	446	6805
13	1125	75	204	3060
14	1064	70	996	15139
15	1585	105	247	3729
16	3763	250	128	1927
17	2422	160	811	12277
18	2357	155	573	8713
19	2403	155	813	12604
20	3067	205	426	6373
21	1691	110	410	6303
22	1756	115	492	7513
23	1513	100	402	6082
24	1591	105	219	3318
25	1937	125	113	1751
26	2208	145	331	5040
27	4172	275	237	3596
28	3349	220	442	6728
29	2073	135	210	3225
30	2576	170	357	5410
Cantonment	200	0	0	0
R.C.C. Area	64136	4200	11401	173769

After calculation of the total number of trips in the city it is essential to identify the number of trips which may be attracted by the proposed bus service. From the analysis it was observed that above 50% of total trips are made by rickshaws or bicycles and above 50% trips take more than 30 minutes' time. From the passenger attitude survey it was observed that about 87% of all passengers think that there is a necessity for public bus services and about 68% of rickshaw passengers, 57% of bicyclists and 43% of pedestrians think that if this service is introduced they will prefer the service to their existing mode of travel. Besides, about 50% trips made

above 4 km distance may be attracted by the proposed public bus services. From the analysis of distance, time, mode and passenger attitude, it is conservatively assumed that if a bus service is run then at least 30% of total trips may be attracted by the service. Table 6.3 shows the number of total trips that may cover by different stops.

Table 6.3 Total Numbers of Trips Covered by the Stops

Bus Stop	Location	Total Numbers of trips covered by the stops
1	Binodpur	7990
2	RU Main gate	1346
3	Kazlagate	3336
4	Talaimari	4110
5	Baze Kazla	1051
6	Ramchandrapur	3318
7	Ahamedpur	4866
8	Kalponar Moar	9990
9	Shaheb Bazar-Zeropoint	5444
10	Monichattar	4309
11	Sheikpara	4805
12	Jailkhanai Moar	4283
13	C&B Moar	3251
14	Beliapara	2883
15	Rajpara Moar	6460
16	Court Station	8584
17	Guripara	5620
18	Laxmipur Moar	3394
19	City bypass Moar	7184
20	Medical Bandogate	1588
21	Barnali Moar	12343
22	Donkharbona Moar	7716
23	Bindur Moar	8385
24	Dhaka Busstand Moar	8215
25	Petrol pump Moar	3782
26	Vadra	6478
27	Debisingpara	1438
28	WDB Moar	3267
29	Shalbagan	8029
30	BDR	2899
31	Ferozabad	2514
32	Shahmakdum Thanar Moar	2614
33	Postal Academy	2455
34	Rod Nawrapara	3683
35	By pass Moar	6139
Total	-	**173769**

If we consider a possible demand level for the service network of 52130 (30%) passengers per day and we assume TK 4 per ticket flat fare (Considering passenger

attitude and different public bus service fair study of different metropolitan city of Bangladesh @ Tk 1.00/km travel is proposed for Rajshahi City) survey it is observed that, this yields Tk.2,08,520.00 in revenue per day. If that level of demand can be maintained for the equivalent of 300 days (250 working days plus 100 days at half the level of demand), annual revenues would be in the range of Tk.6.26 crore. Given the current fare regime (around Tk 4 for an average public transport trip 4 km in length), a fare of Tk. 4 would appear to be quite affordable to existing bus passengers, and would also be attractive to users.

Operating costs are different for different types of buses. As Rajshahi is a low density small city initially a fleet of minibuses with small occupancy should suffice for the city. It will increase the frequency of the services and should reduce the waiting time of passengers, which is an important factor of attraction for the services for the city people. Operating costs for mini buses (for small buses with 33 seats) are typically around Tk 15 per bus/kilometer or less (Louis Berger-BCL, 2004) This figure usually includes bus maintenance, but not depreciation and financing for the rolling stock, which will vary depending on the cost of the bus. To identify the number of buses that may serve the trips, the number of passengers, occupancy, distance of trips and vehicle km. per bus per day have been identified For small buses the occupancy per bus is 33, the average distance per trip for Rajshahi City is 4 km and vehicle km/bus/day is about 210 km. Considering 52130 passengers (30% of daily trips, each of the trips considered here as a passenger) per day and the criteria discussed above. by sample it is deduced that there needs to be about 30 buses per day for the city. The total distance moved by the buses will be about 6300 km. The estimated operating cost per day will be around Tk. 94500. The total operating cost per year will be about 2.84 crore. If each bus is valued at Tk 20,00,000 and is depreciated over 10 years. So, cost for 33 buses will be Tk 6,60,00,000. As the life time of each bus is considered 10 years so, an additional capital depreciation cost of around Tk 60,00,000/per year would result, but profits would still exceed Tk 3 42 crore per year.

While it is likely that the government would pay for infrastructure such as depots. passengers shed etc. The private sector should provide the buses and fare collection

equipment and should be able to operate the system at an affordable fare without subsidies, on a profitable basis.

b) Bus users' benefit

Bus users are the city people who may avail the service. The benefits for the users are as follows.

1) **It will reduce cost for travel:** As there is no bus service in the city, people use mainly rickshaws, which is not quite affordable to the low-income group. From the observation it is observed that per kilometer rickshaw fare is about 2 to 3 Taka. For proposed public bus service in Rajshahi City Tk. 1/kilometer travel has proposed which is about 2 to 3 times less than rickshaw fare. So, if public bus services may introduce it will reduce transport cost of the city people.

2) **It will reduce time for travel:** At present the average time per trip of the city people is about 30 minutes. More than fifty percent of the daily trips are made by rickshaws and bicycles, which are slow moving and non-motorized vehicles. As there is no inexpensive motorized public transport the average time per trip is high. As the average speed of bus is 5 to 10 times higher than any type of non-motorized vehicle and Rajshahi City is a congestion-free area the proposed bus service will reduce the time for travel.

From the above analysis and discussion it is observed that if the service is provided both operators and users will be benefited. Thus the proposed service is financially feasible.

6.4 Socio-economic Feasibility

Like other metropolitan cities if public bus service is introduced in Rajshahi it will bring a radical change to the socio- economic sector of the city With the introduction of the service the movement of people will be easier and more

convenient. As the city's income level is low the proposed public transport will attract people of the city who cannot afford other more expensive modes such as rickshaw, motorcycles or cars. This service will attract people and will generate more trips. As there is no public bus service or other inexpensive public mode it is difficult to move for the city people from one place to another for different purposes. If a public bus service is introduced the city people's and students' mobility will increase. The movement of goods and commuters will increase which will bring a positive change in economic activity of the city. A number of people will be employed in the transport sector and support services, which will also gear up the present economic activity. With the change of the mobility pattern, trade and commerce of Rajshahi City will increase which in turn will increase the GDP of the city.

6.5 Conclusion

From the analysis it is observed that planning of public bus service in Rajshahi City in the context of technical, financial and socio-economic perspectives is feasible. To develop Rajshahi City it is necessary to take immediate step to introduce public bus services.

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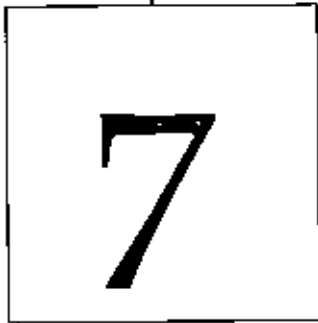
Chapter Seven:
Recommendation and
Conclusion

> > >

CHAPTER SEVEN: RECOMMANDATION AND CONCLUSION

7.1 Recommendation

In this study two alternative plans for bus route have been proposed for Rajshahi City. From the study it is observed that Alternative 1 is more suitable than Alternative 2. So, considering the present situation Alternative 1 can be the route plan for the public bus services of the city

The thirty five of bus stops which were selected on the basis of the nearest point of major traffic generating areas, locational importance, proximity to major intersections and distance between stops can be the stops for proposed bus services.

To introduce the public bus service it is necessary to construct passenger sheds, which are essential at each stop because it is inconvenient for passengers to wait a long time for the bus under the sun or rain at the stop. The concerned authority or City Corporation may construct it at initial stages.

With the introduction of new buses and routes parking facilities would be necessary for the buses when they are not in use. Therefore, terminals are needed for the effective operation of buses in Rajshahi City. With the opening of the new central bus terminal, the present bus terminal for intercity/district buses may used as the depot for city buses.

In the initial stage minibuses with small occupancy should be provided for the city. It will increase the frequency of the services and should reduce the waiting time of the passengers, which will be an important attraction of the service for the city people.

To introduce this service government should take necessary steps. The concerned public authority should introduce this service or it should enact a policy and strategy to attract private entrepreneurs to introduce these services.

7.2 Conclusion

In Bangladesh there is no installation of light rail or tram in urban areas. Mostly buses, minibuses, taxi, auto-tempos, rickshaws are found to ply in the urban areas. For Rajshahi City, bus services can be most efficient and inexpensive public transportation Transportation planners aim to increase the person-capacity characteristics of vehicles, which is only possible by the public transportation system. Public bus transportation system will reduce the vehicle density on the roads and ease traffic congestion and parking problems. Although Rajshahi City at present experience very little traffic congestion. increased economic activity due improved road and rail access to Dhaka may create such problems in future unless polices and measures are adopted to encourage the use of public transport over private transport. A public transportation service must satisfy the requirements of the travelers. It needs to run on the correct routes, offer a high frequency, be reliable and quick, use quality vehicles and staff and be affordable.

As there is no public bus service in Rajshahi City this research was an attempt to provide a plan for public bus services for the City with appropriate policies. From this study it was observed that there is a demand for public bus service. In this study 35 demand oriented bus stoppages and three bus routes were identified. It was revealed that an effective plan of public bus service with appropriate policy measures can positively change the present transport system of Rajshahi City which may bring overall socio-economic benefit for the city.

References

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References

Ahsan, S. M Reazul (2003), "Sustainable Transportation policy for Dhaka City, Bangladesh", Unpublished M.Sc. thesis, Department of Urban Planning, Center of Urban Planning and Environmental Management, The University of Hong Kong.

Ali, Mir Maqsud (2003), "Mass Rapid Transit for Dhaka, Prospects and Challenges", <nation.ittefaq.com/artman...3243.shtml>

Anderson S (1987) "The Swedish land data bank" *International Journal of Geographical Information Systems* 1 (3) : 253-63

Ara. H. (1983), "Socio-Economic Correlates of Urban Travel Pattern: A Study in Dhaka City", unpublished MURP Thesis, Bangladesh University of Engineering and Technology, Dhaka.

BBS (1993), Bangladesh Population Census 1991, Bangladesh Bureau of Statistics, Dhaka.

Bruton, M. J. (1975), *Introduction to Transportation Planning*, Hutchinson, London.

Case, D J. and Latchford, J C R. (1981), "A Comparison of Public Transport in Cities in South East Asia", TRRL Supplementary Report No. 659, pp.112-117.

DDC (2003a) "Working Paper on Transport" Rajshahi Master Plan Project (2004-2024).

DDC (2003b) "Working Paper on Economy and Investment" Rajshahi Master Plan Project (2004-2024).

Fjellstrom, Karl (2003), "Sustainable transport policies, with a case study of Bogotá, Colombia". UNCC. Bangkok, at launch of ANTLER network.

Fjellstrom, Karl (2004), "Working Paper on Public Transport and Mass Rapid Transit in Dhaka" Strategic Transport Plan for Dhaka.

Hasan Md. Nahmadul (1996), "The Role of Bouble Decker Buses As a Mode of Public Transportation in Dhaka City", unpublished MURP thesis, Department of Urban & Regional Planning ,BUET, Dhaka.

Johnson, A. (2003), "Bus Transit and Land Use: illuminating the interaction", *Journal of Public Transportation*, Vol.6 No 4, pp. 21-40

Louis Berger-BCL (2004) "Working Paper on Public Transport and Mass Rapid Transit in Dhaka", Strategic Transport Plan for Dhaka, Dhaka Transport Coordination Board, Dhaka

Nepal, R.(2001), "Problems and Prospects of Public Transportation System in a Metropolis-A Case Study of Kathmandu City", unpublished BURP Dissertation, Khulna University, Khulna

Ortuzar, J.D.D. and Willumsen, L G. (2002), *Modeling Transport*, England, John Wiley & Sons Ltd.

Papacostas, C.S. (1987), *Fundamental of Transportation Engineering*, Prentice-Hall, Inc., Englewood Cliffs.

UNESCAP (2000), "Promotion of User Friendly Public Transport System for the People with Disabilities", Social Development Division, United Nations

Walters, A.A. (1979), *Cost and Scale of Bus Services*, Staff Working Paper No. 325, World Bank, Washington, U.S A

Appendices

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Appendix 2

Socio-economic Survey'2002-2003

Sample Distribution of RCC Area by Ward and Mouzas

Ward No.	Selected Area	Mouza No.	Mouza Name	Sample Nos.
01	Horogram	43	Horogram	160
02	Mollapara	44	Mollapara	125
03	Baharampur	208	Baharampur	160
04	Goalpara	42	Goalpara	115
	Horogram Bazar	43	Horogram	
05	Mohish Bathan	210	Mohish Bathan	160
06	Laskmipur	209	Laskmipur	200
07	Chandipur	207	Chandipur	145
	Sreerampur	205	Sreerampur	
08	Kazihata	206	Kazihata	115
09	Sekhpara	206	Kazihata	60
10	Dargapara	204	Dargapara	75
11	Hetemkhan			90
12	Rajuhata			120
13	Sahebbazar	203	Boalia	75
14	Rambazar			70
15	Dorikharbona			105
16	Sector-2	112	Sopura	250
	Tarokhadia	47	Tarokhadia	
17	Koyerdara	111	Koyerdara	160
	Sopuras. S. Area	112	Sopura	
18	Road Nowdapara	112	Sopura	155
19	Poba	110	Poba	155
20	Choto Banogram	114	Choto Banogram	205
21	Boaliapara			110
22	Seroil	113	Seroil	115
23	Sagorpara			100
24	Ramchandrapur	198	Ramchandrapur	105
25	Baze Kazla	197	Kazla	125
26	Raninagar	198	Ramchandrapur	145
27	Baliapukur	115	Bhadra	275
	Debishingpura	116	Jamalpur	
	Tikkapara	120	Meherchandi	
28	Kazla	197	Kazla	220
	Dhrampur	117	Motihar	
	Keogachhi	118	Keogachhi	
29	Char Satbaria	193	Satbaria	135
	Dashman	194	Dashman	
	Khoajpur	196	Khoajpur	
30	Budpara	125	Budpara	170
Total=30			.	4200

Source: DDC, 2005

Appendix 3

Mode of Trips of the People of Rajshahi City

Ward	Mode of Transport																		
	Rickshaw /Van		Cycle		Motor Cycle		Car/Jeep /Microbus		Bus		Baby Taxi/Tempo		Train		On Foot		Others		Total	
	Fre.	Per.	Fre.	Per.	Fre.	Per.	Fre.	Per.	Fre.	Per.	Fre.	Per.	Fre.	Per.	Fre.	Per.	Fre.	Per.	Fre.	Per.
1	159	37.0	64	14.9	24	5.6	2	0.5	51	11.9	0	0.0	2	0.5	127	29.5	1	0.2	430	100
2	39	16.8	82	35.3	24	10.3	0	0.0	18	7.8	4	1.7	0	0.0	63	27.2	2	0.9	232	100
3	95	26.2	134	36.9	22	6.1	10	2.8	7	1.9	0	0.0	0	0.0	95	26.2	0	0.0	363	100
4	64	32.8	30	15.4	6	3.1	2	1.0	10	5.1	4	2.1	0	0.0	79	40.5	0	0.0	195	100
5	141	31.1	138	30.4	10	2.2	10	2.2	29	6.4	4	0.9	0	0.0	122	26.9	0	0.0	454	100
6	115	31.3	101	27.5	15	4.1	10	2.7	12	3.3	4	1.1	10	2.7	100	27.3	0	0.0	367	100
7	57	20.7	70	25.45	4	1.45	0	0.0	6	2.18	11	4.00	14	5.1	109	39.6	4	1.45	275	100
8	155	39.4	78	19.8	38	9.64	4	1.02	35	8.9	4	1.0	0	0.0	80	20.3	0	0.0	394	100
9	142	38.4	35	9.5	20	5.4	2	0.5	35	9.5	6	1.6	0	0.0	130	35.1	0	0.0	370	100
10	158	48.3	74	22.6	16	4.9	0	0.0	15	4.59	0	0.0	0	0.0	64	19.6	0	0.0	327	100
11	43	31.4	8	5.8	7	5.1	4	2.9	6	4.4	1	0.7	0	0.0	68	49.6	0	0.0	137	100
12	138	30.9	49	11.0	14	3.1	18	4.0	47	10.5	2	0.5	0	0.0	176	39.5	2	0.5	446	100
13	96	47.1	20	9.8	18	8.8	0	0.0	18	8.8	0	0.0	0	0.0	52	25.5	0	0.0	204	100
14	445	44.6	175	17.5	76	7.6	21	2.1	76	7.6	2	0.2	0	0.0	191	19.2	10	1.0	996	100
15	115	46.6	42	17.0	8	3.24	10	4.1	22	8.9	0	0.0	0	0.0	50	20.2	0	0.0	247	100
16	36	28.1	26	20.3	4	3.1	0	0.0	4	3.1	0	0.0	0	0.0	58	45.3	0	0.0	128	100
17	142	17.5	204	25.1	26	3.2	45	5.6	51	6.2	6	0.7	0	0.0	334	41.2	3	0.4	811	100
18	155	27.1	159	27.8	34	5.9	11	1.9	16	2.8	6	1.1	5	0.9	175	30.5	12	2.1	573	100
19	207	25.5	239	29.4	24	3.0	4	5	43	5.3	0	0.0	5	0.6	267	32.8	24	3.0	813	100
20	194	45.5	43	10.1	20	4.6	0	0.0	28	6.5	3	0.7	1	0.2	132	30.9	5	1.2	426	100
21	139	33.9	66	16.1	14	3.4	48	11.7	34	8.3	6	1.5	0	0.0	98	23.9	5	1.2	410	100
22	234	47.6	38	7.7	4	0.8	8	1.6	29	5.9	0	0.0	3	0.6	168	34.1	8	1.6	492	100
23	178	44.3	70	17.4	15	3.7	6	1.5	44	11.0	0	0.0	0	0.0	89	22.1	0	0.0	402	100
24	121	55.3	28	12.7	6	2.7	0	0.0	6	2.7	0	0.0	0	0.0	58	26.5	0	0.0	219	100
25	50	44.3	8	7.1	8	7.1	6	5.3	6	5.3	3	2.7	0	0.0	32	28.3	0	0.0	113	100
26	149	45.0	79	23.4	16	4.8	9	2.7	26	7.9	0	0.0	0	0.0	51	15.4	4	0.3	331	100
27	86	36.3	70	29.5	11	4.6	2	0.8	11	4.6	1	0.4	0	0.0	55	23.2	1	0.4	237	100
28	78	17.7	141	31.9	10	2.3	3	0.68	38	8.6	15	3.4	0	0.0	153	34.6	4	0.9	442	100
29	38	18.1	125	59.5	0	0.0	0	0.0	8	3.8	16	7.6	0	0.0	19	9.1	4	1.9	201	100
30	59	16.5	131	36.6	7	2.0	10	2.8	11	3.08	9	2.5	2	0.6	126	35.3	2	0.5	357	100
Total	3828	33.6	2527	22.2	501	4.4	245	2.1	742	6.5	109	1.0	40	0.4	3321	29.1	88	0.8	11401	100

Source: Socio-economic survey by DDC, 2003

Appendix 4

Flow Trips between Different Wards of Rajshahi City

From	To															
	Ward 1		Ward 2		Ward 3		Ward 4		Ward 5		Ward 6		Ward 7		Ward 8	
	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.
Ward 1	0	0.00	22	5.12	10	2.33	32	7.44	25	5.81	15	3.49	12	2.79	0	0.00
Ward 2	12	5.17	0	0.00	0	0.00	22	9.48	12	5.17	3	1.29	0	0.00	6	2.59
Ward 3	0	0.00	5	1.38	0	0.00	28	7.71	22	6.06	8	2.20	7	1.93	3	0.83
Ward 4	11	5.64	8	4.10	0	0.00	0	0.00	12	6.15	0	0.00	3	1.54	5	2.56
Ward 5	22	4.85	19	4.19	4	0.88	24	5.29	0	0.00	4	1.88	7	1.54	12	2.64
Ward 6	5	1.36	8	2.18	3	0.82	19	5.18	25	6.81	0	0.00	8	2.18	10	2.72
Ward 7	0	0.00	0	0.00	5	1.82	17	6.18	14	5.09	4	1.45	0	0.00	13	4.73
Ward 8	19	4.82	16	4.06	3	0.76	21	5.33	0	0.00	3	0.76	6	1.52	0	0.00
Ward 9	3	0.81	0	0.00	3	0.81	10	2.70	6	1.62	3	0.81	6	1.62	10	2.70
Ward 10	8	2.45	4	1.22	3	0.92	11	3.36	5	1.53	14	4.28	0	0.00	12	3.67
Ward 11	0	0.00	0	0.00	0	0.00	7	5.11	0	0.00	7	5.11	2	1.46	9	6.57
Ward 12	0	0.00	3	0.67	4	0.90	18	4.04	5	1.12	8	1.79	6	1.35	12	2.69
Ward 13	2	0.98	4	1.96	0	0.00	8	3.92	5	2.45	8	3.92	0	0.00	9	4.41
Ward 14	0	0.00	3	0.30	9	0.90	18	1.81	15	1.51	22	2.21	11	1.10	25	2.51
Ward 15	0	0.00	4	1.62	6	2.43	10	4.05	3	1.21	6	2.43	0	0.00	8	3.24
Ward 16	0	0.00	0	0.00	4	3.13	2	1.56	3	2.34	4	3.13	0	0.00	6	4.69
Ward 17	12	1.48	13	1.60	22	2.71	43	5.30	12	1.48	19	2.34	13	1.60	32	3.95
Ward 18	0	0.00	25	4.36	10	1.75	25	4.36	10	1.75	12	2.09	9	1.57	15	2.62
Ward 19	12	1.48	14	1.72	15	1.85	47	5.78	8	0.98	18	2.21	11	1.35	27	3.32
Ward 20	0	0.00	0	0.00	11	2.58	22	5.16	6	1.41	15	3.52	7	1.64	14	3.29
Ward 21	0	0.00	5	1.22	9	2.20	15	3.66	5	1.22	12	2.93	0	0.00	14	3.41
Ward 22	0	0.00	6	1.22	8	1.63	12	2.44	0	0.00	16	3.25	5	1.20	18	3.66
Ward 23	4	1.00	0	0.0	0	0.00	12	2.99	6	1.49	18	4.48	8	1.99	11	2.74
Ward 24	0	0.00	0	0.00	0	0.00	8	3.65	0	0.00	6	2.74	0	0.00	7	3.20
Ward 25	0	0.00	0	0.00	0	0.00	4	3.54	0	0.00	3	2.65	0	0.00	6	5.31
Ward 26	0	0.00	0	0.00	0	0.00	10	3.02	0	0.00	7	2.11	2	0.60	11	3.32
Ward 27	2	0.84	4	1.69	4	1.69	10	4.22	2	0.84	6	2.53	0	0.00	8	3.38
Ward 28	0	0.00	4	0.90	0	0.00	48	10.86	10	2.26	8	1.81	5	1.13	14	3.17
Ward 29	0	0.00	2	0.95	2	0.95	8	3.81	4	1.90	6	2.86	3	1.43	10	4.76
Ward 30	2	0.56	0	0.00	3	0.84	19	5.32	0	0.00	11	3.08	6	1.68	9	2.52
Total	114	1.00	169	1.48	138	1.21	551	4.83	215	1.89	266	2.33	137	1.20	324	2.84

Source: Socio-economic survey by DDC, 2003

Appendix 4.1

From	Ward 9		Ward 10		Ward 11		Ward 12		Ward 13		Ward 14		Ward 15		Ward 16	
	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.
Ward 1	3	0.70	22	5.12	0	0.00	84	19.53	32	7.44	14	3.26	8	1.86	0	0.00
Ward 2	11	4.74	18	7.76	0	0.00	42	18.10	10	4.31	8	3.45	5	2.16	0	0.00
Ward 3	6	1.65	10	2.75	0	0.00	68	18.73	27	7.44	18	4.96	8	2.20	3	0.83
Ward 4	7	3.59	6	3.08	0	0.00	38	19.49	15	7.69	3	1.54	7	3.59	2	1.03
Ward 5	16	3.52	14	3.08	3	0.66	62	13.66	35	7.71	12	2.64	16	3.52	5	1.10
Ward 6	13	3.54	11	3.00	2	0.54	50	13.62	28	7.63	10	2.72	13	3.54	4	1.09
Ward 7	12	4.36	8	2.91	7	2.55	41	14.91	19	6.91	6	2.18	10	3.64	0	0.00
Ward 8	14	3.55	12	3.05	3	0.76	54	13.71	30	7.61	10	2.54	14	3.55	4	1.02
Ward 9	0	0.00	35	9.46	12	3.24	70	13.92	27	7.30	15	4.05	13	3.58	4	1.03
Ward 10	17	5.20	0	0.00	8	2.45	62	18.96	27	5.26	20	6.12	12	3.67	4	1.22
Ward 11	5	3.65	4	2.92	0	0.00	32	23.36	11	8.03	4	2.92	5	3.65	0	0.00
Ward 12	15	3.36	11	2.47	3	0.67	0	0.00	27	6.05	12	2.69	16	3.59	0	0.00
Ward 13	7	3.43	12	5.83	0	0.00	39	19.12	0	0.00	15	7.35	7	3.43	0	0.00
Ward 14	10	1.00	31	3.11	7	0.70	156	15.66	120	12.03	0	0.00	58	5.82	56	5.62
Ward 15	7	2.83	14	5.67	0	0.00	43	17.41	22	8.91	12	4.86	0	0.00	0	0.00
Ward 16	0	0.00	8	6.25	0	0.00	24	18.75	9	7.03	6	4.69	4	3.13	0	0.00
Ward 17	10	1.23	32	3.95	3	0.37	125	15.41	58	7.15	10	1.23	12	1.48	18	2.22
Ward 18	12	2.09	12	2.09	6	1.05	38	15.36	44	7.68	15	2.62	20	3.49	6	1.05
Ward 19	12	1.48	37	4.55	0	0.00	121	14.88	62	7.63	14	1.72	25	3.03	22	2.71
Ward 20	15	3.52	13	3.05	3	0.70	58	13.62	31	7.28	9	2.11	22	5.16	8	1.88
Ward 21	5	1.22	17	4.15	0	0.00	68	16.59	21	5.12	12	2.93	16	3.90	0	0.00
Ward 22	8	1.61	22	4.47	0	0.00	88	17.59	28	5.69	15	3.05	12	2.44	0	0.00
Ward 23	8	1.99	15	3.73	0	0.00	68	16.92	16	3.98	0	0.00	12	2.99	0	0.00
Ward 24	4	1.83	8	3.65	0	0.00	29	13.24	11	5.02	6	2.74	8	3.65	0	0.00
Ward 25	2	1.77	5	4.42	0	0.00	21	18.58	9	7.96	0	0.00	6	5.31	0	0.00
Ward 26	8	2.42	12	3.63	2	0.60	55	16.62	28	8.46	9	2.72	12	3.63	8	2.42
Ward 27	9	3.50	12	5.06	0	0.00	42	17.72	16	6.75	8	3.38	10	4.22	0	0.00
Ward 28	5	1.81	16	3.62	0	0.00	72	16.29	36	8.14	13	2.94	22	4.98	0	0.00
Ward 29	8	3.31	14	6.67	0	0.00	33	15.71	16	7.62	5	2.38	7	3.33	0	0.00
Ward 30	8	2.24	15	4.20	0	0.00	49	13.73	18	5.04	0	0.00	13	1.64	4	1.12
Total	260	2.28	446	3.91	59	0.52	1778	15.60	833	7.31	271	2.38	393	3.45	148	1.30

Source: Socio-economic survey by DDC, 2003

Appendix 4.2

From	Ward 17		Ward 18		Ward 19		Ward 20		Ward 21		Ward 22		Ward 23		Ward 24	
	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.
Ward 1	7	1.63	9	2.09	0	0.00	15	3.49	11	2.56	25	5.81	12	2.79	8	1.86
Ward 2	4	1.72	0	0.00	0	0.00	6	2.59	5	2.16	7	3.02	0	0.00	0	0.00
Ward 3	8	2.20	11	3.30	0	0.00	22	6.06	8	2.20	18	4.96	0	0.00	0	0.00
Ward 4	7	3.59	7	3.59	0	0.00	8	4.10	5	2.56	6	3.08	0	0.00	0	0.00
Ward 5	16	3.52	16	3.52	8	1.76	19	4.19	10	2.20	14	3.08	0	0.00	0	0.00
Ward 6	13	3.54	13	3.54	6	1.63	15	4.09	8	2.18	11	3.00	2	0.73	0	0.00
Ward 7	11	4.00	8	2.91	0	0.00	12	4.36	9	3.27	11	4.00	0	0.00	0	0.00
Ward 8	14	3.55	14	3.55	7	1.78	16	4.06	11	2.79	12	3.05	0	0.00	0	0.00
Ward 9	10	2.70	13	3.51	8	2.16	18	4.86	8	2.16	11	2.97	5	1.35	3	0.81
Ward 10	14	4.28	6	1.83	0	0.00	14	4.28	7	2.14	0	0.00	10	3.06	0	0.00
Ward 11	5	3.65	4	3.65	2	1.46	0	0.00	3	2.19	4	2.92	2	1.46	0	0.00
Ward 12	12	2.69	16	3.59	8	1.79	15	3.36	13	2.91	22	4.93	19	4.26	15	3.36
Ward 13	7	3.43	0	0.00	0	0.00	11	5.39	6	2.94	7	3.43	0	0.00	0	0.00
Ward 14	35	3.51	35	3.51	18	1.81	42	4.22	22	2.21	31	3.11	22	2.21	10	1.00
Ward 15	0	0.00	5	2.02	4	1.62	6	2.43	10	4.05	6	2.43	5	2.02	10	4.05
Ward 16	6	4.69	4	3.13	0	0.00	5	3.91	3	2.34	4	3.13	0	0.00	3	2.34
Ward 17	0	0.00	32	3.95	18	2.22	28	3.45	24	2.96	28	3.45	8	0.99	5	0.62
Ward 18	20	3.49	0	0.00	55	9.60	22	3.84	8	1.40	12	2.09	11	1.92	14	2.44
Ward 19	33	4.06	55	4.77	0	0.00	36	4.43	16	1.97	18	2.22	10	1.23	10	1.23
Ward 20	6	1.41	11	2.58	15	3.52	0	0.00	22	5.16	13	3.05	12	2.82	9	2.11
Ward 21	6	1.46	12	2.93	6	1.46	27	6.59	0	0.00	23	5.61	18	4.39	12	2.93
Ward 22	0	0.00	0	0.00	0	0.00	36	7.32	28	5.69	0	0.00	28	5.69	24	4.88
Ward 23	6	1.49	10	2.49	6	1.49	17	4.23	22	5.47	32	7.96	0	0.00	21	5.22
Ward 24	8	3.65	12	5.48	0	0.00	18	8.22	14	6.39	12	5.48	15	6.85	0	0.00
Ward 25	0	0.00	4	3.54	0	0.00	6	5.31	5	4.42	5	4.42	7	6.19	5	4.42
Ward 26	8	2.42	13	3.93	8	2.42	18	5.44	16	4.83	18	5.44	5	1.51	6	1.81
Ward 27	2	0.84	4	1.69	12	5.06	10	4.22	11	4.64	9	3.80	7	2.95	5	2.11
Ward 28	6	1.36	12	2.71	0	0.00	10	2.26	17	3.85	16	3.62	6	1.36	8	1.81
Ward 29	0	0.00	8	3.81	0	0.00	7	3.33	6	2.86	5	2.38	6	2.86	0	0.00
Ward 30	13	3.64	12	3.36	4	1.12	11	3.08	9	2.52	11	3.08	8	2.24	7	1.96
Total	277	2.43	347	3.04	185	1.62	470	4.12	337	2.96	391	3.43	218	1.91	175	1.53

Source: Socio-economic survey by DDC, 2003

Appendix 4.3

From	Ward 25		Ward 26		Ward 27		Ward 28		Ward 29		Ward 30		Within the ward		Out side RCC		Total	
	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.
Ward 1	15	3.49	10	2.33	2	0.74	4	0.93	5	1.16	0	0.00	20	4.65	8	1.86	430	100
Ward 2	7	3.02	0	0.00	6	2.59	3	1.29	0	0.00	7	3.02	35	15.09	3	1.29	232	100
Ward 3	6	1.65	8	2.20	11	3.30	9	2.48	0	0.00	12	3.31	30	8.26	7	1.93	363	100
Ward 4	8	4.10	5	2.56	8	4.10	0	0.00	0	0.00	2	1.03	16	2.21	6	3.08	195	100
Ward 5	19	4.19	12	2.64	17	3.74	4	0.88	0	0.00	7	1.54	43	9.47	14	3.08	454	100
Ward 6	15	4.09	10	2.72	12	3.27	0	0.00	0	0.00	8	2.18	35	9.54	12	3.27	367	100
Ward 7	7	2.55	5	1.82	11	4.00	0	0.00	5	1.82	4	1.45	26	9.45	8	2.91	275	100
Ward 8	16	4.06	10	2.54	15	3.81	9	2.28	0	0.00	12	3.05	37	9.39	12	3.05	394	100
Ward 9	7	1.89	0	0.00	14	3.78	0	0.00	0	0.00	10	2.70	35	9.46	11	2.97	370	100
Ward 10	4	1.22	9	2.75	0	0.00	3	0.92	7	2.14	6	1.83	31	9.48	9	2.75	327	100
Ward 11	0	0.00	4	2.92	5	3.65	1	0.73	0	0.00	2	1.46	14	10.22	4	2.92	137	100
Ward 12	19	4.26	12	2.69	11	2.47	4	0.90	0	0.00	9	2.02	123	27.58	8	1.79	446	100
Ward 13	9	4.41	0	0.00	8	3.92	2	0.98	0	0.00	3	1.47	29	14.22	6	2.94	204	100
Ward 14	12	1.20	11	1.10	27	2.71	12	1.20	5	0.50	40	4.02	92	9.24	41	4.12	996	100
Ward 15	0	0.00	0	0.00	11	4.45	7	2.83	5	2.02	4	1.62	28	11.34	11	4.45	247	100
Ward 16	0	0.00	0	0.00	5	3.91	1	0.78	0	0.00	5	3.91	19	14.84	3	2.34	128	100
Ward 17	34	4.19	80	2.22	32	3.95	12	1.48	17	2.10	13	1.60	86	10.60	22	2.71	821	100
Ward 18	0	0.00	8	1.40	32	5.58	0	0.00	5	0.87	12	2.09	45	7.85	20	3.49	573	100
Ward 19	5	0.62	7	0.86	21	2.58	19	2.34	8	0.98	13	1.60	89	10.95	28	3.44	813	100
Ward 20	11	2.58	4	0.94	15	3.52	4	0.94	4	0.94	7	1.64	46	10.80	13	3.05	426	100
Ward 21	9	2.20	8	1.95	17	4.15	5	1.22	0	0.00	7	1.71	46	11.22	15	3.66	410	100
Ward 22	12	2.44	10	2.03	20	4.07	11	2.24	8	1.63	12	2.44	53	10.77	12	2.44	492	100
Ward 23	17	4.23	10	2.49	27	6.72	5	1.24	0	0.00	7	1.74	34	8.46	10	2.49	402	100
Ward 24	10	4.57	0	0.00	8	3.65	4	1.83	0	0.00	4	1.83	20	9.13	7	3.20	219	100
Ward 25	0	0.00	0	0.00	6	5.31	1	0.88	0	0.00	2	1.77	14	12.39	2	1.77	113	100
Ward 26	0	0.00	0	0.00	14	4.23	4	1.21	2	0.60	8	2.42	34	10.27	13	3.93	331	100
Ward 27	3	1.27	2	0.84	0	0.00	4	1.69	2	0.84	4	1.69	21	8.86	8	3.38	227	100
Ward 28	0	0.00	0	0.00	25	5.66	0	0.00	20	4.52	16	3.62	38	8.60	12	2.71	442	100
Ward 29	7	3.33	5	2.38	7	3.33	6	2.86	0	0.00	8	3.81	20	9.52	7	3.33	210	100
Ward 30	6	1.68	12	3.36	13	3.64	22	6.16	14	3.92	0	0.00	44	12.32	14	3.92	357	100
Total	258	2.26	180	1.58	400	3.51	156	1.37	112	0.98	244	2.14	1203	10.55	346	3.03	11401	100

Source: Socio-economic survey by DDC, 2003

Appendix 4.4

Appendix 5

Flow of Trips between Different Proposed Bus Stops for Rajshahi City

From	Stop 1		Stop 2		Stop 3		Stop 4		Stop 5		Stop 6		Stop 7		Stop 8		Stop 9	
	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.	Freq.	Per.
Stop 1	0	0.00	26	4.11	26	4.11	22	3.48	12	1.90	12	1.90	6	0.95	15	2.37	102	16.11
Stop 2	10	3.89	0	0.00	8	3.11	12	4.67	10	3.89	4	1.56	0	0.00	7	2.72	41	15.95
Stop 3	10	5.35	2	4.81	0	0.00	8	4.28	3	1.60	2	1.07	2	1.07	6	3.21	22	11.73
Stop 4	8	4.79	6	3.59	6	3.59	0	0.00	0	0.00	0	1.20	0	0.00	1	2.40	26	15.57
Stop 5	1	1.49	1	1.49	0	0.00	0	0.00	0	0.00	0	0.00	3	4.29	2	2.86	2	2.86
Stop 6	8	2.37	6	1.78	4	1.19	12	3.56	6	1.78	0	0.00	0	0.89	8	2.37	58	17.21
Stop 7	6	2.78	5	1.98	6	2.38	9	3.57	3	1.19	4	1.59	0	0.00	6	2.38	41	16.27
Stop 8	2	0.36	2	0.36	4	0.71	12	2.14	8	1.43	6	1.07	4	0.71	0	0.00	154	27.46
Stop 9	10	1.96	5	0.98	21	4.13	18	3.54	10	1.96	10	1.96	5	0.98	8	1.57	0	0.00
Stop 10	2	0.72	0	0.00	0	0.00	6	2.16	4	1.44	5	1.80	2	1.72	7	2.52	65	23.38
Stop 11	0	0.00	1	0.58	2	0.58	4	1.16	2	0.58	4	1.16	4	1.16	4	1.16	59	17.15
Stop 12	0	0.0	2	0.85	0	0.00	4	1.70	5	2.13	0	0.00	2	0.85	6	2.55	42	17.87
Stop 13	2	1.31	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	2	1.31	4	2.61	35	22.88
Stop 14	2	0.72	0	0.00	2	0.72	0	0.00	0	0.00	0	0.00	4	1.44	7	2.52	68	24.46
Stop 15	0	0.00	2	0.59	2	0.59	4	1.19	6	1.78	6	1.78	3	0.89	18	5.36	64	18.99
Stop 16	2	0.46	1	0.23	2	0.46	4	0.92	4	0.00	4	0.92	4	0.92	10	2.30	80	20.15
Stop 17	8	1.36	2	0.34	4	0.68	10	1.70	4	0.68	4	0.68	6	1.02	12	2.40	105	17.32
Stop 18	5	1.45	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	5	1.45	9	2.64	85	24.30
Stop 19	4	0.52	4	0.52	3	0.39	14	1.82	15	1.95	15	1.95	7	0.91	18	2.34	152	19.79
Stop 20	2	0.62	2	0.62	0	0.00	11	3.42	6	1.86	6	1.86	3	0.93	8	2.48	52	16.15
Stop 21	4	1.19	4	1.19	10	2.99	4	1.19	0	0.00	4	1.19	0	0.00	8	2.39	69	20.60
Stop 22	0	0.00	5	2.18	4	1.75	8	3.49	4	1.75	5	2.18	0	0.00	8	2.18	46	20.09
Stop 23	0	0.00	3	1.32	2	0.88	8	3.51	4	1.75	4	1.75	2	0.88	5	2.19	37	16.23
Stop 24	2	0.62	3	0.93	4	1.23	8	2.47	4	1.23	4	1.23	3	0.93	8	2.47	62	19.14
Stop 25	2	0.57	4	1.13	2	0.57	10	2.83	7	1.98	7	1.98	4	1.13	6	1.70	61	17.28
Stop 26	4	0.80	10	2.58	16	4.12	13	3.35	7	1.80	7	1.80	4	1.03	9	2.32	73	18.81
Stop 27	1	1.03	1	1.03	0	0.00	3	3.09	0	0.00	2	2.06	1	1.03	2	2.06	20	20.62
Stop 28	1	0.44	1	0.44	0	0.00	6	2.62	0	0.00	0	0.00	0	0.00	6	2.62	38	16.59
Stop 29	6	1.68	2	0.56	8	2.23	2	0.56	2	0.56	4	1.12	3	0.84	8	2.23	52	14.53
Stop 30	0	0.00	0	0.00	0	0.00	6	2.24	0	0.00	4	1.49	0	0.00	8	1.99	38	14.18
Stop 31	3	1.04	0	0.00	3	1.39	10	3.46	5	1.73	5	1.73	3	1.04	7	1.42	50	17.30
Stop 32	2	0.58	2	0.58	3	0.87	2	0.58	0	0.00	4	1.17	3	0.87	3	2.33	56	16.33
Stop 33	2	0.68	4	1.36	4	1.36	10	3.39	3	1.20	4	1.36	0	0.00	6	2.71	52	17.63
Stop 34	1	0.43	2	0.85	3	1.28	2	0.85	4	1.71	2	0.85	2	0.85	6	2.56	36	15.38
Stop 35	0	0.00	15	4.02	15	4.02	13	3.49	7	1.88	7	1.88	4	1.07	9	2.41	60	16.09
Total	106	0.93	131	1.15	165	1.45	248	2.18	148	1.30	175	1.53	95	0.83	276	2.42	1934	16.96

Appendix 5.1

To

From	Stop 10 Freq.	Stop 10 Per.	Stop 11 Freq.	Stop 11 Per.	Stop 12 Freq.	Stop 12 Per.	Stop 13 Freq.	Stop 13 Per.	Stop 14 Freq.	Stop 14 Per.	Stop 15 Freq.	Stop 15 Per.	Stop 16 Freq.	Stop 16 Per.	Stop 17 Freq.	Stop 17 Per.	Stop 18 Freq.	Stop 18 Per.
Stop 1	25	3.95	14	2.21	8	1.26	35	5.53	10	1.58	19	3.00	33	5.21	8	1.26	22	3.48
Stop 2	10	3.89	6	2.33	3	1.17	12	4.67	2	0.78	6	2.33	8	3.11	2	0.78	10	3.89
Stop 3	6	3.21	6	3.21	2	1.07	10	5.35	3	1.60	6	3.21	9	4.81	2	1.07	6	3.21
Stop 4	6	3.59	3	1.80	4	2.40	7	4.19	2	1.20	6	3.59	9	5.39	2	1.20	6	3.59
Stop 5	12	17.14	3	4.29	1	1.43	3	4.29	1	1.39	2	2.86	2	2.86	0	0.00	3	4.29
Stop 6	14	4.15	7	2.08	4	1.19	14	4.15	5	1.48	12	3.56	13	3.86	4	1.19	13	3.86
Stop 7	10	3.97	7	2.78	0	0.00	8	3.17	4	1.59	8	3.17	12	4.76	0	0.00	11	4.37
Stop 8	38	6.77	18	3.21	8	1.43	8	1.43	6	1.07	12	2.14	18	3.21	0	0.00	18	3.21
Stop 9	37	7.27	11	2.16	6	1.18	18	3.54	8	1.57	14	2.75	18	3.54	4	0.79	12	2.36
Stop 10	0	0.00	25	8.99	6	2.16	12	4.32	4	1.44	6	2.16	6	2.88	2	0.72	8	2.88
Stop 11	15	4.36	0	0.00	4	1.16	12	3.49	4	1.16	12	3.49	14	4.07	2	0.58	10	2.91
Stop 12	9	3.83	5	2.13	0	0.00	9	3.83	4	1.70	11	4.68	12	5.11	3	1.28	8	3.40
Stop 13	10	6.54	4	2.61	0	0.00	0	0.00	2	1.31	7	4.58	10	6.54	0	0.00	4	2.61
Stop 14	18	6.47	8	2.88	0	0.00	0	0.00	0	0.00	13	4.68	18	6.47	0	0.00	7	2.52
Stop 15	16	4.75	6	1.78	6	1.78	11	3.26	5	1.48	0	0.00	12	3.56	2	0.59	13	3.86
Stop 16	27	6.21	10	2.30	5	1.15	24	5.52	7	1.61	6	1.38	0	0.00	5	1.15	15	3.45
Stop 17	25	4.24	9	1.53	7	1.19	18	3.06	9	1.53	18	3.06	22	3.74	0	0.00	20	3.40
Stop 18	26	7.67	9	2.61	0	0.00	0	0.00	5	1.45	16	4.64	23	6.67	0	0.00	0	0.00
Stop 19	38	4.95	17	2.21	10	1.30	42	5.47	12	1.56	28	3.65	72	6.77	10	1.30	27	3.52
Stop 20	13	4.04	8	2.48	4	1.24	12	3.73	5	1.55	16	4.97	18	4.59	4	1.24	17	5.28
Stop 21	17	5.07	12	3.58	6	1.79	10	2.99	5	1.49	10	2.99	12	3.58	0	0.00	12	3.58
Stop 22	12	5.24	2	0.87	4	1.75	8	3.49	4	1.75	8	3.49	10	4.37	0	0.00	10	4.37
Stop 23	10	4.39	7	3.07	5	2.19	8	3.51	4	1.75	8	3.51	11	4.82	1	1.32	8	3.51
Stop 24	15	4.63	9	2.78	4	1.23	18	5.56	5	1.54	12	3.70	15	4.63	4	1.23	10	3.09
Stop 25	15	4.15	9	2.55	6	1.70	18	5.10	6	1.70	16	4.53	22	6.23	0	0.00	16	4.53
Stop 26	18	4.64	9	2.32	5	1.29	12	3.09	6	1.55	9	2.32	10	2.58	5	1.29	13	3.35
Stop 27	5	5.15	2	2.06	1	1.03	3	3.09	2	2.06	3	3.09	3	3.09	1	1.03	3	3.09
Stop 28	9	3.93	5	2.18	3	1.31	9	3.93	2	0.87	6	2.62	8	3.49	3	1.31	8	3.49
Stop 29	14	3.91	4	1.12	2	0.56	20	5.59	6	1.68	10	2.79	12	3.35	2	0.56	14	3.91
Stop 30	9	3.36	4	1.49	2	0.75	10	3.73	4	1.49	8	2.99	9	3.36	2	0.75	12	4.48
Stop 31	12	4.15	6	2.08	4	1.38	4	2.77	5	1.73	7	2.42	8	2.77	0	0.00	4	1.38
Stop 32	14	4.08	4	1.17	4	1.17	20	5.83	9	2.62	10	2.92	12	3.50	2	0.58	14	4.08
Stop 33	13	4.41	6	2.02	4	1.36	11	3.73	5	1.69	2	0.68	4	1.36	0	0.00	9	3.05
Stop 34	9	3.65	0	0.00	0	0.00	8	3.42	0	0.00	6	2.56	8	3.42	0	0.00	6	2.56
Stop 35	15	4.02	8	2.14	5	1.34	21	5.63	6	1.61	5	1.34	5	1.34	5	1.34	13	3.49
Total	542	4.75	263	2.31	133	1.17	439	3.85	166	1.46	338	2.96	460	4.03	77	0.68	332	2.91

Appendix 5.2

From	Stop 28 Freq.	Stop 28 Per.	Stop 29 Freq.	Stop 29 Per.	Stop 30 Freq.	Stop 30 Per.	Stop 31 Freq.	Stop 31 Per.	Stop 32 Freq.	Stop 32 Per.	Stop 33 Freq.	Stop 33 Per.	Stop 34 Freq.	Stop 34 Per.	Stop 35 Freq.	Stop 35 Per.	Not flows by the Stop Freq.	Not flows by the Stop Per.	Total Freq.	Total Per.
Stop 1	8	1.26	14	2.11	12	2.00	0	0.00	0	0.00	2	0.32	0	0.00	2	0.32	89	14.06	633	100
Stop 2	2	0.78	10	3.89	6	2.33	0	0.00	0	0.00	0	0.00	0	0.00	1	0.39	25	9.73	257	100
Stop 3	2	1.07	6	3.21	3	1.60	0	0.00	0	0.00	0	0.00	1	0.53	1	0.53	18	9.63	187	100
Stop 4	3	1.80	6	3.59	3	1.89	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	18	10.78	167	100
Stop 5	2	2.86	2	2.86	2	2.86	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	8	11.43	70	100
Stop 6	4	1.19	8	2.37	2	0.59	0	0.00	0	0.00	1	0.30	0	0.00	1	0.30	43	12.76	337	100
Stop 7	6	2.38	4	1.59	3	1.19	0	0.00	1	0.40	1	0.40	0	0.00	0	0.00	32	12.70	252	100
Stop 8	6	1.07	14	2.50	13	2.32	2	0.36	0	0.00	2	0.36	0	0.00	2	0.36	69	12.30	561	100
Stop 9	8	1.57	11	2.16	8	1.57	2	0.39	0	0.00	0	0.00	0	0.00	2	0.39	152	29.86	509	100
Stop 10	6	2.16	8	2.88	6	2.16	0	0.00	0	0.00	0	0.00	1	0.36	1	0.36	36	12.95	278	100
Stop 11	6	1.74	10	2.91	8	2.33	0	0.00	0	0.00	2	0.58	2	0.58	2	0.58	62	18.02	344	100
Stop 12	3	1.28	8	3.40	6	2.55	0	0.00	0	0.00	1	0.43	0	0.00	1	0.43	29	12.34	235	100
Stop 13	2	1.31	4	2.61	4	2.61	2	1.31	0	0.00	0	0.00	0	0.00	0	0.00	21	13.73	153	100
Stop 14	4	1.44	7	2.52	7	2.52	4	1.44	0	0.00	0	0.00	0	0.00	0	0.00	41	14.75	278	100
Stop 15	4	1.19	11	3.26	8	2.37	0	0.00	0	0.00	1	0.30	0	0.00	2	0.59	38	11.28	337	100
Stop 16	5	1.15	14	3.22	10	2.30	0	0.00	0	0.00	1	0.23	0	0.00	1	0.23	65	14.94	435	100
Stop 17	7	1.19	24	4.07	20	3.40	0	0.00	0	0.00	4	0.68	4	0.68	3	0.51	72	12.22	589	100
Stop 18	5	1.45	9	2.61	9	2.61	5	1.45	0	0.00	0	0.00	0	0.00	0	0.00	47	13.62	345	100
Stop 19	10	1.30	22	2.86	18	2.34	4	0.52	4	0.52	2	0.26	0	0.00	6	0.78	96	12.50	768	100
Stop 20	4	1.24	13	4.04	0	0.00	0	0.00	0	0.00	1	0.31	0	0.00	1	0.31	43	13.35	322	100
Stop 21	7	2.09	11	3.28	8	2.39	2	0.62	2	0.62	1	0.30	0	0.00	1	0.30	40	11.94	335	100
Stop 22	3	1.31	6	2.62	4	1.75	0	0.00	1	0.44	2	0.67	0	0.00	2	0.87	27	11.79	239	100
Stop 23	3	1.32	9	3.95	0	0.00	0	0.00	0	0.00	0	0.00	1	0.44	2	0.88	30	13.16	238	100
Stop 24	4	1.23	8	2.47	6	1.85	0	0.00	0	0.00	1	0.31	1	0.31	1	0.31	38	11.73	324	100
Stop 25	6	1.70	10	2.83	8	2.27	2	0.57	0	0.00	2	0.57	0	0.00	2	0.57	40	11.33	353	100
Stop 26	5	1.29	5	1.29	3	0.77	0	0.00	0	0.00	2	0.52	4	1.03	4	1.03	58	14.95	388	100
Stop 27	1	1.03	4	4.12	3	3.09	0	0.00	0	0.00	0	0.00	0	0.00	1	1.03	12	12.37	97	100
Stop 28	0	0.00	12	5.24	10	4.37	2	0.87	2	0.87	1	0.44	0	0.00	3	1.31	32	13.97	229	100
Stop 29	5	1.40	0	0.00	12	3.35	8	2.23	8	2.23	4	1.12	2	0.56	6	1.68	58	16.20	358	100
Stop 30	5	1.87	22	8.21	0	0.00	6	2.24	4	1.49	4	1.49	2	0.75	4	1.49	39	14.55	268	100
Stop 31	4	1.38	12	4.15	12	4.15	0	0.00	6	2.08	2	0.69	6	2.08	6	2.08	38	13.15	289	100
Stop 32	4	1.17	5	1.46	12	3.50	8	2.33	0	0.00	4	1.17	2	0.58	5	1.46	59	17.20	343	100
Stop 33	4	1.36	12	4.07	11	3.73	3	1.02	5	1.69	0	0.00	0	0.00	1	0.34	43	14.58	295	100
Stop 34	3	1.28	14	5.98	12	5.13	4	1.71	4	1.71	2	0.85	0	0.00	7	2.99	35	14.96	234	100
Stop 35	5	1.34	11	2.95	10	2.68	0	0.00	0	0.00	11	2.95	10	2.68	0	0.00	33	8.85	373	100
Total	160	1.40	335	2.94	248	2.18	54	0.47	73	0.64	55	0.48	35	0.31	70	0.61	1549	13.69	11401	100

Appendix 5.4

Appendix 6

উত্তরদাতা প্রদত্ত সর্বপ্রকার তথ্য গোপন রাখা হবে

রাজশাহী উন্নয়ন কর্তৃপক্ষ

রাজশাহী মহানগরীর স্ট্রাকচার প্ল্যান, মাস্টার প্ল্যান ও ডিটেইল্ড এরিয়া ডেভেলপমেন্ট প্ল্যান

পরামর্শক সংস্থা : ডেভেলপমেন্ট ডিজাইন কনসালটেন্টস লিঃ

আর্থ-সামাজিক নমুনা জরিপ প্রশ্নমালা

নমুনা নম্বর ☐ সাক্ষাৎকার গ্রহণকারী ঃ .... তারিখ ঃ ....

ক) উত্তরদাতা পরিচিতি ঃ

১. পরিবার প্রধানের নাম ঃ ....

২. উত্তরদাতার নাম ঃ . ...

৩. বর্তমান ঠিকানা ঃ

থানা	ইউনিয়ন/ওয়ার্ড	মৌজা/মহল্লা	রাস্তার নাম/নম্বর	বাড়ীর নম্বর	এলাকার ধরণ

বিঃদ্রঃ এলাকার ধরণ:-

১. বাঁশ/কুঁড়ি/ছিটেফোঁড় /সেমি পাকা
প্রাচীন পরিবেশ
নিম্ন সামাজিক সুবিধাদি
প্রধানতঃ নিম্নকেন্দ্রিক পেশা

২. বাঁশ কুঁড়ি / ছিটেফোঁড়/সেমি পাকা
সম্পূর্ণ প্রাচীন পরিবেশ
নাগরিক সুবিধা নেই
নষ্টি পেশা

৩. সরকারী/মহাসড়কপার্শ্ব
লোকার্নিং/হাউজিং এস্টেট

৪. নিম্ন বাড়ী, কাঁচা/সাধ পাকা
অধিক ঘনত্ব, নিম্ন আয় শ্রেণী

৫. পাকা বাড়ী
ভালো নাগরিক সুবিধাদি
মধ্যম ঘনত্ব
মধ্য/উচ্চ আয় শ্রেণী

৪. স্থায়ী ঠিকানা ঃ

a. রাজশাহী শহর

b. অন্য শহর
শহরের নাম ... .

c. গ্রাম
গ্রামের নাম ... ...

থানা ....
জেলা .. . .

☐ সকল তথ্য নেয়া হয়েছে

☐ অসম্পূর্ণ

সুপারভাইজার/ওয়ের স্বাক্ষর

☐ ডাটা এন্ট্রিকারী

সাহেব ....

☐ তথ্য নিরীক্ষক

তারিখ ....

খানার জনসংখ্যা ও আর্থ-সামাজিক বৈশিষ্ট্য :

১. পরিবারের ধরণ

১ একক   2 যৌথ   3 একান্নবর্তী।

২. ধর্ম

১ মুসলিম   2 হিন্দু   3 খ্রীষ্টান
৪ বৌদ্ধ   ৭ আদিবাসী   ৬ উপজাতি

৩. খানা ও জনসংখ্যা সম্পর্কিত তথ্য :

ক্রমিক নং (আই ডি)	খানা প্রধানের সংগে সম্পর্ক	বয়স	লিঙ্গ ১ = পুরুষ, 2 = স্ত্রী	বৈবাহিক অবস্থা	শিক্ষা	পেশা
	2-কোড	3	৪	5-কোড	6-কোড	7-কোড
1						
2						
3						
4						
5						
6						
7						
8						
৯						
10						
11						
12						

কোড :

কলাম-2: খানা প্রধানের সংগে সম্পর্ক
1 খানা প্রধান
2 স্ত্রী/স্বামী
3 পুত্র/কন্যা
4 পিতা/ মাতা
5 ভাই/বোন
৬ শ্বশুর/শ্বাশুড়ী
7 জামাই/বধূ
৮ নাতি/নাতনী
৯ পুত্রবধূ/জামাতা
10 অন্যান্য

কলাম-5: বৈবাহিক অবস্থা
1 অবিবাহিত
2 বিবাহিত
3 বিধবা/বিপত্নীক
4 তালাক প্রাপ্ত
5 পৃথক

কলাম 6 : শিক্ষা
0 নিরক্ষর
1 প্রাথমিক
2 নিম্ন-মাধ্যমিক
3 এস.এস. সি
1 এইচ. এস, সি
5 ডিগ্রি
৬ স্নাতক/প্রকৌশলী/এমবিবিএস
7 স্নাতর্ ডিগ্রি ও উর্ধে
৪ টেকনিক্যাল সার্টিফিকেট পাশ
৯ ভোকেশনাল টেড
10 ধর্মীয় শিক্ষা/মাদ্রাসার শিক্ষা
11 প্রাতিষ্ঠানিক
12 অন্যান্য

কলাম-7 : পেশা
1 অনিয়োজিত
2 স্বনিয়োজিত বা ব্যবসা পরিচালনা, সংযুক্ত কর্মরত
3 বেসরকারী অফিসের কর্মী
4 শ্রমিক
5 কৃষি শ্রমিক/ কর্মী
6 ডাক্তার/ প্রকৌশলী
7 ট্যাক্সি/গাড়ি চালক
৪ দর্জি/হস্তশিল্পী/কারিগর
৯ দিন মজুর
10 দিন মজুর (কৃষি)
11 গৃহস্থালী গৃহস্থ
12 শিক্ষক

13 দিন মজুর (কৃষি)
14 গৃহস্থালী কর্ম
15 বেকার
16 ধর্ম/যাজী
17 অবসরপ্রাপ্ত
18 দিন মজুর (অন্যান্য)
19 অন্যান্য

১   খানা প্রধানের জন্মস্থান কি এই গ্রামে?   হ্যাঁ ☐   না ☐

যদি না হয়, তবে পরবর্তী প্রশ্নের উত্তর দিন.

২.   আবাস ও অভিগমন ঃ

এই গ্রামে কতদিন বসবাস আছেন? (বছর)	পরিবারের কতজন সদস্য বাইরে থাকেন?		কোথা থেকে অভিগমন করা হয়েছে (গ্রাম-১, বাংলাদেশের বাইরে-২, গ্রাম-৩)।যদি ৩ হয় তবে দেশের নাম	কত অভিগমন করা হয়েছে? (সাল)	অভিগমনের কারণ	অভিগমনের পর প্রথম অবস্থান	অভিগমনের জন্য যোগাযোগের উৎস	যে গ্রাম থেকে অভিগমন করা হয়েছে সেখানে জমির সম্পত্তি আছে কি না	দেশের বাইরে থেকে অর্থ প্রেরণ ও অর্থ আনা হয় কিনা	এই গ্রামে অভিগমন করে সংসারের সংসার
	গ্রাম	অন্য গ্রাম								
১	২	৩	৪	৫	৬-কোড	৭-কোড	৮-কোড	৯-কোড	১০-কোড	১১-কোড

কোড ঃ

কলাম-৬ ঃ অভিগমনের কারণ
01   চাকুরী/কর্মসূত্র
02   নদী ভাঙন
03   প্রাকৃতিক দুর্যোগ/বন্যা
04   দারিদ্র
05   বেকারত্ব
06   বৈবাহিক কারণে
07   সামাজিক অস্থিরতা
08   পারিবারিক দ্বন্দ্ব
09   অন্যান্য

কলাম-৭ ঃ অভিগমনের পর প্রথম অবস্থান
01   বস্তি বাড়ী
02   হোটেল/মেস
03   মেস
04   স্বাধীন বাড়ী
05   সার্ভিং
06   কর্মস্থল
07   বাসা
08   ফুটপাথ/প্ল্যাটফর্মে
09   অন্যান্য

কলাম-৮ ঃ অভিগমনের জন্য যোগাযোগের উৎস
01   আত্মীয় স্বজন
02   বন্ধুবান্ধব
03   পত্রিকা
04   নির্বাচিত গ্রামবাসী
05   অন্যান্য

কলাম-৯ঃ যেখান থেকে অভিগমন করা হয়েছে সেখানে জমির সম্পত্তি
01   বাড়ি
02   বাড়ী
03   ব্যবসায়
04   শিল্পকারখানা
05   অন্যান্য

কলাম-১০ ঃ দেশের বাইরে থেকে অর্থ প্রেরণ ও অর্থ আনা
01   অর্থ আনা হয়
02   অর্থ আনা হয় না
03   অর্থ প্রেরণ করা হয়
04   অর্থ প্রেরণ করা হয় না

কলাম-১১ ঃ অভিগমন করে সংসারের সংসার
01   চাকুরী বৃদ্ধিতে
02   গৃহস্থালী কর্ম
03   পারিবারিক ব্যবসায়ে সাহায্যকারী
04   কৃষিক্ষেত্রে
05   অন্যান্য

৩   ১.   আপনার পরিবারে গত ১২ (১৯৯০-২০০১) বছরে কেউ অভিগমন করেছেন কি?   হ্যাঁ ☐   না ☐

২.   যদি হ্যাঁ হয়, তবে অভিগমনের কারণ কি ছিল ?   ১) চাকুরী/কর্মসূত্র   ২) বেকার ও/ দারিদ্র   ৩) বৈবাহিক কারণ   ৪ সামাজিক অস্থিরতা,
৫ বন্যা ৬ অন্যান্য.

৪   ১.   আপনার পরিবার থেকে গত ১২ (১৯৯০-২০০১) বছরে কেউ বহির্গমন করেছেন কি?   হ্যাঁ ☐   না ☐

২.   যদি হ্যাঁ হয় তবে বহির্গমনের কারণ কি ছিল ?   ১) চাকুরী/কর্মসূত্র,   ২) বেকার/ দারিদ্র, ৩ বৈবাহিক কারণ,   ৪ সামাজিক অস্থিরতা
৫ বন্যা ৬ অন্যান্য.

৫   অভিগমন / বহির্গমন সম্পর্কিত নিম্নে বর্ণিত তথ্য দিন ঃ

সদস্যের নাম (বয়স)	অভিগমনের স্থান	বহির্গমনের স্থান	সাল
১	২	৩	৪

ঘ) **কর্ম সংস্থান, আয় ও বিনিয়োগ :**

১   পরিবারের (প্রাপ্ত বয়স্ক) সদস্যদের পেশা :

পরিবারের সদস্য (আই,ডি)	প্রধান পেশা			সহায়ক পেশা		
	যে কর্মক্ষেত্রে আছে	প্রধান পেশার ধরণ	কাজের মজুরীর ধরণ	যে কর্মক্ষেত্রে আছে	সহায়ক পেশার ধরণ	কাজের মজুরীর ধরণ
1	2-কোড	3	4-কোড	5-কোড	6	7-কোড

কোড:
কলাম 2 এবং 5
১ সরকারী, আধাসরকারী স্বায়ত্বশাসিত সংস্থা   ২ বেসরকারী সংস্থা
৩ এন.জি ও   ৪ শিক্ষা প্রতিষ্ঠান
৫ নিজস্ব ব্যবসা প্রতিষ্ঠান (কোম্পানী/দোকান/ এজার্কশন)
৬ ইনফরমাল অর্থনৈতিক কর্ম
৭ অন্যান্য

কোড কলাম 4 এবং 7
১ মাসিক বেতন   ২ দৈনিক মজুরী
৩ কাজ অনুযায়ী মূল্য   ৪ নিজস্ব প্রতিষ্ঠানে কর্মরত
৫ বিনা বেতনে কর্মরত
৬ অন্যান্য

২   পরিবারের আয়ের উৎস :

	উৎস	আয় (টাকা)		
১	বেতন	টাকা		মাসিক
২	সম্পত্তি (শহর)	টাকা		বার্ষিক
৩	বাড়ী ভাড়া	টাকা		মাসিক
৪	উদ্বস্তা	টাকা		বার্ষিক
৫	মজুরী	টাকা		প্রতিদিন
৬	কৃষি	টাকা		বার্ষিক
৭	হাঁস, মুরগী, গরু, ছাগল	টাকা		বার্ষিক
৮	মৎস্য চাষ	টাকা		বার্ষিক
৯	অন্যান্য	টাকা		উল্লেখ করুন
		মোট আয় ঃ		মাসিক

৩   নিজস্ব ব্যবসা বা পেশার ক্ষেত্রে প্রারম্ভিক পুঁজির পরিমান উল্লেখ করুন - টাকা   (সাল ইং ....)

৪.   পুঁজির উৎস:

১	উত্তরাধিকার সূত্রে (থেকে পাওয়া)	২	নিজ সঞ্চয়াব	৩	যৌতুক
১	বন্ধুবান্ধব ও আত্মীয়	৪	সহকর্মা	৬	পাওনা
৭	বিনিয়োগকারী	৮	অন্যান্য		

৫.   প্রতিষ্ঠানের বর্তমান মূল্য কত?   টাকা   □□□□□□

৬   বিনিয়োগের ধরণ (গত ১০ বৎসরে) :

ক্রমিক নং	বিনিয়োগের শ্রেণী ও ক্ষেত্র	ক্রয় / নিবন্ধন		ক্রয় মূল্য টাকা	বর্তমান মূল্য টাকা
		মূল্য	সংখ্যা / পরিমাণ		
১	ইমারতে বিনিয়োগ :				
	- জমি				
	- বাড়ী				
	- অফিস				
	- দোকান				
	- কারখানা				
	- গুদাম				
	- অন্যান্য				
	মোট (১)				
২	কৃষি ও সংশ্লিষ্ট ক্ষেত্রে বিনিয়োগঃ				
	- জমি ক্রয়				
	- ভূমি উন্নয়ন				
	- কৃষি যন্ত্র ক্রয়/মেরামত				
	- সেচ ব্যবস্থা				
	- গবাদি পশু ক্রয়				
	মোট (২)				
৩	ব্যবসায়/কারবারে বিনিয়োগঃ				
	- চলতি মূলধন				
	- কাঁচামাল				
	- অন্যান্য				
	মোট (৩)				
৪	অলংকার :				
	- স্বর্ণ				
	- রূপা				
	মোট (৪)				
৫	গৃহস্থালী জিনিসপত্র :				
	- আসবাবপত্র				
	- বাসা ঘরের জিনিসপত্র				
	মোট (৫)				
৬	বিনোদন সামগ্রী :				
	- রেডিও/টি-ইন-ওয়ান				
	- টেলিভিশন				
	- ভি.সি.আর/ভি.সি.পি				
	- অন্যান্য				
	মোট (৬)				
৭	যানবাহন				
	- বাস				
	- ট্রাক				
	- ট্রাক্টর				
	- ঠেলাগাড়ি				
	- মাইক্রোবাস				
	- মটার				
	- বিমা/জান				
	- নৌকা/লঞ্চ				
	- অন্যান্য				
	মোট (৭)				
৮	আর্থিক প্রতিষ্ঠানে বিনিয়োগঃ				
	- সেভিংস একাউন্টস				
	- স্থায়ী আমানত				
	- পোষ্টাল সেভিংস সার্টিফিকেট				
	- কোম্পানী শেয়ার				
	- অন্যান্য				
	মোট (৮)				
	সর্বমোট				

৭. ঋণকৃত অর্থের উৎস ও অন্যান্য তথ্য :

অর্থের উৎস	ঋণকৃত অর্থের তথ্যাবলী					
	টাকা	মাল	সুদের হার	মেয়াদ	ঋণের উদ্দেশ্য	বর্তমানে অনাদায়ী দেনা (টাকা)
১	২	৩	৪	৫	৬	৭
সরকারী ব্যাংক						
সমবায় ব্যাংক						
মহাজন						
আত্মীয়, বন্ধুবান্ধব						
অন্যান্য সূত্র						

৮. পারিবারিক ব্যয় (মাসিক) :

বাড়ীর ভাড়া (নিজস্ব বাড়ী)	বাড়ী ভাড়া বাবদ (ভাড়াবাড়ী)	খাদ্য	যাতায়াত	স্বাস্থ্য	কাপড়/ পোষাক	শিক্ষা	বিদ্যুৎ, জ্বালানী, টেলিফোন ইত্যাদি	সামাজিক অনুদান	অন্যান্য
১	২	৩	৪	৫	৬	৭	৮	৯	১০

মোট ব্যয় ☐☐☐☐☐☐

গৃহায়ণ :

১. উত্তরদাতার পরিবারের জমির মালিকানা :

a) খানা প্রধান মালিক   হ্যাঁ ☐   না ☐

b) খানা প্রধান মালিক না হলে,

১. ভাড়া বাসেন   ২ ভাড়াটে ভাড়াটে
৩. বেআইনী দখলদার   ৪ বিনা ভাড়ায় বসবাসকারী
৫. সরকারী বাসা

যদি খানা প্রধান জমির মালিক হন, তবে নিচের প্রশ্নের উত্তর দিন :

১. যে জমিতে এই বাড়ী অবস্থিত সে জমির আয়তন কত ?

কাঠা	বিঘা	ডেসিমেল	বর্গফুট	অন্যান্য
১	২	৩	৪	৫

৩. খানা প্রধান অন্য কোন জমির প্লট/একাধিক প্লটের মালিক হলে, সেগুলির বিবরণ.

ক্রমিক নং	জমির অবস্থান ওয়ার্ড/ইউনিয়ন	ব্যবহার			জমির পরিমাণ	বরগা	মূল্য/শিকারণ (টাকা)
		ডেসি	কাঠা	বঃফুট			

জমির ব্যবহার কোড   জমির ধরন কোড :
০১ ব্যবসায়   ০৫ খালি জমি   ০১ উচ্চ জমি
০২ কৃষি   ০২ মাঝারী
০৩ বাস   ০৩ নীচু জমি
০৪ বাণিজ্য প্রতিষ্ঠান   ০৪ পুকুর/ডোবা

৪   জমির মালিকানা লাভের পদ্ধতি :
     ১   উত্তরাধীকার সূত্রে
     ২   দান সূত্রে
     ৩   সরকারী বরাদ্দসূত্রে / লীজ হিসাবে প্রাপ্ত
     ৪   ক্রয় সূত্রে

৫.   জমির মালিকানার ধরণ
     ১   সম্পূর্ণ একক মালিকানা
     ২   যৌথ/ আংশিক মালিক
     ৩   সমবায় মালিকানা
     ৪   বেআইনী দখল
     ৫   মালিকানা সম্পর্কে নিশ্চিত নয়

৬   বাড়ীর মালিকানাবান / বাড়ীতে অবস্থানের ধরণ

     ১.   সম্পূর্ণ একক মালিকানা   ২.   যৌথ মালিকানা
     ৩.   ব্যক্তি মালিকানাধীন বাড়ীর ভাড়াটে   ৪.   সরকারপ্রাপ্ত সরকারী বাড়ীর বাসিন্দা
     ৫.   ভাড়াটের ভাড়াটে   ৬   ভাড়া বিহীন
     ৭.   বে-আইনী দখলদার   ৮.   অন্যান্য

৭   উত্তরদাতা বাড়ীর মালিক হলে, মালিকানায় প্রাপ্তির উৎস :

     ১   উত্তরাধীকরণ সূত্রে   ২   দান সূত্রে   ৩   ক্রয় সূত্রে
     ৪   নিজস্ব নির্মিত   ৫   অন্যান্য

৮   বাড়ীর পাঠামোর ধরণ :

     ১   পাকা ইমারত (সম্পূর্ণ কংক্রিট)
     ২   আধা পাকা (টিনের ছাদসহ, টিনের বেড়া, বর্ধিত অথবা মাটির মেঝেসহ)
     ৩   কাঁচা (টিন, কাঠ, খড়, মাটি)
     ৪   নীচু কুঁড়িঘর

৯.   ১.   বাড়ীর স্থান আরডিএ কর্তৃক অনুমোদন দত্ত কিনা ?   [   ]

     ২.   বাড়ী তৈরীর আইন (চার্জ দুই দিকে জায়গা ছাড়া ইত্যাদি) মেনেছেন কি ?   হ্যাঁ [   ]   না [   ]

     ৩.   বাড়ী তৈরীর আইন না মেনে থাকলে, কারণ কি ?   ১ = এ ব্যাপারে সচেতন না ২ = এসব মানা সাধ্যাতীত/গুরুত্ব নেই
                                                   ৩ = আগ্রহী মনে করি

     ৪   বাড়ীর সম্মুখ বা বা প্রশস্ত রাস্তে রাইটা জায়গা ছাড়তে রাজি আছেন কি?   হ্যাঁ [   ]   না [   ]

     ৫   রাস্তা সম্প্রসারণের ক্ষেত্রে আপনি ভূমিকা রাখতে রাজি আছেন কিনা ?   হ্যাঁ [   ]   না [   ]

১০. ইমারতের তলা :   [   ]

১১   কক্ষের সংখ্যা (রান্নাঘর বারান্দা ও গোসল না ছাড়া)   [   ]

১২   পৃথক আবাসন সমস্যা আছে কি ?   হ্যাঁ [   ]   না [   ]
     সমস্যা থাকলে কারণ :
     01   আয়ের স্বল্পতা
     02   জমির ঊর্ধ্ব মূল্য
     03   উপযুক্ত স্থানে জমির অপ্রাপ্যতা
     04   নাগরিক সাধারণ পরিবেশ
     05   অনুন্নত দুর্যোগাপ্রবণ/অনাবাসিক এলাকা না পছন্দ
     06   অপর্যাপ্ত নাগরিক সুবিধাদি
     07   অন্যান্য

) অবকাঠামোগত সুবিধাদি :

১   অত্যাবশ্যকীয় সার্ভিস সমূহ :

রাস্তাঘাট ব্যবস্থা			পানি সরবরাহ			পানি সরবরাহের সময়কাল	স্থায়ীত্ব ও গাদন	সাধারণ ধরণ	পয়ঃনিষ্কাশন
বাসা থেকে গাড়ী চলাচল রাস্তার দূরত্ব	বাড়ীর সম্মুখস্থ রাস্তার ধরণ	বাড়ীর সম্মুখস্থ রাস্তার ধরণ	উৎস	সপ্তাহে ন সময়	মান				
1	2	৩-কোড	৪-কোড	৫	৬ কোড	7 ঘন্টা	৪ কোড	৯ কোড	১০ কোড

কন্যাবস্থান ও কন্যা		সাধারণ পরিষ্কার			বাড়ি বা বাসার ঘর সোপান হতে উপরে তলায় হয়ে থাকা	উপরতলার অধিকারে
১১-কোড	12	13 কোড	১৪	15 কোড	16	17 কোড
কাযন	গরমের পানির উত্তাপ	মাথা গোসল স্থান	টয়লেট (গাদি বা বে) গাদি গোসল কত দূরে	কুলানা গোসল পরিষ্কার মান	১ তলা ২ তলা	

কোড :

কলাম-3: বাড়ী সম্মুখস্থ রাস্তার ধরণ
01 পিচ ঢালা
02 সুরকি বিছানো
03 শীল
04 অন্যান্য

কলাম-4: পানির উৎস
01 পৌর করপোরেশনের সরবরাহ
02 নিজস্ব টিউবওয়েল
03 বহুগৃহি টিউবওয়েল
04 কম্যুনিটি কল
05 পাম্প/কল
06 পুকুর
07 কূপ
08 অন্যান্য . . . . .

কলাম 6 পানির মান
01 খুব ভাল
02 উপযোগ করা ভাল
03 সাদাসিধ দূষণ
04 উপযোগ ভালমন্দ
05 অন্যান্য

কলাম 7: পানির সরবরাহ
01 সারাই দিন সরবরাহ
02 সকাল বেলা
03 পানি সহিত
04 পরি পানি ও যানে
05 অন্যান্য

কলাম-8: স্থায়ীত্ব উপাদান
01 সিমেন্টের বাগে
02 কেরোসিন
03 লাকড়ি
04 বৈদ্যুতিক হিটার
05 অন্যান্য ....

কলাম-9: তাপের উৎস
01 বিদ্যুৎ
02 কেরোসিন
03 গোবরগ্যাস
04 অন্যান্য

কলাম-10: পয়ঃনিষ্কাশন
01 পয়ঃনিষ্কাশন ব্যবস্থা নাই
02 কাচা
03 সেপটিক ট্যাংক
04 পাকা

কলাম-11: কন্যাবস্থা, সম্পর্ক কারণ
01 নিচ তলায়
02 সাদি নিরুপেজ সাই যা সাদ
03 নিরুপমা বাড়ার সাথ সাথ সাদ
04 অন্যান্য

কলাম-13: সাধারণ রক্ষনের স্থান
01 বাড়ীর বাইরে ফেলা হয়
02 ডাস্টবিনের আশে পাশে
03 পৌরসভা কর্তৃক বাড়ী থেকে সংগ্রহ করা নেওয়া হয়
04 অন্যান্য . . . .

কলাম-15: সাধারণ গমনের সময়সূচী
01 প্রতিদিন
02 সপ্তাহে একদিন
03 প্রতিদিন গিত
04 অন্যান্য

কলাম-17: টয়লেটের মালিকানা
01 এককগত
02 ন্যাস
03 সমূহগতি

২   অত্যাবশ্যকীয় সার্ভিস সমূহের প্রধান প্রধান সমস্যাগুলো উল্লেখ করুন (প্রধান তিনটি সমস্যার উল্লেখ করুন) ঃ

১

২

৩

সামাজিক সুবিধাদি : স্বাস্থ্য, শিক্ষা, চিত্তবিনোদন

১ স্বাস্থ্য

বস্তুর মধ্যে ও চিকিৎসা:

১.১ গত তিন মাসে আপনার পরিবারে কেউ অসুস্থ হয়েছিল কি ?   হ্যাঁ ☐ ১   না ☐ ২

১.২ অসুস্থ যদি হয়ে কোন ধরনের সংখ্যা   ☐

১.৩ অসুখের ধরন (একাধিক উত্তর হতে পারে) ?

আমাশয় ☐ ১	ডায়রিয়া ☐ ২	বাত/ব্যথা ☐ ১
জ্বর ☐ ৫	যক্ষা ☐ ৬	কৃমি ☐ ২
মাথা ব্যথা ☐ ৭	অন্যান্য ☐ ১০	অন্যান্য........

১.৪ চিকিৎসার জন্য সাধারণত কোথায় যান ? (একাধিক অনুযায়ী) :

| ডিগ্রীধারী ডাক্তার ☐ ১ | গ্রামীণ চিকিৎসা ☐ ৩ | সরকারী হাসপাতাল ☐ ৫ | প্রাইভেট ক্লিনিক/হাসপাতাল ☐ |
| হোমিওপ্যাথিক ☐ ১ | প্রাইভেট চিকিৎসালয় ☐ ৭ | থানা.চিকিৎসক ☐ ৭ | অন্যান্য,........ ☐ ৮ |

১.৫ কোন প্রতিরোধক টীকা গ্রহণ   হ্যাঁ ☐   না ☐

যে কেন্দ্রে কোথায় টীকা দিয়েছেন কি ?
উত্তর যদি হয়ে থাকে :

১১ উপকরণ পাওয়া যায়নি
১২ এ নিয়ে ভেবে দেখিনি কখনো
১৩ এ নিয়ে ভেবে দেখিনি কখনো
১৪ মাসে নিচের বাড়তি
২৫ ধর্মে নিষেধ
৬   পাড়ায়/এলাকায় আপত্তি

১.৬ পরিবার পরিকল্পনা :

পরিবার পরিকল্পনা পদ্ধতি ব্যবহার করেন কি ?   হ্যাঁ ☐   না ☐
উত্তর যদি না হয় তবে কারণ :
১   উপকরণ পাওয়া যায়না
৩   এ নিয়ে ভেবে দেখিনি কখনো
৭   ধর্মে নিষেধ
৪   পাড়ায়/এলাকায় আপত্তি

২   শিক্ষা :

২.১ পরিবারের সদস্যদের শিক্ষাগত বিবরণ

পরিবারের সদস্য (বয়স (বছর)	শিক্ষা প্রতিষ্ঠান	বর্তমান ক্লাস নম্বর	পেশা	প্রাতিষ্ঠানিক মাধ্যমে ধরন	প্রতিষ্ঠান বিহীন নাম	যদি বিদ্যালয়ে না যায় গরহাজির কারণ
১	২-তে	৩	৪-তে	৫	৬	৭-তে

কলাম-১ : বয়স

কলাম-২ : শিক্ষা প্রতিষ্ঠান
01 কিন্ডার গার্টেন
02 প্রাইমারী স্কুল
03 মাদ্রাসা
04 মাধ্যমিক

কলাম-৩ : শ্রেণী
01 কিন্ডার
02 ক্লাস
03 ভর্তি হয়নি
04 ভর্তি মাধ্যমিক

কলাম-৭ : বিদ্যালয়ে না যাওয়ার কারণ
01 বিদ্যালয় মান খারাপ
02 গরীবের কারণ
03 পাঠ্য বাবদ খরচ
04 পড়াশোনায় আগ্রহ নেই

05 কারিগরী শিক্ষা প্রতিষ্ঠান   05 গাড়ী   05 পরিচিত শিক্ষক সংঘ
06 কলেজ   06 মাইক্রোবাস / বাস   06 অন্যান্য
07 বিশ্ববিদ্যালয়   07 নৌকা
08 অন্যান্য   08 অন্যান্য

১.১ প্রাথমিক বিদ্যালয় বয়সের উপযোগী বসয়ের ছেলেমেয়ের সংখ্যা

তন্মধ্যে কতজন বিদ্যালয়ে যায়না

বিদ্যালয়ে না যাওয়ার কারণ :

০১ আর্থিক সমস্যাজনিত   ০২ দূরে বিধায়
০৩ শিক্ষার প্রয়োজন না বোধে   ০৪ অন্যান্য

৩ চিত্তবিনোদন :

নিম্নলিখিত চিত্ত বিনোদন মাধ্যম সমূহের যথো যে ক্ষেত্রে প্রযোজ্য সেগুলোর উত্তর দিন

সিনেমা হল বাড়ি থেকে কিমি দূরত্বের মধ্যে		পরিবারে সিনেমার দর্শক সংখ্যা		যেখানে চিত্তবিনোদন		গৃহের বাইরে চিত্তবিনোদন		বাড়ির চিত্তবিনোদনের স্থান	
১ কি.মি.	৫ কি.মি.	কতদিন নিয়মিত সিনেমা দেখেন	মাসে ক চলন ?	টেলিভিশন দেখা	যাত্রা দেখা	ক্লাবঘরে	বন্ধু বান্ধব/প্রতিবেশী বাড়ী বেড়ানো	বাড়ি	পুকুর
১	২	৩	৪	৫-কোড	৬-কোড	৭-কোড	৮-কোড	৯	১০

কোড ঃ
কোড-৩, টিভি অনুষ্ঠান   কোড-৬ যেখানে দেখা   কোড-৭ বাইরে বেড়ানো   কোড ৪ প্রতিদিন
01 সিনেমা   01 ক্লাবঘর   01 জিলা   01 পার্বণ প্রতিদিন
02 সিনেমা-বিশ চ্যানেল   02 গৃহ   02 থানা   02 প্রতি সপ্তাহে
03 নাটক   03 মাঠ   03 বাণিজ্যিক   03 প্রতি মাসে
04 ইংরেজি গান   04 টেলিভিশন   04 স্থানীয়   04 পার্বণ
05 অন্যান্য   05 গ্রাম   05 অন্যান্য   05 পার্ব / চিত্তবিনোদন
       06 অন্যান্য   06 সপ্তাহ ১ বার
                                  07 অন্যান্য

৪ কেনাকাটা

কেনাকাটা	বিপণী কেন্দ্রের নাম	বাড়ী থেকে দূরত্ব	বাহন	যাতায়াতে ব্যয় (টাকা)	যাতায়াত সম্পর্কে মতামত
১	২	৩	৪-কোড	৫	৬-কোড
চাল, ডাল, ইত্যাদি					
দৈনন্দিন বাজার					
সাধারণ পারিবারিক কেনাকাটা					
বিশেষ পারিবারিক কেনাকাটা					

কোড.
কোড-৪ বাহন   কোড-৬ যাতায়াত সম্পর্কে মতামত
01 রিক্সা   02 সাইকেল   01 দূরত্ব জনিত সমস্যা
03 ভ্যান   04 বাস   02 ব্যয় বেশী
05 টেম্পু   06 নৌকা   03 যান বাহন
07 গাড়ি   08 পদব্রজ   04 অন্যান্য
09 অন্যান্য

৬. আপনার সর্বাপেক্ষা গুরুত্বপূর্ণ প্রয়োজন কোনটি ?
অগ্রাধিকার ভিত্তিতে নম্বর দিন :

ক)   আয়
     ১ = চাকুরী
     ২ = বেতন বৃদ্ধি (যদি চাকুরীতে থাকেন) ☐
     ৩ = ব্যবসার সুবিধা
                                        ☐

খ)   আবাসন :
     ১ = ভালো বাসস্থান   ☐
     ২ = জমির মালিকানার নিশ্চয়তা   ☐
     ৩ = রক্ষা ও নিষ্কাশন ব্যবস্থার উন্নয়ন ☐
     ৪ = এলাকায় নিরাপত্তা   ☐

গ)   ভৌতাবকাঠামো সুবিধা
     ১ = পানি সরবরাহ   ☐
     ২ = বিদ্যুৎ   ☐
     ৩ = গ্যাস/জ্বালানী   ☐
     ৪ = ময়লাঘর পরিষ্কার   ☐

ঘ)   সামাজিক সেবা
     ১ = শিক্ষা সুবিধা   ☐
     ২ = স্বাস্থ্য সুবিধা   ☐
     ৩ = চিত্তবিনোদন সুবিধা   ☐

ঙ)   এই শহরের প্রধান সমস্যা সমূহ চিহ্নিত করুন (সর্বোচ্চ ৫টি) :

     1

     2

     3.

     4

     5

৭)   খানা সদস্যদের সম্পদ সংক্রান্ত জরীপ :

১   পরিবারের কেউন সদস্য নিম্ন বর্ণিত কোন বাহন চালিয়ে ব্যবহার করেন কি ?
          ১   কার
          ২   মোটর সাইকেল
          ৩   সাইকেল
          ৪   করেন না

২   পরিবারের নিজস্ব মালিকানায় নিম্ন বর্ণিত বাহনগুলোর কোনটি আছে কি ?
          ১   কার/জীপ
          ২   মোটর সাইকেল
          ৩   সাইকেল
          ৪   একাধিক
          ৭   কোনটি নেই

৩   পরিবারের নিজস্ব মালিকানায় বাহনগুলোর রাখার সুবিধা আছে কি ?
          ১   হ্যাঁ   ২   না

Appendix 7

Reaesrch Title : Planning of public Bus Services for RajShahi City

Department of Urban and regional Planning
Bangladesh University of Engineering and Technology(BUET), Dhaka
Questionnaire for passenger attitude survey

(For Research Purpose Only)

1 General information about the respondent;

Mode of Trip:

Age	Sex	Occupation	Origin	Destination

Age code
1 = 0-15
2 = 16-30
3 = 31-45
4 = 45+

Sex Code
1 = Male
2 = Female

Occupation
1 = Service
2 = Business
3 = Student
4 = Others

2. Do you think that there is a necessity for public bus service in Rajshahi City?
    a) Yes   b) No

3. If yes, why?
    a) It is cheaper than other mode
    b) It will reduce the time of trip
    c) It is safer than other modes
    d) It will reduce the congestion of traffic
    e) It is more convenient than other modes
    f) Other (Specify)

4. If public bus services are introduced will you prefer the service to your existing mode?

5. If yes, why?
    a) It is cheaper than other mode
    b) It will reduce the time of trip
    c) It is safer than other modes
    d) It will reduce the congestion of traffic
    e) It is more convenient than other modes

Appendix 7.1

f) Other (Specify)

6. If public bus services are introduced how much time are you willing to wait for a bus at the bus stop?
   a) > 10 minutes
   b) 10-20 minutes
   c) 20-30 minutes
   d) 30+ minutes   -

7 If public bus services are introduced how much money are you willing to pay/km of travel?
   a) Upto 0.50 Tk.
   b) Upto 1.00Tk
   c) Upto 1 50Tk
   d) >1.50Tk

8 Remarks:

....

                              Surveyor's Signature:................... ....
                              Date: ....