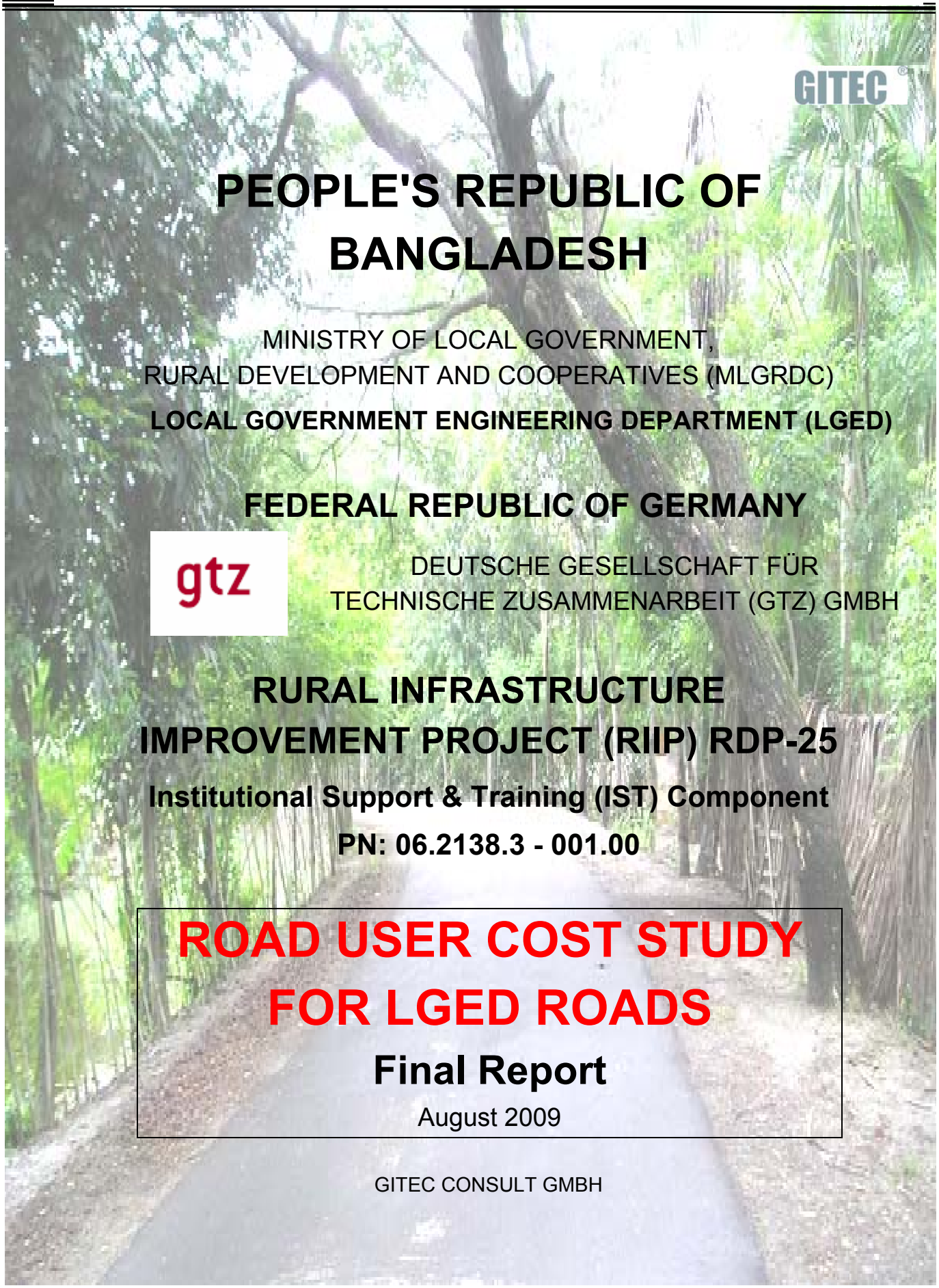

PEOPLE'S REPUBLIC OF BANGLADESH

MINISTRY OF LOCAL GOVERNMENT,
RURAL DEVELOPMENT AND COOPERATIVES (MLGRDC)

LOCAL GOVERNMENT ENGINEERING DEPARTMENT (LGED)

FEDERAL REPUBLIC OF GERMANY

DEUTSCHE GESELLSCHAFT FÜR
TECHNISCHE ZUSAMMENARBEIT (GTZ) GMBH

RURAL INFRASTRUCTURE IMPROVEMENT PROJECT (RIIP) RDP-25

Institutional Support & Training (IST) Component

PN: 06.2138.3 - 001.00

ROAD USER COST STUDY FOR LGED ROADS

Final Report

August 2009

GITEC CONSULT GMBH

Düsseldorf, Fed. Rep. of Germany

Foreward

It is a great pleasure for me to see that the Rural Development Project-25, (RDP-25), IST under Local Govt. Engineering Department has published the Road User Costs (RUC) Report 2009. The Report contains as usual three components of basic works like Vehicle Operating Costs (VOC), Travel Time Costs (TTC) and Accident Costs (ACC).

As is known to all professionals in the transport realm, RUC occupies a dominantly major proportion of the total life-cycle costs of a road project which may increase even up to ninety five percent (selected 18 Upazila and 18 Union Road in 36 District) depending on the volume of traffic on a road segment. RUC is such a vital issue that it is terribly uneconomic to ignore it in any extent.

This huge road user costs can be substantially reduced through timely and proper maintenance of the road network. The materials contained in the RUC report are principally used as the basic inputs in carrying out annual maintenance planning of road projects under LGED through application of HDM model. Besides, they are also largely used as significant inputs in conducting economic feasibility study of road and bridge projects.

Preparation of this study is the outcome of a combined effort of the officers and staff working in the Rural Development Project-25 (RDP-25), IST on various levels in such form as data collection, data entry to the computer, data analysis, model run and report writing. The Study team Consist of three experts, Mohammed Zafar Ullah, Transport Specialist and Principal Investigator, Rainer Kuhnle, Team Leader, Dr. Gholam Mustafa, Monitoring & Evaluation Specialist. Over all coordination of the study was supervised by Md. Abdus Shahed, Project Director, Rural Development Project-25.

I hope the RUC study carried out by the Rural Development Project-25 (RDP-25), IST with its limited resources will go a long way to achieve the cherished goal for which it is intended. In fine, I cordially thank the officers and staff of the RDP-25 engaged in doing this important task and hope that their efforts will continue to do the same in future as well.

(Md. Wahidur Rahman)
Chief Engineer
Local Govt. Engineering Department
Sher-e-Bangla Nagar, Agargoan, Dhaka

Preface

Local Govt. Engineering Department (LGED) has been pursuing a policy of following a planning system to allocate its budget to its highway maintenance and development programs according to socioeconomic merits. An integral part of this system is the estimation of accurate Road User Costs (RUC) annually. The Rural Development Project-25 (RDP-25), IST under LGED has been doing the job to update the RUC report on regular basis.

RUC report 2009 is the first time of this type. It contains vehicle operating, travel time and accident costs analyzed on the basis of data collected through conducting field surveys in thirty six districts headquarters in Bangladesh as well as collection of relevant data from various concerned agencies and organizations.

The field surveys were conducted in various regions of the country which included vehicle operator's survey and passenger and freight time cost survey, while other essential data like vehicle registration, vehicle price, vehicle make and model, tax structure, fuel and tyre price, and accident related data had to be collected from concerned public and private agencies.

Preparation of this report is the outcome of a combined effort of the officers and staff working in the RDP-25, IST on various levels in such form as data collection and compilation, data entry to the computer, data analysis, model run and report writing.

Although care was taken to enrich the report as much as possible, there is still scope of some improvement.

It is understandable that the effect of RUC on the economy of the country is colossal. It is as such desirable that the outcome of the study should be as much accurate as possible and closest to the reality. But in doing this job RDP-25, IST has been facing some methodical problems which need to be addressed properly. One area of such issue is the requirements of some expert training program arranged in LGED headquarter on the understanding of the relevant aspects of HDM-4 model as well as on some key areas of RUC analysis to be essentially imparted to the officers doing the job. RUC analysis of non-motorised vehicles is also a vital area in this respect. Besides in order to carry out the RUC studies with solemn reliability, more personnel and financial resources are required. It is suggested that a unit like "economic circle" in RHD can be formed within LGED system.

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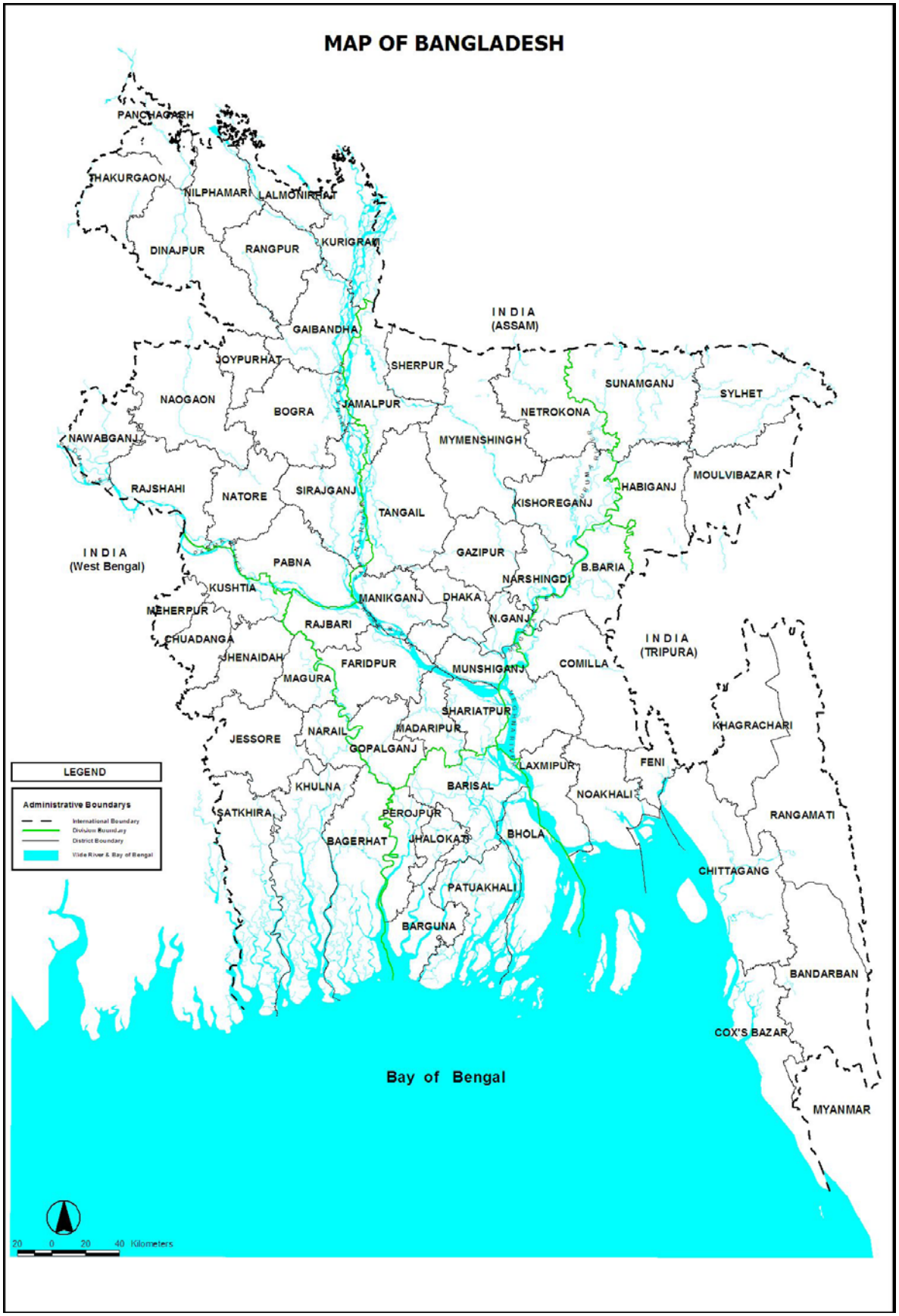
Abbreviations

AADT	Annual Average Daily Traffic
ACC	Accident Cost
ADC	Additional Deputy Commissioner
ADM	Additional District Magistrate
ADP	Annual Development Programme
BADC	Bangladesh Agricultural Development Corporation
BCR	Benefit Cost Ratio
BME	Benefit Monitoring and Evaluation
BRDB	Bangladesh Rural Development Board
CGC	Control Growth Centre
C.I.	corrugated iron
CPI	Consumer Price Index
CUP	Control Union Parishads
DAE	Department of Agricultural Extension
DOE	Department of Education
DOF	Department of Forest
DC	Deputy Commissioner
DRSC	District Road Safety Committees
D&S	Design and Supervision
EIRR	Economic Internal Rate of Return
FUPM	Female Union Parishad Members
GC	Growth Centre
GCC (road)	Growth Centre Connecting (road)
GoB	Government of Bangladesh
HH	Household
I(R)RI	International (Road) Roughness Index
IST	Institutional Support and Training Component of RIIP
LGD	Local Government Division
LGED	Local Government Engineering Department
LTk.	Lac Taka (= 100,000 Taka)
Md.	Mound (approx. 36 kg)
MES	Monitoring and Evaluation Specialist
MMC	Market Management Committee
MOLG RD&C	Ministry of Local Government, Rural Development & Co-operatives
NPV	Net Present Value
PIC/SIC	Project/Subproject Implementation Committee
PKM	Person kilometer
PL	Pedestrian with Load
PWL	Pedestrian without Load
RCC	Reinforced Cast Concrete
RDP	Rural Development Project
RHD	Roads and Highways Department
RIIP	Rural Infrastructure Improvement Project
RIMMU	Rural Infrastructure Maintenance Management Unit
RMP	Rural Maintenance Programme
RRMP	Rural Road Master Plan
MT	Metric ton
MUMP	Male Union Parishad Members
NGO	Non-governmental Organisation

PGC	Project Growth Centre
PUP	Pilot Union Parishads
TB	Tuberculosis
TBA	Traditional Birth Attendant
THO	Thana Health Officer
Tk.	Taka
TKM	Ton-Kilometer
TTC	Travel Time Cost
UE	Upazila Engineer
UHC	Union Health Centre
UH&FWC	Union Health and Family Welfare Centre
UNO	Upazila Nirbahi (Executive) Officer
UP	Union Parishad (Council)
URSC	Upazila Road Safety Committees
VGD/VGF	Vulnerable Group Development/Vulnerable Group Feeding
VOC	Vehicle Operation Cost
VPD	Vehicles per Day
WADT	Weekly Average Daily Traffic


MAP OF BANGLADESH
PANCHAGARH
THAKURGAON
NILPHAMARI
LALMONIRHAT
DINAJPUR
RANGPUR
KURIGRAM
GAIBANDHA
JOYPURHAT
SHERPUR
NAOGAON
BOGRA
JAMALPUR
NETROKONA
SUNAMGANJ
SYLHET
NAWABGANJ
MYMENSHINGH
RAJSHAHI
NATORE
SIRAJGANJ
TANGAIL
KISHOREGANJ
HABIGANJ
MOULVIBAZAR
PABNA
GAZIPUR
B.BARIA
KUSHTIA
MANIKGANJ
DHAKA
NARSHINGDI
MEHERPUR
N.GANJ
RAJBARI
CHUADANGA
JHENAIDAH
FARIDPUR
MUNSHIGANJ
COMILLA
MAGURA
SHARIATPUR
KHAGRACHARI
JESSORE
NARAIL
MADARIPUR
GOPALGANJ
LAXMIPUR
FENI
KHULNA
BARISAL
NOAKHALI
SATKHIRA
PEROJPUR
RANGAMATI
BAGERHAT
JHALOKATI
BHOLA
CHITTAGANG
PATUAKHALI
BARGUNA
BANDARBAN
COX'S BAZAR
Bay of Bengal
MYANMAR
INDIA (ASSAM)
INDIA (West Bengal)
INDIA (TRIPURA)
LEGEND
Administrative Boundarys
International Boundary
Division Boundary
District Boundary
Wide River & Bay of Bengal
20 0 20 40 Kilometers

1 INTRODUCTION

1.1 Background

The need for Road User Cost (RUC) study in LGED cannot be over emphasised. LGED have been engaged in rural road improvement since last 3 decades. To justify the improvement of each road, there has to be economic justification. The economic justification constitutes mainly economic analysis and then income and employment generation. To do a sound economic analysis, the determinations of Vehicle Operating Cost (VOC) along with travel time and accident costs are essential. So far, LGED have no basic study for determining these parameters. Consequently, the researchers had to depend upon a 5 years old (2004-2005) RHD study whose road categories are different from LGED's. The present study has been undertaken to fill that gap.

LGED have been engaged in new construction, development and maintenance of rural roads and bridges for which feasibility, monitoring and evaluation are required by Planning Commission and donor agencies. This can be done fairly quickly with the determination of *Vehicle Operating Costs and Travel Time Costs in relation to International Roughness Index (IRI) as these are* standardized for LGED roads in the present study.

Road user costs (RUC) are the costs borne by the people through use of the road network facility. A road infrastructure project involves three types of cost in its useful life; they are; construction cost, maintenance cost and road user cost. While construction and maintenance costs are incurred by the concerned road development agency, road user costs are borne by the users of road output. Of these three components of life-cycle cost, road user cost occupies the major proportion depending on the volume of traffic plying on road.

According to an empirical study carried out by the Organisation for Economic Cooperation and Development (OECD) in 1994 on cost-shares under optimal maintenance situation of road infrastructure, the proportion of RUC is about 38% on a road with 50 vehicles per day, about 75% on a road with 300 vehicles per day and above 90% on a road with 5000 vehicles per day.

1.2 Road Classification

1.2.1 Road Types, Definitions and Ownership/Responsibility as per Planning Commission's Notification, 2003

In November 2003, the Government has made a change to earlier road classification system and delineated the ownership/responsibility of each category of roads for their improvement and maintenance. (Bangladesh Gazette volume-I, dated 6th November 2003). The new definition classifies the road system into six main categories. The road type/category, definition and, ownership and responsibility are listed in Table 1.1:

Table 1.1: Road Types, Definitions and Ownership/Responsibility in Bangladesh[3]

Sl. No	Type/Category	Definition	Ownership/ Responsibility
1.	National Highway	Highways connecting National capital with Divisional HQs or seaports or land ports or Asian Highway.	RHD*
2.	Regional Highway	Highways connecting District HQs or main river or land ports or with each other not connected by National Highways.	RHD
3.	Zila Road	Roads connecting District HQ/s with Upazila HQ/s or connecting one Upazila HQ to another Upazila HQ by a single main connection with National/Regional Highway, through shortest distance/route.	RHD
4.	Upazila Road	Roads connecting Upazila HQ/s with Growth Center/s or one Growth Center with another Growth Center by a single main connection or connecting Growth Center to Higher Road System**, through shortest distance/route.	LGED*/ LGI*
5.	Union Road	Roads connecting Union HQ/s with Upazila HQs, growth centres or local markets or with each other.	LGED/ LGI
6.	Village Road	a) Roads connecting Villages with Union HQs, local markets, farms and ghats or with each other. b) Roads within a Village.	LGED/ LGI

1. The roads belong to the Pourashavas and the City Corporations have not been included under the above list. The responsibility for development and maintenance of such roads will lie with the respective Pourashavas and the City Corporations.

* LGED-Local Government Engineering Department, RHD-Roads and Highways Department, LGI - Local Government Institutions.

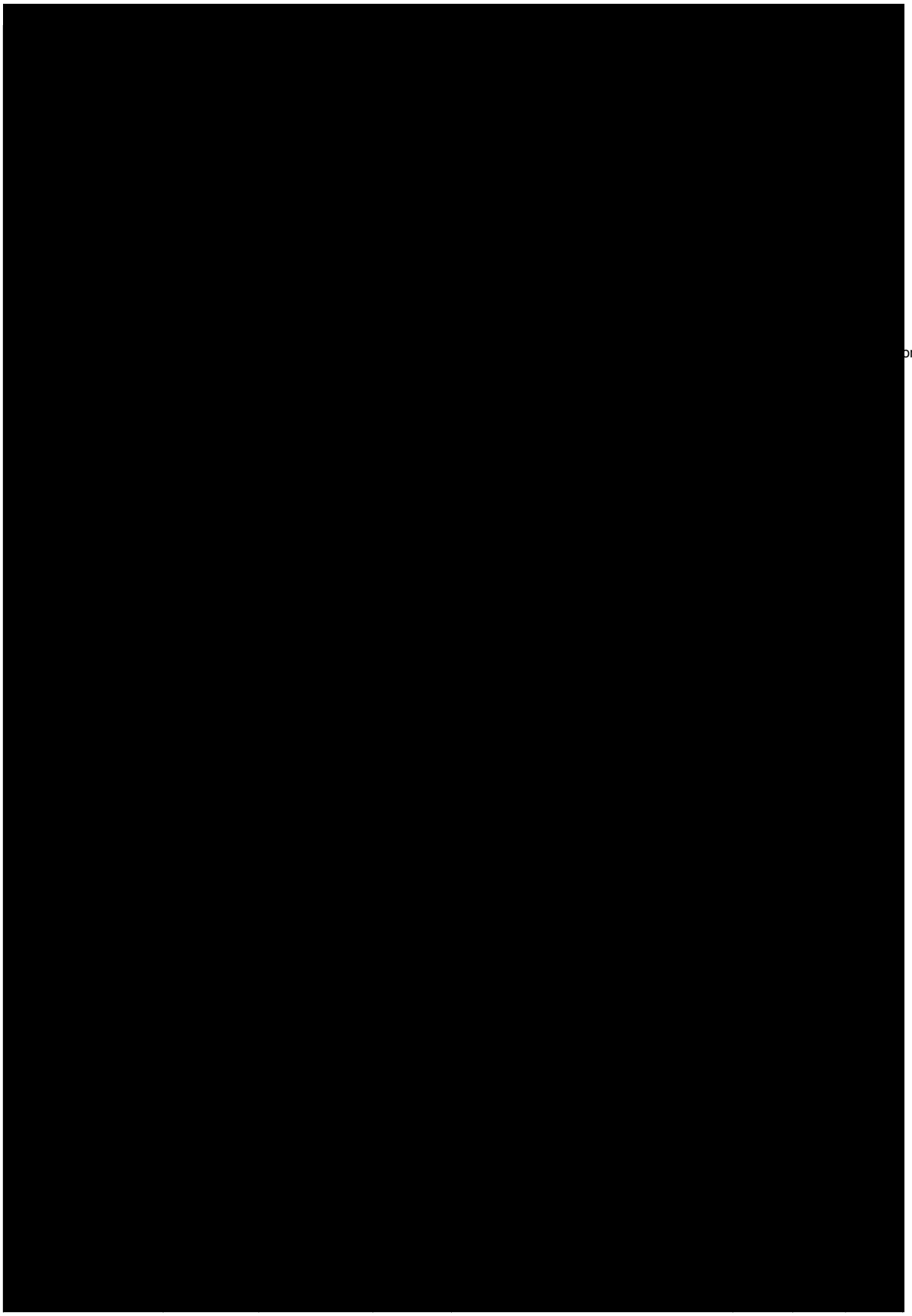
** Higher Road System - National Highway, Regional Highways, and Zila Roads.

[3] Published in the Bangladesh Gazette, volume 1, 6th November, 2003

***Source**: Training Manual on Road Maintenance Management, (RIMMU), August 2006*

1.3 Selected Roads for the Study

The surveyed LGED roads are presented below Table 1.2.



1.4 The LGED Road Network

The LGED are responsible, in conjunction with the local government institutions, for the 'rural road network', which is sub-divided into three clearly defined classes of road – Upazila Road (earlier Feeder Roads Type-B, FRB), Union Road (earlier R1), and Village Road (earlier R2 and R3). The local government institutions, in particular, the union Parishads are basically responsible for maintenance of earthen Union and Village roads through earthworks. The present extent and the condition of the rural road network, which totals over 250,892 km, are summarized in Table 1.3.

Table 1.3: Present Status of Rural Roads Development in Bangladesh

Road Type	Total Length (km)	Surface Type and Length (km)			
		Dev.by BC/RCC(km)	Taken under Diff. Projects(km)	Remaining length to be dev./improved(km)	
Upazila Roads	36488	21561	3142	11785	32%
Union Roads	42085	12127	2054	27903	66%
Village Roads (A+B)	172319	8%			
Bangladesh Total	250892				

Source: *LGED Data Base: Rural Infrastructure Maintenance Management Unit (RIMMU), Dhaka, 2008*

1.5 Rural Road Network

Based on the recent road re-classification and about 671 number of roads have been transferred from RHD to LGED through gazette notification as Upazila roads are now being under process of inclusion and inventory correction in the LGED's road inventory database. However, at present, total length of the Upazila road in the country reaches 36,488 km and that of the Union road accounts for 42,085 km. Village roads length comprises 172,319 km have two categories viz. 'A' and 'B'. Out of these lengths, 21,561 km of Upazila road have been upgraded to date with all-weather bitumen-surfaced, while the proportion of improvement/upgrading for Union road is 12,127 km followed by Village road only 8% with bitumen-surface finished. Present condition of improvement/ upgrading for Upazila road, Union road, and Village roads are shown in Table 1.4.

In 2007, LGED Road Inventory was carried out nearly 76% of the total length of the UZR, UNR, and VR roads, were earthen and only 24% were assessed as being in good condition. With continuing investment in the sector the overall condition of the network has improved since the inventory was completed, but the major part of the network still consists of earthen embankments. Even for Upazila roads the most important roads in the rural network which play a critical role in the marketing of agricultural produce and have been the main focus for investment in upgrading. Only about Earthen 34.44% HBB/WBM/BFS 9.19%,CC/ RCC 0.77%,BC 55.59% .. Thus, although substantial progress has been made in developing Upazila roads to all-weather, good condition standard much remains to be done.

Table 1.4: Present Status of structure Development on Rural Roads in Bangladesh

Road Type	Total roads (km)	Surface Type and Length (km)	
		Bridge/Culvert (m)	Existing Gap(m)
Upazila Roads	36488	271861	125071
Union Roads	42085	193378	150758
Village Roads-(A+B)	172319		
Bangladesh Total	250892	465239	275829

Source*: LGED Data Base: Rural Infrastructure Maintenance Management Unit (RIMMU), Dhaka, 2008*

1.6 Structure of the Report

The report is presented as a Final Report. It presents, in a comprehensive manner. The Final Report consists of 6 (six) chapters and 1 (one) Annex A.

Chapter 1 Introduction/ Background of the study

It contains overview of the project and it sector performance. Mentioned the situation of Upazila and Union roads. Road Classification.

Chapter 2 Methodology of the Study

This huge road user costs can be reduced substantially through proper and timely maintenance of the road network. It contains Methodological framework of the Study. Data collection techniques, Sampling, Questionnaire & Checklist, Orientation of LGED Field Staff.

Chapter 3 The Bangladesh Vehicle Fleet

Information on the Bangladesh vehicle fleet was collected from BRTA, which is responsible for motorised vehicle registrations and renewals in Bangladesh. The organisation does not publish an annual report on registrations but provides data to the Bangladesh Bureau of Statistics (BBS) which is published annually in the Statistical Yearbook of Bangladesh.

Chapter 4 Vehicle Operating Cost

Vehicle Operating Cost (VOC) is a complex procedure, as costs of all relevant components of the vehicle are needed for the entire Bangladesh vehicle fleet consisting of a plethora of vehicle types. It contains Number of Registered Vehicles, Representative Vehicle Types, Vehicle Categories, Annual Utilization of Vehicles, Operational Life of Vehicles, Vehicles Purchase Costs, Representative Vehicle Tyres, Economic & Financial Costs of Fuel & Lubricants, Vehicles Maintenance Costs, Crew Wage Costs and Annual Overhead Costs etc.

Chapter 5 Travel Time Costs

Travel Time Costs (TTC) also referred to as Values of Time are an important component of road user costs. It contains Vehicle Occupants by Trip purpose, Vehicle Occupants by Occupation, Monthly Income, Travel Time Cost of Passengers by Category of Vehicle and Road Class.

Chapter 6 Accident Costs

Accident means road accident and accident costs refer to the costs borne by the economy due to occurrence of a road accident. It contains Number of RTA casualty. The causalities are classified in three basic categories: Fatalities, Grievous/Serious injuries & Simple/Slight injuries. Crew Wage Costs, Fatal Causalities by Age Group, Lost output Causality Costs, Medical Costs per RTA.

2 METHODOLOGY

2.1 General

This huge road user costs can be reduced substantially through proper and timely maintenance of the road network. With this understanding, Economics Circle of RHD in collaboration with the IDC Transport Economists developed a methodology to carry out road user cost study during 1995 through 1997. Following this methodology, the Economic Circle of RHD published “RHD Road User Cost Annual Report for (2004-5)”. The RHD study dealt with RHD roads which are different from LGED roads. Moreover, RHD study is almost 5 years old. So far, LGED consultants used RHD results after some adjustments. The present study has been embarked upon with a view to having an independent RUC study of LGED’s own. This will lay the foundation of economic and financial analysis of LGED roads and bridges under various projects. Three RUC components such as Vehicle Operating Cost (VOC), Travel Time Cost (TTC) and Accident Cost (ACC) were considered in this study. The input parameters were collected from both primary and secondary sources and entered in a HDM model. The HDM run produced VOC and IRI in different years. These VOCs along with Travel Time costs are the results of this study which will lay the foundation of economic and financial analysis of LGED roads and bridges.

2.2 Data Collection

The inputs for the study were collected mainly through field surveys conducted in various regions of the country, which include among others vehicle operator's survey and passenger travel time cost survey while other essential data like vehicle registration, vehicle price, vehicle make and model, tax structure, fuel and tyre price, and accident related data were collected from concerned public and private agencies. RHD have a wing named as “Economic Circle” who are responsible to collect similar data for their study. They extended full cooperation for data verification. The road related data such as construction cost, maintenance cost and road specifications of LGED roads were collected from Rural Infrastructure Maintenance Management Unit (RIMMU) of LGED.

2.3 Sampling

Based on a shortlist prepared on the available data from a number of infrastructures of each Project district, total 18 numbers Upazila roads, 18 numbers Uniona roads. In addition to economic viability, many factors were taken into consideration for making a shortlist of Upazila roads and growth centre/ markets such as, topographical situation, road networking and connectivity, transportation and communication need, trading facilities in the growth centre/ markets, community aspiration and participation, etc.

2.4 Questionnaire and Checklist

One of the instruments used for data and information collection was questionnaire and checklist. There was 10 (ten) Questionnaire and 10 (ten) Checklists used for data collection covering all components of the proposed project. The data and information collected by the LGED field level staff in the respective District and Upazila under guidance of the district level Executive Engineer and at Upazila level Upazila Engineers.

2.5 Orientation of LGED field Staff

District level a day long orientation course prior to the survey organized for the Executive Engineer, Assistant Engineers, Upazila Engineers, Sub-Assistant Engineers, Surveyors, Community Organizers and other relevant staffs to become familiar with survey methodology, the questionnaire and checklists, and to enable them supervise, monitor and conduct the data collection activities through participatory techniques. A participatory approach has been used involving extensive consultation with stakeholders and potential beneficiaries down to grass-root level.

2.6 Supervision and Monitoring Data Collection Survey

The district level LGED Executive Engineer, Assistant Engineers and at Upazila level Upazila Engineer, supervised data collection survey by the LGED field staff. The filled in questionnaire and checklist received from the field were duly checked, verified and reviewed by the study team at LGED HQ. One Upazila Engineer and an Assistant Engineer nominated by the concern district level Executive Engineer LGED, who was directly responsible for monitoring, supervision of the survey activities in the respective district.

2.7 Data Analysis

Having receipt of the data and information from the field, those were reviewed and in some cases validated by the study team in case of errors and omissions and then processed through customized software program to make a database for feasibility study of the Project. The outputs generated from the customized software program were analyzed and incorporated in this report through presentation of tables.

2.8 Limitation, Weakness and Issues

This Road User Cost study activity, a comprehensive task had to be performed in a very limited time and as a result, the field level LGED staff had to complete the data collection survey very quickly at the cost of proper monitoring and supervision. The Upazila level staffs of LGED fully involved in this survey works were to do this job within limited time period as additional responsibility and consequently the raw data, had to be rationalized in some cases in line with other similar data of same type of infrastructures. The Road User Cost study report perhaps could be richer without these limitations.

2.9 Field Visits

The Transport Specialist in consultation with the Project Director, RDP-25 selected 18 Upazila and 18 Union roads to get first hand experience about nature of vehicle movement and travel time cost passenger in vehicles. The AADT of vehicles along the roads were collected from database of maintenance Unit, LGED. Two roads, one Upazila Road (UZR) and one Union Road (UNR) from each of 18 districts selected from all 6 divisions. The list of selected roads is presented in section 1.2. Other visits include BRTA, Economic Circle of RHD and concerned public and private agencies in six Divisional Head Quarters including Dhaka who extended good cooperation.

2.10 Preparation of the Study

Preparation of the study is the outcome of a combined effort of the officers and staff working in the RDP-25 on various levels in such from as data collection, data entry to the computer, data analysis, model run and report writing. The Study team consists of three experts Mohammed Zafar Ullah, Principal Investigator/ Transport Specialist, Rainer Kuhnle, Team Leader, Dr. Gholam Mustafa, Monitoring and Evaluation Specialists. Over all coordination of the study was done by Md Abdus Shaheed, Project Director, RDP-25.

2.11 RUC Components

RUC consists of following three components:

- Vehicle operating costs (VOC), that is, the physical costs of operating a vehicle such as fuel, spare parts, depreciation, crew costs, etc;
- Travel time costs (TTC), that is, the value of time spent in traveling that could be used in other activities;
- Accident costs (ACC), that is, the physical costs of an accident measuring the value of injuries and fatalities.

The importance of controlling road user costs becomes evident just when it is understood that the Bangladesh transport sector consumes some 1.5 million tonnes of petroleum products annually. And this is only one component of vehicle operating costs, which include among others cost of the vehicle itself, its maintenance parts and tyres. Costs involved in all such major components of VOC are a huge burden to the economy as well as a severe drain on the scarce foreign exchange, which could largely be reduced through proper management and upkeep of the road network.

Since 1995 Local Govt. Engineering Department (LGED) has been developing systems to allocate its Upazila and Union Road maintenance and development budgets according to economic criteria. A vital part of this system is to provide an accurate and up-to-date estimate of Road User Costs. The IST component of RIIP/ RDP-25 Project under LGED undertakes this important task. It contains vehicle operating, travel time and accident costs updated on the basis of data collected through field surveys of road users, transport owners as well as operators and transport businesses. The statistics on the number and nature of road accidents are however taken from the National Road Traffic Accident Report 2007 prepared by the Road Safety Cell under BRTA.

The accident costs report has been updated mainly in respect of number of accidents (fatal, grievous and simple), lost output, medical costs, property damage costs and lost earnings, and other related costs. The estimation of costs relating to lost output, property damage, lost earnings etc have been based on the data collected through VOC and TTC field surveys, while costs involved in other relevant components have been estimated on the basis of secondary data through using other publications. It is important to mention here that in order to carry out a comprehensive ACC study, we need to have the accurate data on the number of road accidents and to undertake a detailed survey of medical costs in the representative hospitals of the country both government and private, urban and rural.

The report considers both motorised and non-motorised transport costs. The latter were included in the report in line with their inclusion in the HDM-4 appraisal model, which is the basis for road maintenance planning under the Department.

It may be mentioned here that the RUC figure has been calculated on the basis of the number of registered motorised vehicles in 2007 and their average rate of utilisation in terms of kilometre and hour. If the RUC of non-motorised vehicles plying on road all over the country is also taken into account the amount of annual users' costs will be much higher than the one estimated here.

TTC surveys in six major divisional cities were carried out on Upazila & Union Roads in order to develop a greater understanding of the issues involved, and to estimate a common national set of TTC according to vehicle types along LGED roads.

The survey was based on the Average Wage approach whereby the wage rates of vehicle occupants are assessed and then their average rates have been estimated to reflect the value of time of occupants in different vehicles. An assessment of the number of travelers in work time (WT) and non-work time (NWT) is made for each vehicle type. The TTC for WT is then taken as the estimated wage rate.

2.12 Financial and Economic Costs

All costs in the report are given in financial and economic prices. The financial price is the retail market price of the product. The economic price reflects the true value (that is, the real worth) as well as the scarcity premium of the resource to the economy. In the economic jargon, this is termed as a "shadow" or "accounting" price of the resource in the economy. The shadow price of unskilled labour, for instance, may well be lower than the wage to reflect its abundant supply, while that of a skilled professional may be higher than the salary given to him, if his opportunity cost is considered. The economic price of a factor or a product also excludes all tax elements as they reflect mostly a transfer of resources from one sector of the economy to another or from one agency to another within the economy. On the other hand, subsidy elements, if any are included with the economic price. Furthermore, market distortion or imperfection and government regulations or interventions are also taken into consideration while shadow-pricing a factor or a product. In case of imported inputs, economic costs were based on the border prices plus port handling, transportation, assembling and retail cost (profit margin) duly shadow priced. Local inputs of labour and materials were also shadow priced using the LGED Standard Conversion Factor of 0.8. Some transport economists opine that this standard conversion factor could now be 0.9 considering the relatively higher opportunity cost of a factor or a product with the increased job opportunity created in the economy. This opinion may be taken into consideration in future studies, if thought realistic.

3 THE BANGLADESH VEHICLE FLEET

3.1 Registered Vehicles

Information on the Bangladesh vehicle fleet was collected from BRTA, which is responsible for motorised vehicle registrations and renewals in Bangladesh. The organisation does not publish an annual report on registrations but provides data to the Bangladesh Bureau of Statistics (BBS) which is published annually in the Statistical Yearbook of Bangladesh.

BRTA is not responsible for non-motorised traffic registrations, which are left to the local authorities to regulate. Non-registration is common and the actual number of NMV is unknown. However, this report has dealt with the operating costs of both motorized vehicles as well as non-motorised.

Table 3.1 shows BRTA figures for vehicles registered in Bangladesh from 2003 to 2007. The BRTA figures indicate that to date some 375907 motorised vehicles have been registered in the country.

Table 3.1 Number of Registered Vehicles in Bangladesh

Type of Vehicles	**2003**	**2004**	**2005**	**2006**	**2007**	**Total**
Motor Car	7045	5410	6431	8447	11941	**39274**
Jeep/Station Wagon/Microbus	2245	2514	3963	5540	5650	**19912**
Taxi	5020	540	515	277	15	**6367**
Bus	421	857	783	1020	1368	**4449**
Minibus	1594	622	361	241	382	**3200**
Truck	2795	2583	2791	3065	2521	**13755**
Motorcycle	21096	24941	43226	51106	85131	**225500**
Auto-Rick/ 3 Wheeler	13856	8974	4877	6898	10530	**45135**
Human Haller	993	259	97	141	268	**1758**
Covered Van	0	581	0	0	0	**581**
Others	4183	1921	2834	3572	3466	**15976**
Total	**59248**	**49202**	**65878**	**80307**	**121272**	**375907**

Source: BRTA, 2007

3.2 Representative Vehicles

The Bangladesh vehicle fleet is characterised by a large number of different vehicle types spanning up to three decades in age. LGED has derived a classification of motorised vehicles and non-motorised vehicles for traffic counting which categorises vehicles into two broad groups: one for eleven standard motorised vehicles and the other for four standard non-motorised vehicles, as set out in Table 3.2.

No data is published on the makes and models of vehicle registered by BRTA. A detailed examination of BRTA registration records was undertaken in 2008 to derive this information. This was supposed to be reviewed for application in the current RUC report in view of the fact that by the time of about 10 years since 2008 there was a lot of change in the pattern of vehicle fleet in Bangladesh. However the idea of reviewing the makes and models of the

registered vehicle fleet to adapt the changes in the exercise of selecting the updated representative vehicles category has not been given up. It is published. Meanwhile a summary of the results of 2008 analysis for the two most popular makes of motorised vehicle in each category is shown in Table 3.3. This demonstrates that in all categories over half the vehicles consist of two makes and models. But in case of a number of vehicle categories the fleet is dominated by one make only. Toyota in the car group is an example. A brief comparison of costs and characteristics for the principal models demonstrated little variation and it was therefore decided to adopt the leading model in each group as the representative vehicle.

Table 3.2 LGED Vehicle Categories LGED Category Description of Vehicle

LGED Category	Description
Medium Truck	Two or three axle rigid > three tonne payload
Small Truck	Two axle rigid < three tonne payload
Bus Heavy	>40 seats and >36 feet chassis
Bus Mini	16-39 seats and <36 feet chassis
Bus Light	<16 seats
Utility	Four wheel drive Jeeps and Pick-ups
Car	All saloon cars and Taxis
Motor Cycle	All two wheeled Motorised vehicles
Auto Rickshaw	Three wheeled Motorised vehicles
Nosimon/ Auto Rickshaw	Three wheeled Motorised vehicles
Tempo	Large Passenger & Cargo carrying 3 wheelers
Cycle Rickshaw	Three wheeled Passenger NMV
Rickshaw Van	Three wheeled Cargo NMV
Cart	All Animal Carts andHuman drawn/Push Carts
Bicycle	All two wheeled Non-Motorised vehicles

Source: BRTA, & Maintenance Unit., LGED, 2008

Table 3.3 Summary of Representative Vehicles by Category and Model (Per Cent of Registered Vehicle Fleet) LGED Category Most Popular Make/Model % Second Popular Make/Model % Total Two Makes %

LGED Category	Most Popular Make/Model	%	Second Popular Make/Model	%	Total Two Makes %
Medium Truck	Tata SE 1612	28%	Bedford England	27%	55%
Small Truck	Isuzu NKR55L	46%	Toyota	13%	59%
Bus Heavy	Hino AK series	56%	Tata	32%	82%
Bus Mini	Tata LP909	44%	Mitsubishi	19%	63%
Bus Light	Toyota Liteace	81%	Mitsubishi	13%	94%
Utility	Mitsubishi Pajero	25%	Toyota	23%	48%
Car	Toyota Corolla	74%	Nissan	7%	81%
Motor Cycle	Honda 125	58%	Yamaha	14%	72%
Auto Rick	Bajaj Baby Taxi	97%	Other	3%	100%
Nosimon/ Auto Rick	Unknown	97%	Other	3%	100%

Source: BRTA, & Maintenance Unit., LGED, 2008

As Bangladesh has no vehicle manufacturing plant, all vehicles are imported either completely built up (CBU) or completely knocked down (CKD). Most trucks, buses and auto-

rickshaws are imported knocked down in the form of chassis and engine, whereas cars, microbuses, motor cycles and utilities are imported whole. The vehicle market is dominated by Japanese and Indian manufacturers and in particular:

- Toyota (Japan) - Microbuses, four wheel drives and Saloon cars
- Honda (Japan) - Motorcycle
- Hino (Japan) - Buses
- Tata (India) - Trucks and Buses
- Bajaj (India) - Auto-Rickshaws/ Motor Cycles

The following section gives a brief description of the vehicles in each of the LGED categories.

Truck Medium

The medium truck market is dominated by three makes: Bedford England, Bedford Hindustan and TATA, which account for some 75 per cent of the market. However, the number of Bedford's has been declining in recent years and the TATA is becoming increasingly popular. During 1994-95 truck imports were dominated by TATA who's most popular model is the 15.6 tonne GVW SE1612.

Truck Small

It is evident that the small truck market is increasing in importance. Previous studies have not identified this as an important category but the 1995/1996 traffic census identified significant volumes on the LGED road network. This increasing trend has been steadily prevailing since then. This increase is symptomatic of the development of the economy and commercial liberalisation. New vehicles are being imported mostly from Japan and Isuzu, Toyota and Mitsubishi dominate this small but growing market. The Isuzu NKR55L was selected as the representative model.

Bus Heavy

Heavy buses can be divided into luxury (Air Conditioned and Chair Class) and ordinary categories. Hino of Japan and TATA of India dominate the Bus Heavy market, with some 90 per cent of the total market share. Of these the Hino AK series is by far the most popular and is expected to increase its market share with the introduction of more luxury air-conditioned inter-urban services as the road network improves. In the category of large bus, the chair class bus still dominates and as such has been selected as the representative vehicle for modelling.

Bus Mini

The major brands of minibus are Isuzu, Mitsubishi, Hindustan, TATA, Nissan, Toyota and Eicher. The Japanese makes were popular till the last half of the 1980's but the Indian akes have been steadily increasing their share and now the TATA LP909 is dominating new purchases. For the last three years its share of the total market was over 70%.

Bus Light

Microbuses are usually privately owned and small numbers are operated by public transport. Toyota dominates this category with its Hyace and Lightace models and has an 81% share of the market. The Mitsubishi L300 accounts for most of the remainder.

Car

Toyota also dominates the car fleet with 74% of the market. Most imports now consist of the highly popular Corolla Sedan 5 door saloon, which comes in several variants. A mid range variant (1300 GL) was chosen for the representative model. Some cars are imported as re-conditioned second hand vehicles.

Utility/ Jeep (4WD)

The utility vehicle market is dominated by Japanese luxury four wheel drive models, usually referred to as Jeeps. The Mitsubishi Pajero and the Toyota Land Cruiser account for over half this market. The utility category also includes pick ups. But as these vehicles account only for a small proportion of the whole utility market they are not considered for separate modelling. In 1999 a joint venture between Mitsubishi and Progati Industries Ltd Bangladesh started to import Pajeros in knocked down form and manufacture their bodywork locally. The cost of these vehicles is significantly less than the completely built up versions. The proportion of these vehicles in the market is increasing significantly. At the same time the Rangs Limited has been importing Pajero GL V31 VHNDR category of vehicles. These types of middle range Pajeros are dominating the present market share. So, the Pajero GL V31 VHNDR has been chosen for modelling.

Auto-Rickshaw

The auto-rickshaw market is divided into three categories, which are defined by their respective manufacturers: Mishuk (Atlas), Babytaxi (Bajaj), Tempo (Vespa). In addition auto-vans are built on various chassis. The Mishuk is a locally developed three wheeled vehicle based on a motorcycle engine, manufactured in Bangladesh by Atlas Ltd. However, only a small number of this variety was constructed so far and the market is still dominated by the Bajaj Babytaxi. The usually Vespa based Tempo is a larger passenger carrying vehicle (up to 15) which has a small but growing share of the auto rickshaw market.

It should be noted that an important development in 2002 was the introduction of CNG (Concentrated Natural Gas) powered auto-rickshaws in Bangladesh. The VOC's for this new category will be assessed in the next RUC studies.

Modified Tempo

The auto-rickshaw market is divided into three categories, which are defined by their respective manufacturers: Mishuk (Atlas), Babytaxi (Bajaj), Tempo (Vespa). In addition auto-vans are built on various chassis. The Mishuk is a locally developed three wheeled vehicle based on a motorcycle engine, manufactured in Bangladesh by Atlas Ltd. However, only a

small number of this variety was constructed so far and the market is still dominated by the Bajaj Babytaxi. The usually Vespa based Tempo is a larger passenger carrying vehicle (up to 15) which has a small but growing share of the auto rickshaw market.

It should be noted that an important development in 2002 was the introduction of CNG (Concentrated Natural Gas) powered auto-rickshaws in Dhaka. The VOC's for this new category will be assessed in the next RUC studies.

Motorcycle

Honda dominates the motorcycle market with 58 percent of the fleet, most of which are 125cc variants. Yamaha, Bajaj and Suzuki account for 14 per cent, 6 per cent and 4 per cent of the remaining market respectively.

Bicycle

Under this category, all two-wheeled NMT are considered. India and China made Bicycles largely dominate in the market. A small proportion of this category is assembled by the vendors combining local and imported parts and accessories. In this study, modelling of bicycles for VOCs are based on a composite of the available models in Bangladesh.

Rickshaw/ Rickshaw-Van

All three wheeled non-motorised transports are considered under this group. Rickshaw is a very common mode of transport throughout Bangladesh. The vans are more popular in rural areas. The frames and bodies of this type of vehicle are made locally using both local and imported parts. Rims and chains are generally imported from adjacent areas of the neighbouring country, while tyres and bearing are locally manufactured.

Animal Carts

All animal drawn/pushed carts are categorised here. Animal carts are mainly rural vehicles, while push carts exist both in rural and urban areas. All of this type of vehicles are locally made with no imported parts used. Wheels are made by wood covered with iron and rubber rims.

3.3 Characteristics of Representative Vehicles

Table 3.4a and 3.4b set out the physical characteristics of the representative vehicle types identified in the previous section.

Table 3.4a Vehicle Characteristics: Engine and Tyres

Category	Make	Imported as	Fuel	CC	Cylin-ders	Metric HP	No. Tyres	Type of Tyres
Motorized								
Medium Truck	Tata SE 1612/42	CKD	Diesel	5675	6	120	6	10.00x20-16PR
Small Truck	Isuzu NKR55L	CKD	Diesel	2771	4	72	4	7.50x20-12PR
Bus Heavy	Hino AK3HMKA	CKD	Diesel	6443	6	195	6	9.00x20-14PR
Bus Mini	Tata LP909/36	CKD	Diesel	4788	6	112	6	7.50x20-12PR
Bus Light	Toyota Liteace	CBU	Petrol	1800	4	79	4	5.50x13-8PRLT
Utility/Jeep	Mitsubishi Pajero	CBU	Petrol	2400	4	132	4	205 - R16
Car	Toyota Corolla Sadan 1300GL	CBU	Petrol	1300	4	110	4	155 - SR13
Auto Rickshaw	Bajaj Baby Taxi	CKD	Petrol/ 5%Oil	145	1	5.52	3	4.0x8-6PR
Nosimon/ Auto Rick	Bajaj Baby Taxi	CKD	Petrol/ 5%Oil	145	1	5.52	3	4.0x8-6PR
Motor Cycle	Honda CG125	CBU	Petrol	125	1	11	2	Front 2.5 - 4PR Rear 3.0 -4PR

Source: BRTA, & Maintenance Unit., LGED, 2008

Table 3.4b Vehicle Characteristics: Weights and Dimensions

Category	Make	Axles No.	TARE kg	GVW kg	Length mm	Width mm	Height mm
Medium Truck	Tata SE 1612/42	2	4,015	15,660	6,970	2,434	3,625
Small Truck	Isuzu NKR55L	2	2,750	5,200	6,025	1,880	2,220
Bus Heavy	Hino AK3HMKA	2	4,145	12,500	10,005	2,430	1,995
Bus Mini	Tata LP909/36	2	3,300	9,000	5,970	2,159	1,900
Bus Light	Toyota Liteace	2	1,180	2,150	4,453	1,695	1,870
Utility (Jeep)	Mitsubishi Pajero	2	1,930	2,800	4,645	1,695	1,865
Car	Toyota Corolla Sedan 1300GL	2	998	1,510	4,270	1,685	1,380
Auto Rickshaw	Bajaj Baby Taxi	2	200	580	1,900	745	1,020
Nosimon/ Auto Rick	Bajaj Baby Taxi	2	200	580	1,900	745	1,020
Motor Cycle	Honda CG125	2	96	N	1900	745	1020
Bicycle	nc	2	nc	50	nc	nc	nc
Rickshaw/van	na	2	nc	304	nc	nc	nc
Rickshaw	na	2	nc	304	nc	nc	nc
Animal Cart	na	1	nc	1800	nc	nc	nc

Source: Vehicle retailers in Dhaka, BRTA, & Maintenance Unit., LGED, 2008

Notes:

N = no manufacturers data

TARE = unloaded weight, GVW = gross vehicle weight

CKD = completely knocked down, CBU = completely built unit

4 VEHICLE OPERATING COSTS

4.1 Introduction

The prediction of vehicle operation cost (VOC) is a complex procedure, as costs of all relevant components of the vehicle are needed for the entire Bangladesh vehicle fleet consisting of a plethora of vehicle types. Moreover, the variation of these costs under different operating conditions must also be understood. These operating conditions are normally categorised as:

- Horizontal curvature
- Vertical curvature
- Road Surface Condition
- Traffic Congestion

The starting point in using the RUE (Road User Effect) sub-model of the HDM-4 is to configure the model for Bangladesh. This involves selecting the representative vehicle types to be modelled and the units of currency used. All costs were input in Taka.

Given that a stand alone VOC model for HDM-4 is not yet available, unit VOCs were derived for this study by running a project analysis on one km representative section of road and recording the predicted unit VOCs at different roughness levels.

4.2 Selection of Representative Vehicle Types

The LGED vehicle types were selected in 1995 as a balance between having too many categories that would be difficult for the traffic survey enumerator to classify and getting sufficient vehicle types to accurately model RUC and traffic effects. This means that some “sub-categories” of vehicles are not recorded (see Table 4.1) especially in the Large Bus, Auto Rickshaw, Cycle Rickshaw and Cart categories. The last column of Table 4.2 shows which vehicle belonging to the respective sub category is currently modelled. In each case the most prevalent vehicle is modelled according to current knowledge. The exception is the cart category where human carts may outnumber animal carts. But since there is no applicable HDM relationship with regards to human carts, animal cart had to be chosen.

The modelling could be improved by estimating a weighted average relationship for the vehicles with sub categories. This would have to be based on additional research to identify the proportions of vehicles in each category and to collect the VOC information needed to model them. Alternatively, the sub-categories could be included in an expanded traffic count form and new relationships established. But this is not possible to take into consideration until the current problems with the traffic counting programme are addressed as enumerators already face a lot of troubles classifying the 15 existing categories.

Table 4.1 LGED Vehicle Categories

LGED Category	Sub Category	Modeled
Truck Medium		
Truck Small		
Bus Heavy	Ordinary, Chair, Luxury	Chair
Bus Light		
Bus Mini		
Utility		
Car		
Auto Rickshaw	Baby Taxi, Tempo	Baby Taxi, Modified Tempo
Motor Cycle		
Cycle Rickshaw	Passenger and Van	Passenger
Animal Cart	Animal and Human	Animal

***Source**: LGED Vehicle Categories*

The data inputs for the model were collected through field survey during 2008. A total of 40 operators for each type of vehicles were chosen with 10 operators in Dhaka, Chittagong, Rajshahi, Khulna, Barisal & Sylhet areas each. The data were entered into a computer database and stored in the LGED Maintenance Unit. It is understandable that in order to arrive at more realistic results for the country as a whole, field surveys covering more areas and operators are necessary, which calls for more financial and personnel resources as well as time span.

4.3 Utilization

4.3.1 Existing Characteristics

The way in which a vehicle is utilized is a key parameter in estimating VOC. In Bangladesh commercial vehicles are often intensively utilized. Buses, in particular, are operated around the clock with different sets of crews on daytime and nighttimes schedules. Table 4.2 shows utilization rates for the operators surveyed in 2008. Large buses operating on the intercity routes are utilized for up to 83% of the time available. Medium truck and mini bus are utilized more than 65 per cent. Light vehicles like microbus, jeep, car and motorcycle are less utilized.

For modelling VOC it is necessary to estimate how many kilometres on average a vehicle is driven for in a year and how many hours the vehicle is operated for. The data on vehicle utilization collected through 2008 survey by Economics Circle are set out in Table 4.2. This shows that distances travelled by large buses are very high reflecting their higher utilization ratios, while the smaller vehicles except baby taxi are driven much less as would be normally expected.

Table 4.2 Average Annual Utilization of Vehicles

Category	Annual Driven Km	Annual Hours in Work	Annual Hours Driven	Utilization Ratio (1)
Truck Medium	80,700	3,100	2,036	66%
Truck Small	74,000	3,600	1,748	49%
Bus Heavy	129,800	3,450	2,864	83%
Bus Light	66,700	3,060	2,121	69%
Bus Mini	56,800	3,200	1,171	37%
Utility	22,000	4,700	863	18%
Car	50,000	2,850	1,276	45%
Auto Rickshaw	46,000	1,950	1,695	87%
Tempo	44,000	3,850	2,126	55%
Motor Cycle	13,000	3,950	588	15%
Bicycle *	4,000	2,60	nc	nc
Rickshaw *	14,000	1,000	nc	nc
Animal Cart *	5,000	1,600	nc	nc

***Source**: Vehicle Operators Survey 2008*
Note: (1) = Hours driven as % of hours in work
* = Non-Motorized Vehicle

Another important aspect of utilization is the length of time vehicles are operated before they are scrapped or sold on, known as the service life. This is a vital component in estimating the depreciation charges attributable to each vehicle. The survey established the average age of vehicles belonging to the operators interviewed and also to what age operators normally keep the vehicles under their possession (Table 4.3). Table 4.3 also sets out the percentage of vehicles in the sample that were purchased second-hand.

Table 4.3 Age and Operational Life of Vehicles in Years

Category	Average Age	Normal Service Life	Second Hand Purchases %
Truck Medium	9	9	12
Truck Small	10	8	43
Bus Heavy	7	5	11
Bus Light	10	5	17
Bus Mini	9	6	42
Utility	8	7	9
Car	8	5	31
Auto Rickshaw	4	5	7
Tempo	8	6	16
Motor Cycle	8	5	0
Bicycle *	nc	18	nc
Rickshaw *	nc	12	nc
Animal Cart *	nc	8	nc

***Source**: Vehicle Operators Survey 2008*
** = Non-Motorized Vehicle*

4.3.2 Response of Operators to Road and Bridge Improvements

As part of the survey, operators were asked what benefits they had experienced through implementation of road and bridge projects. The purpose of this was to establish an idea of the impact of the road improvement programme in general terms and to find out how operators respond to improved conditions of a road. This determines how depreciation is modeled in the economic appraisal system.

The results showed that all operators interviewed had benefited from road and bridge improvements (Table 4.4).

Table 4.4 Operator's Responses to Road Improvements (Percent)

Response	Truck Med	Truck Small	Bus Heavy	Bus Light	Bus Mini	Utility	Car	Tempo	Auto Rick	Motor Cycle
Benefited	80	43	48	33	38	23	13	25	25	5
Change in operation	63	40	34	30	23	10	20	28	23	3
More trips	36	38	46	62	73	67	50	75	63	100
Longer trips	21	25	54	38	27	33	50	25	37	0
Increased load	43	37	0	0	0	0	0	0	0	0

Source: Vehicle Operators Survey 2008
** = Non-motorized Vehicle*

The operators were also asked what specific projects they had benefited from. The three most beneficial projects are set out in Table 4.5 & 4.6.

Table 4.5 Average Saving in Time and Operation Cost to Operators for Specific Road & Bridge Projects (% saving compared with trip before improvement)

Project	Truck Med	Truck Small	Bus Heavy	Bus Light	Bus Mini	Utility	Car	Tempo	Auto Rick	Motor Cycle	Average
Dhamrai-Dhantara Road (Savar portion) Road											
Time Saving	13	20	24	23	25	21	48	19	80	-	24
VOC Saving	16	24	15	22	17	14	17	18	-	-	19
Sreepur College-Kapasia											
Time Saving	18	28	10	14	20	20	24	-	22	-	19
VOC Saving	14	15	5	9	10	12	13	-	12	-	11
Dhaka City Roads											
Time Saving	-	15	-	-	-	-	-	12	16	-	16
VOC Saving	-	9	-	-	-	-	-	12	12	-	12

Source: Vehicle Operators Survey 2008

Table 4.6 Average Saving in Travel Time and Operation Cost to Operators for Improvement of Network in General (% saving compared with trip before improvement)

Saving	Truck Med	Truck Small	Bus Heavy	Bus Light	Bus Mini	Utility	Car	Tempo	Auto Rick	Motor Cycle	Average
Time Saving	17	19	20	19	32	20	26	13	27	23	21
VOC Saving	13	19	13	12	17	12	24	11	9	18	14

4.4 Vehicle Purchase Costs

Vehicle purchase costs were derived from a survey of established motor vehicle outlets in Dhaka. In order to derive economic costs the final retail prices (actual cost to the purchaser) are required to be broken down into its constituent parts to identify taxation and foreign currency elements.

Duties and taxes are charged on the "Assessable Value (AV)" of the import, which means the Cost, Insurance & Freight (CIF) value in foreign currency converted to Taka at the prevailing exchange rate set by the Bangladesh Bank. If the Cost & Freight (C&F) value only is given, then insurance and a landing fee of 1% each is applied to the C&F cost to give the assessable value. A number of duties and taxes are charged on CIF value, which is set out in Bangladesh Operative Tariff Schedule issued by the National Board of Revenue. The following five duties and taxes are payable on the assessable value (AV):

Customs Duty (CD)	:	Charged at a percentage rate on the AV. These vary between 14 and 40% for vehicle imports. Duty on micro and car have been reduced from 40 to 25 and 35 to 25% since 2000. On the other hand duty on medium truck, large bus, mini bus, baby taxi and motorcycle have been increased;
Development Surcharge (DS)	:	Charged at a uniform rate of 4% of AV on all types of motorised vehicle to directly fund development works;
Supplementary Duty (SD)	:	Additional charge under the VAT Act on jeep, car, baby taxi and motor cycle charged as a percentage rate on AV;
Value Added Tax (VAT)	:	Charged almost at a uniform rate of 15% (except mini bus whereon 19% and motor cycle 18%) on the AV inclusive of customs duty and Supplementary Duty, i.e., VAT on CIF+CD+SD;
Advance Income Tax (AIT)	:	Charged at a flat rate of 3% on AV, except for Government imports;
Landing Permit Fee (LPF)	:	Charged at a flat rate of 1.5% of AV on imports in excess of Taka 100,000, except for Government imports mainly applicable for large bus type.

Tariffs charged on the representative vehicle categories are set out in Table 4.7. The CIF prices of the vehicle at Chittagong Port are paid either in US dollar or Japanese Yen. Other costs include port dues, transportation, assembling (for knocked down units) and dealers' overheads and margins. The economic cost is taken as the CIF cost plus all port, transport and assembly costs incurred in getting to the retail price of the vehicle which are shadow priced according to the Standard Conversion Factor (SCF). Table 4.8 sets out breakdown of vehicle purchase costs.

Table 4.7 Percentage Tariffs Applicable to Representative Vehicles and Tyres

Category	LPF on CIF	CO on AV	SD on AV+CD	VAT on AV+CD+SD	AIT on AV	IDSE on AV	ATVAT*	PSI on CIF
Truck Medium	1%	25%		15%	3%	4%	1.5%	1%
Truck Small	1%	25%		15%	3%	4%	1.5%	1%
Bus Heavy	1%	12%		15%	3%	4%	1.5%	1%
Bus Light	1%	12%		15%	3%	4%	1.5%	1%
Bus Mini	1%	25%		15%	3%	4%	1.5%	1%
Utility	1%	25%	65%	15%	3%	4%	1.5%	1%
Car	1%	25%	25%	15%	3%	4%	1.5%	1%
Auto Rick	1%	25%	15%	15%	3%	4%	1.5%	1%
Motor Cycle	1%	25%	15%	15%	3%	4%	1.5%	1%
All Tyres	1%	25%		15%	3%	4%	1.5%	

***Source**: Road Network Maintenance and Improvement Project II, 2007 Notes: * on 110% of AV+CD+IDSE.*

Table 4.8 New Vehicle Purchase Costs (Taka in 2008 Prices)

Category	CIF Value	Tariffs	Assembly & Other Cost	Total Financial	Total Economic
Truck Medium	922,180	380,859	831,860	2,134,899	1,587,668
Truck Small	909,800	340,190	202,544	1,452,534	1,071,835
Bus Heavy	2,645,986	403,593	1,175,138	4,224,717	3,586,096
Bus Light	731,745	319,236	354,019	1,405,000	1,014,960
Bus Mini	1,260,000	541,800	400,500	2,202,300	1,580,400
Utility	1,154,367	1,575,132	771,769	3,501,267	1,771,782
Car	1,074,000	687,360	322,950	2,084,310	1,332,360
Auto Rick	19,534	64,069	127,261	210,863	121,342
Motor Cycle	12,890	35,641	13,772	62,303	23,908

***Source**: Vehicle Dealer's Survey May 2008*

4.5 Consumable Costs

4.5.1 Tyre Costs

Tyres are imported from India, Japan, Malaysia, Indonesia and Taiwan with Indian tyres dominating the market mainly because they are relatively cheaper. The use of re-treaded tyres is common, as is shown in Table 4.9. Although the usage has significantly been increased from 20 to 57% in case of medium truck with an associate fall in prices. Table 4.10 sets out a breakdown of new tyre prices for each of the representative vehicle types.

Table 4.9 Use of Re-Treaded (RT) Tyres

Item	Truck Med	Truck Small	Bus Heavy	Bus Light	Bus Mini	Utility	Car	Tempo	Auto Rick
% Of RT usage	57	9	30	33	50	-	20	59	19
Cost Tk per RT tyre	1067	1450	2333	2,233	1200	-	575	1019	774

***Source:** Vehicle Operators Survey 2008*

Table 4.10 Cost of New Tyre (Taka 2008 Prices)

Category	Tyre Size	Make	CIF Cost	Tariffs	Other Costs	Financial Cost	Economic Cost
Truck Medium	10.00x20-16PR	India RZ	11023	6040	2147	19210	12741
Truck Small	7.50x20-12PR	Indonesia Dunlop	4485	885	885	6255	5193
Bus Heavy	9.00x20-14PR	India RZ	9991	1555	1555	13101	11235
Bus Light	7.50x20-12PR	Indonesia Dunlop	4388	481	841	5710	5061
Bus Mini	5.50x13-6PR	Indonesia Dunlop	2246	517	517	3280	2660
Utility	205-R16	Japan Dunlop	5614	913	913	7440	6344
Car	155-SR13	Japan Dunlop	2173	426	426	3025	2514
Auto Rick	4.00x8-6PR	India Dunlop	649	90	90	829	721
Motor Cycle	Front 2.5-18 4PR	India Dunlop	544	143	143	830	658
	Rear 3.0 –17 4PR	India Dunlop	964	166	166	1296	1097

***Source**: Vehicle Dealer's Survey May 2008*

4.5.2 Fuel and Lubricants

Detailed information on fuel and lubricant cost is collected from Bangladesh Petroleum Corporation (BPC). The breakdown of unit costs of fuel and lubricants is set out in the following table 4.11.

Table 4.11 Economic and Financial Costs of Fuel (Taka per litre in 2008)

Item	Petrol		Diesel	
	Financial	Eco	Financial	Eco
C&F	21.39	19.25	21.39	19.25
Tariffs	6.90	0.00	6.90	0.00
Other cost (Agent/ other cost at port area, Transportation cost and loss & Dealers/ agent commission etc.)	48.71	47.61	15.71	18.54
Subsidy				0.07
Total	77.00	69.00	44.00	40.00

***Source**: Bangladesh Petroleum Corporation May, 2008*

Notes: (1) US$1=Taka 65 as applied by BPC

4.6 Vehicle Maintenance Policies and Costs

The majority of the operators interviewed maintained their own vehicles as shown in Table 4.12. But the trend to maintain the vehicle in garage is increasing. Most operators usually

prefer to service their vehicles on a time related basis, with some exception in case of small & medium truck and jeep.

Table 4.12 Vehicle Maintenance Policy

Policy	Truck Med	Truck Small	Bus Heavy	Bus Light	Bus Mini	Utility	Car	Motor Cycle	Temp	Auto Rick
Maintained by owners %	92	90	74	78	73	65	68	80	92	95
Maintained in garage %	8	10	26	23	28	35	32	20	8	5
Time related %	80	75	83	88	83	68	90	85	95	78
Use related %	20	25	8	13	18	33	10	15	5	22

***Source**: Vehicle Operators Survey 2008*

The annual costs of maintaining the representative vehicles were estimated from the operators' surveys and are set out in Table 4.13. Costs are highest for large buses, which appear to be realistic from the point of view of their high utilization. The average maintenance labour cost per month is around Taka 14,000 for all vehicles, assuming a 200 working hours per month, the average financial cost per hour stands for Taka 70 and economic Taka 56.

Table 4.13 Annual Financial Cost of Vehicle Maintenance (Taka 2008 prices)

Policy	Truck Med	Truck Small	Bus Heavy	Bus Light	Bus Mini	Utility	Car	Motor Cycle	Temp	Auto Rick
Maintained by owners %	92	90	74	78	73	65	68	80	92	95
Maintained in garage %	8	10	26	23	28	35	32	20	8	5
Time related %	80	75	83	88	83	68	90	85	95	78
Use related %	20	25	8	13	18	33	10	15	5	22

***Source**: Vehicle Operators Survey 2008*

4.7 Crew Costs

Driver and helper costs are set out in Table 4.14. Nearly all trucks and buses have a permanent helper in addition to the driver. The costs of drivers and helpers for buses are based on two crews per vehicle.

Table 4.14 Crew Wage Costs (Taka 2004 prices)

Cost Parameters	Med Truck	Small Truck	Large Bus	Mini Bus	Micro Bus	Utility	Car	Tempoo	BabyTaxi
Driver per month	5980	4123	8872	5648	4523	5704	4079	5031	3994
Helper per month	2412	1892	4729	3081	2118	0	2000	2034	1267
Driver per hour	23	14	31	22	17	15	17	16	12
Helper per hour	7	5	12	9	6	0	8	5	4
Total financial/hr	30	19	44	31	23	15	25	21	16
Total economic/hr	24	25	35	25	19	12	20	17	13

***Source**: Vehicle Operators Survey 2008*

Table 4.15 Crew Wage Costs (Taka per hour in 2006-07 prices)

Vehicle Category	Total Financial	Total Economic
Truck Medium	34	27
Truck Small	22	17
Bus Heavy	50	40
Bus Light	26	28
Bus Mini	35	21
Utility	17	14
Car	28	23
Auto Rick	24	19

***Source**: Road Network Maintenance and Improvement Project II, 2007*

4.8 Overhead Costs

Overhead costs are set out in Table 4.16. These consist of office administration and rental charge, garaging, insurance, vehicle excise duty/ VAT and tolls/route permit fees.

For calculation of economic costs, tax elements and 70% of toll money being treated as transfer payments are eliminated from the financial values. Overhead costs are high in Bangladesh, in part due to ferry and bridge tolls that account for 60% of financial overheads in case of medium trucks and large buses and significant proportions (45%) in respect of small trucks and mini buses.

Table 4.16 Annual Overhead Costs Taka (2007-08)

Vehicle Category	Total Financial	Total Economic
Truck Medium	199460	109988
Truck Small	92321	59040
Bus Heavy	430074	247748
Bus Light	161847	139394
Bus Mini	238782	153527
Utility	28494	22909
Car	121385	64685
Auto Rick	32597	26272
Motor Cycle	9916	7340

***Source**: Road Network Maintenance and Improvement Project II, 2007*

4.9 VOC Inputs

The summary of VOC inputs required to run the HDM model arrived at through the analysis of relevant parameters are presented in Table 4.17.

Table 4.17 Summary of VOC Inputs 2007/8

Item Cost	Unit	Medium Truck		Small Truck		Bus Heavy		Mini Bus		Bus Light		Utility		Car		Auto Ricksaw		Motor Cycle		Animal Cart		Rickshaw		Bi Cycle	
Unit Costs		Fin	Eco	Fin	Eco	Fin	Eco	Fin	Eco	Fin	Eco	Fin	Eco	Fin	Eco	Fin	Eco	Fin	Eco	Fin	Eco	Fin	Eco	Fin	Eco
Purchase cost of vehicle	Tk'000 per vehicle	2,134	1,587	1,452	1,071	4,224	3,586	1,405	1,014	2,202	1,580	3,501	1,771	2,084	1,332	210	121	100	90	17	15	11	10	6	5
Cost of new tyre	Tk per tyre	19,210	12,741	6,255	5,193	13,101	11,235	5,710	5,061	3,280	2,660	7,440	6,344	3,025	2,514	829	721	533	480	278	250	278	250	278	250
Maintenance labour cost	Tk per hour	55	44	55	44	55	44	55	44	55	44	55	44	55	44	50	45	50	45	6	5	3	3	2	2
Overhead cost	Tk '000 per annum	199	110	92	59	430	280	239	154	162	139	28	23	121	85	16	14	22	20	8	7	7	6	22	5
Crew Wages	Tk per hour	34	27	22	17	50	40	35	28	26	21	17	14	28	23	16	14	16	14	4	4	3	3	16	2
Fuel cost (Diesel)	Tk per litre	44	40	44	40	44	40	44	40	44	40	44	40	44	40	44	40	44	40	-	-	-	-	-	-
Fuel cost (Petrol)	Tk per litre	77	69	77	69	77	69	77	69	77	69	77	69	77	69	77	69	77	69	-	-	-	-	-	-
Lubricant cost	Tk per litre	320	288	320	288	320	288	320	288	320	288	320	288	320	288	320	288	320	288	-	-	-	-	-	-
Utilization																									
Annual km driven	Kms per annum	72,630		66,600		116,820		51,120		60,030		19,800		45,000		41,400		13,000		5,000		1,400		3,000	
Annual hours driven	Hrs per annum	2,790		3,240		3,105		2,880		2,754		4,230		2,565		1,755		1,490		2,000		755		490	
Average service life	Years	11		8		10		10		12		13		11		8		8		3		2		2	
Physical Characteristics																									
Manufacturers GVW	Kg	14,094		4,680		11,250		1,935		8,100		2,520		1,359		522		0		200		100		50	
TARE weight	Kg	3,614		2,475		3,731		1,062		2,970		1,737		898		180		86		50		25		12	
Axles	Number	2		2		2		2		2		2		2		2		2		2		2		1	
Length	mm	6,273		5,423		9,005		4,008		5,373		4,181		3,843		1,710		1,710		50		25		12	
Width	mm	2,191		1,692		2,187		1,526		1,943		1,526		1,517		671		671		12		6		3	
Height	mm	3,263		1,998		1,796		1,683		1,710		1,679		1,242		918		918		10		5		2	
HDM Parameters																									
HDM- 4 vehicle type	Code	9		8		15		12		14		7		4		1		1							
Maintenance Model	Rotation Coefficient																								
Life Model	Type																								

Source: Road Network Maintenance and Improvement Project II, RHD 2007, Economic Circle, HDM Circle, MIS, RHD
Note: Data collection from BBS, Vehicle Dealers, Custom office, BRTA Head office, 6 Divisional BRTA Office, Project Director, RDP-25, LGED Maintenance Cell.

4.10 Estimation of Unit Vehicle Operating Cost

4.10.1 Assignment of HDM-4 Vehicle Categories

HDM-4 representative vehicle types were assigned to each of the 10 motorised vehicle types and 3 non-motorised vehicle types on the basis of the vehicle characteristics like number of axles, tyres, type of fuel, GVW, vehicle dimension among others (Table 4.18).

HDM-4 does not have a three-wheeled motorised vehicle type. That's why the motorcycle relationship was used as the representative vehicle for the auto rickshaw with some modifications in respect of relevant characteristics. It should be noted that the auto rickshaw modeled represents a Baby Taxi and that the larger Tempo will have higher operating costs.

Non Motorised Transport costs have been incorporated in the modeling system of Road User Cost study. The HDM-4 cart is an animal cart. In case of economic appraisal this vehicle could be used only when it is confirmed through traffic count survey that the vehicle in question is animal cart. It means that the man drawn cart will not be used in the name of animal cart. In respect of cycle rickshaw only passenger cycle rickshaws are modelled, although it is acknowledged that rickshaw vans are an important component of this market. If it is desired to model the van separately then further research will have to be conducted.

Table 4.18 Assignment of Representative Vehicle Types

LGED Category	HDM Representative Vehicles	HDM Vehicle Type	HDM Vehicle Code
Truck Medium	Truck Medium	MT	9
Truck Small	Truck Small	MT	8
Bus Large	Bus Large	MT	15
Bus Large	Bus Large	MT	14
Bus Large	Bus Large	MT	12
Utility	Utility	MT	7
Car	Car	MT	4
Auto Rickshaw	Auto Rickshaw	MT	1
Motor Cycle	Motor Cycle	MT	1
Cycle/ Rickshaw	Cycle/ Rickshaw	NMT	2
Cart	Cart	NMT	3
Bicycle	Bicycle	NMT	1

4.11 VOC Modelling

The modelled predictions were validated against fare and tariff data collected during the Vehicle Operating Cost survey. This demonstrated a reasonable correlation.

It was considered that the maintenance parts model was over-estimating in the high roughness range for medium trucks, large buses and utilities. The maintenance model rotation factor was therefore adjusted from 1 to 0.85, which reduced total VOC by 15-20 per cent.

The Optimal Life method was over-estimating depreciation costs by 5-10% and the constant life model was therefore adopted for all vehicle types.

The financial VOC per km resulted through HDM run at different roughness levels are presented according to different type of motorised vehicle in Table 4.19 & 4.20.

Table 4.19 Sensitivity of Financial VOC of Motorised Vehicle to Road Roughness (Taka/km)

Inte Rou Index (IRI)	Auto Rickshaw	Car	Large Bus	Bus Mini	Medium Truck	Bus Light	Motor Cycle	Truck Small	Utility	Animal Cart	Rickshaw	Bicycle
4	5.31	17.87	76.00	31.35	23.80	16.85	3.53	12.60	17.72	8.91	2.58	1.79
5	5.54	18.85	79.61	33.05	25.33	17.73	3.59	13.29	18.08	9.27	2.71	1.87
6	5.65	19.49	81.63	34.12	26.39	18.27	3.65	13.45	19.32	9.68	2.86	1.97
7	5.73	19.66	81.48	34.39	26.85	18.35	3.69	14.09	19.43	10.21	3.06	2.03
8	6.34	19.90	82.92	35.20	26.98	17.49	3.69	14.19	20.31	11.18	3.41	2.26
9	6.51	21.14	85.78	37.10	29.10	19.68	3.71	15.97	22.85	11.29	3.86	2.38
10	6.53	23.48	90.87	41.23	32.33	21.86	3.79	17.74	25.39	11.37	4.08	2.71
11	6.67	25.83	91.51	45.35	33.34	24.05	3.90	18.41	27.93	12.79	4.19	2.82
12	6.80	25.96	92.15	46.14	35.46	24.35	3.93	18.51	29.36	13.29	4.43	2.90
13	6.87	26.07	92.66	47.12	36.02	24.95	4.07	18.70	29.95	14.02	4.48	3.04
14	6.95	26.20	93.48	48.26	36.31	25.14	4.14	19.30	30.46	15.81	5.54	3.34
15	7.01	27.33	94.04	49.78	36.57	25.36	4.27	19.74	31.03	16.92	5.64	3.84
16	7.23	27.41	100.26	50.74	37.12	26.10	4.42	19.86	33.10	16.98	5.66	3.86

The economic VOC per km of motorised vehicle resulted through HDM run at different roughness levels are presented in Table 3.20.

Table 4.20 Sensitivity of Economic VOC of Motorised Vehicle to Road Roughness (Taka/km)

Inte Rou Index (IRI)	Auto Rickshaw	Car	Large Bus	Bus Mini	Medium Truck	Bus Light	Motor Cycle	Truck Small	Utility	Animal Cart	Rickshaw	Bicycle
4	4.78	16.09	68.40	28.21	21.42	15.17	3.18	11.34	15.95	8.02	2.32	1.61
5	4.99	16.96	71.65	29.74	22.80	15.96	3.23	11.96	16.27	8.34	2.44	1.68
6	5.09	17.54	73.46	30.71	23.75	16.44	3.28	12.10	17.39	8.71	2.57	1.77
7	5.16	17.69	73.33	30.96	24.16	16.52	3.32	12.68	17.49	9.19	2.75	1.83
8	5.70	17.91	74.62	31.68	24.28	15.74	3.32	12.78	18.28	10.06	3.07	2.03
9	5.86	19.02	77.20	33.39	26.19	17.71	3.34	14.37	20.57	10.16	3.47	2.14
10	5.88	21.14	81.78	37.10	29.10	19.68	3.41	15.97	22.85	10.23	3.67	2.44
11	6.00	23.25	82.36	40.82	30.01	21.64	3.51	16.57	25.14	11.51	3.77	2.54
12	6.12	23.36	82.94	41.53	31.92	21.91	3.54	16.66	26.42	11.96	3.99	2.61
13	6.19	23.46	83.40	42.41	32.41	22.45	3.66	16.83	26.95	12.62	4.03	2.74
14	6.25	23.58	84.13	43.44	32.68	22.63	3.73	17.37	27.41	14.23	4.99	3.01
15	6.31	24.60	84.63	44.80	32.91	22.82	3.84	17.77	27.92	15.23	5.08	3.46
16	6.51	24.67	90.23	45.67	33.41	23.49	3.98	17.87	29.79	15.28	5.09	3.47

Unit operating costs for all types of motorised vehicle are higher than those of the previous year except motorcycle. The main reason for this is the higher vehicle, particularly the CIF price of medium truck, microbus, utility and car. Besides, there is some increase in the overhead, maintenance labour and particularly in fuel costs. This is because of the fact that in the 2009 year study report there was some under estimation in the C&F cost of fuel as provided by the

BPC. The utilization of vehicle is increased; on the contrary normal service life is decreased. It may be mentioned that though the unit operating costs are generally higher this year, they are still below the fare in the transport market for buses and trucks.

4.12 Pedestrian Costs

Pedestrians do get benefit from road development on two accounts. Firstly, a part of their energy is saved due to improved roads. Secondly, they need to spend less time on the improved road to get to their destination. However, 'Pedestrians' are not considered in the HDM-4 model which was the basis of our analysis. Since it is now felt that pedestrians are important components along village roads of LGED, they may be included exogenously. The next best alternative for pedestrians is to use Rickshaw which carries 2 passengers. Therefore, 50% of VOC cost of Rickshaw can be taken as opportunity cost of pedestrians. Economic analysis can be carried out by including this cost until further empirical research is carried out on the issue.

5 TRAVEL TIME COSTS

5.1 General

Travel Time Costs (TTC) also referred to as Values of Time are an important component of road user costs. The concept of travel time costs is based around the premise that time spent in traveling has an “opportunity cost” and could be used in an alternative activity which also produce or may produce some significant utility popularly known as benefit. If the alternative activity can have a monetary value assigned to it this can be used as a part of RUC in the economic appraisal of projects, particularly of the transport projects having relation with consumption of time in the use of their output.

TTC may vary from country to country, even from project to project in the same country. This can vary in size from 20 percent of total RUC to over 80 percent of the same in the economic and/or financial appraisal of schemes depending on the extent of time delays involved in case of the project under study as well as the income pattern of the users of the project output. In case of the construction of a major new bridge to replace a ferry for example, TTC will be immensely significant compared to a road improvement project without any change in its alignment or pavement and/or shoulder capacity. Again, value of time will be much higher in a more developed country like the USA or Britain than that in a less developed country like Bangladesh or Afganistan. Similarly this variation in value of time may exist between a more developed region or society of a country and a relatively less developed part or habitation of the same country.

Time costs can be estimated for road users and for freight consignments. Costs may be broken down into “in vehicle time” and “out of vehicle time”. The latter may be important to bus passengers waiting for a vehicle, but is specialized in its application and is not considered in the LGED approach which focuses on “in vehicle time" values only.

Time costs will vary between different vehicle types according to the socio-economic characteristics of the occupants, their trip purpose and the type of freight carried. For analysis purposes TTC are expressed as hourly values per vehicle by assuming average occupancies and loading factors for each vehicle type.

Although every vehicle or category of vehicles will have its own total TTC it is sometimes considered appropriate to apply a uniform TTC across all vehicle types to avoid biasing investment towards roads with a dominance of one type of user over another (i.e. a road with many high income car users will generate much higher time savings than a road with many low value rickshaw users: a scenario typically prevailing in Bangladesh). In this case of uniform application the TTC is referred to as an “equity” value. This approach is appropriate mainly for the developed country as income distribution in such country is more or less smooth and even. Users of cars and bicycles may belong to the same economic class as most of them own and use both of the vehicles to suit the convenience of their movement. In a country like Bangladesh on the contrary, the income pattern between the users of highly expensive motorised vehicles such as cars and jeeps and those of slow moving non-motorised transport such as rickshaws and bicycles is substantially different and these two categories of road users belong to two completely different economic classes in the society. That's why the approach of uniform TTC has not been adopted in Bangladesh to date. In this study TTC has been estimated according to separate vehicle type.

As TTC varies geographically according to the socio-economic characteristics of the region, it would be expected, for instance, that road users in Dhaka city will value their time more than those in a remote Barolekha Upazila in Moulovibazar. It is usual practice; in this case, to adopt a set of nationally averaged TTC applicable to all analyses to avoid the sort of geographical biases in road investment. This approach will continue to be used in Bangladesh in line with current methodology.

5.2 Summary of Survey Results

This section sets out a summary of the Upazila & Union Road travel time surveys conducted in 2008. Details of TTC data presented in Tables 5.1, 5.1a & 5.1b set out the distribution of trip purpose for Upazila & Union Roads respectively. Average 168 (Upazila level) & 172 (Union Level) occupants are interviewed in selected 18 Upazila & 18 Union Roads.

Table 5.1 Sample Distribution of Vehicle Occupants by Trip Purpose (Upazila + Union Rd)

Trip Purpose	Bus Heavy	Bus Light	Bus Mini	Car	Utility	Tempo	Auto Rick	Modified Tempo	Motor Cycle	Bicycle	Rickshaw	Rickshaw Van	Animal Cart	Total	%
Journey to/ From Work	3	5	5	6	6	10	4	12	8	8	4	7	0	**78**	**23%**
Employers Business	5	7	8	10	6	12	11	12	22	12	13	11	4	**133**	**39%**
Own Business	4	6	5	9	9	4	7	2	2	12	7	8	8	**83**	**24%**
Family and Social	0	0	1	3	1	9	2	10	4	4	1	9	2	**46**	**14%**
Total	**12**	**36**	**38**	**56**	**44**	**70**	**48**	**72**	**72**	**72**	**50**	**70**	**28**	**340**	**100%**
Average	3	9	10	14	11	18	12	18	18	18	13	18	7	85	**25%**

***Source**: Travel Time Cost Survey 2007-08, RDP-25, LGED, Time Saving in Developing Countries, JDGF Howe, Journal of Transport Economics and Policy, May 1976. Valuation of Economic Costs: United Kingdom's Transport Research Laboratory (TRL*)
Note: Vehicle Occupants by Trip: LGED Upazila & Union Rd. in 6 Divisions

Table 5.1a Sample Distribution of Vehicle Occupants by Trip Purpose (Upazila Road)

Trip Purpose	Bus Heavy	Bus Light	Bus Mini	Car	Utility	Tempo	Auto Rick	Modified Tempo	Motor Cycle	Bicycle	Rickshaw	Rickshaw Van	Animal Cart	Total	%
Journey to/ From Work	2	2	3	3	4	5	2	6	4	4	2	4	0	**41**	**24%**
Employers Business	3	3	4	6	3	6	5	6	11	6	7	6	2	**68**	**40%**
Own Business	3	3	3	4	3	2	2	1	1	6	1	2	4	**35**	**21%**
Family and Social	0	0	1	2	0	4	2	5	2	2	1	5	0	**24**	**14%**
Total	**8**	**18**	**19**	**28**	**22**	**35**	**24**	**36**	**36**	**36**	**25**	**35**	**14**	**168**	**100%**
Average	2	5	5	7	6	9	6	9	9	9	6	9	4	42	**25%**

***Source**: Travel Time Cost Survey 2007-08, RDP-25, LGED.*
Note: Vehicle Occupants byTrip: LGED Upazila & Union Rd. in 6 Divisions

Table 5.1b Sample Distribution of Vehicle Occupants by Trip Purpose Union Road)

Trip Purpose	Bus Heavy	Bus Light	Bus Mini	Car	Utility	Tempo	Auto Rick	Modified Tempo	Motor Cycle	Bicycle	Rickshaw	Rickshaw Van	Animal Cart	Total	%
Journey to/ From Work	1	3	2	3	2	5	2	6	4	4	2	3	0	**37**	**21%**
Employers Business	2	4	4	4	3	6	6	6	11	6	6	5	2	**65**	**38%**
Own Business	1	3	2	5	6	2	5	1	1	6	6	6	4	**48**	**28%**
Family and Social	0	0	0	1	1	5	0	5	2	2	0	4	2	**22**	**13%**
Total	**4**	**18**	**19**	**28**	**22**	**35**	**24**	**36**	**36**	**36**	**25**	**35**	**14**	**172**	**100%**
Average	1	5	5	7	6	9	6	9	9	9	6	9	4	43	**25%**

***Source**: Travel Time Cost Survey 2007-08, RDP-25, LGED.*
Note: Vehicle Occupants byTrip: LGED Upazila & Union Rd. in 6 Divisions

Table 5.2 Sample Distribution of Vehicle Occupant by Occupation (Upazila + Union Road)

Trip Purpose	Bus Heavy	Bus Light	Bus Mini	Car	Utility	Tempo	Auto Rick	Modified Tempo	Motor Cycle	Bicycle	Rickshaw	Rickshaw Van	Animal Cart	Total	UZ+UN %
Labor	0	0	0	0	0	1	2	9	2	2	3	6	2	**27**	**8%**
Farming/ Fishing	0	0	1	2	1	4	2	6	2	5	4	11	2	**40**	**12%**
Shop Employee	0	1	0	1	0	0	0	0	0	0	0	0	0	**2**	**1%**
Peon	0	0	1	0	0	0	0	1	1	2	0	0	0	**5**	**1%**
Salesman	0	0	0	0	0	0	0	0	0	1	0	0	0	**1**	**0%**
Mechanic/ Driver	0	0	0	0	1	0	0	1	1	1	0	0	0	**4**	**1%**
Office Worker	3	1	3	4	2	5	4	6	4	7	3	2	2	**46**	**14%**
Student	0	5	2	6	4	9	4	0	8	4	0	4	0	**46**	**14%**
Professional	1	4	4	6	6	9	6	6	9	6	5	7	0	**69**	**20%**
Officer	1	2	2	1	2	1	3	4	2	4	3	2	2	**29**	**9%**
Un-employed	0	0	0	0	2	1	0	0	0	0	0	0	0	**3**	**1%**
Housewife	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Businessman	6	5	6	8	5	5	3	3	7	4	7	3	6	**68**	**20%**
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Total	**11**	**18**	**19**	**28**	**23**	**35**	**24**	**36**	**36**	**36**	**25**	**35**	**14**	**340**	**100%**
Average	0.79	1.29	1.36	2	1.64	2.5	1.71	2.57	2.6	2.6	1.8	2.5	1	24.3	**7%**

***Source:** Travel Time Cost Survey 2007-08, RDP-25, LGED.*

Table 5.2a Sample Distribution of Vehicle Occupant by Occupation (Upazila Road)

Trip Purpose	Bus Heavy	Bus Light	Bus Mini	Car	Utility	Tempo	Auto Rick	Modified	Motor Cycle	Bicycle	Rickshaw	Rickshaw	Animal Cart	Total	UZ %
Labor	0	0	0	0	0	0	0	4	0	0	1	3	1	**9**	**5%**
Farming/ Fishing	0	0	1	1	1	2	1	3	1	4	2	6	1	**23**	**14%**
Shop Employee	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Peon	0	0	1	0	0	0	0	1	1	2	0	0	0	**5**	**3%**
Salesman	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Mechanic/ Driver	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Office Worker	1	0	2	2	1	2	3	2	2	3	0	0	0	**18**	**11%**
Student	0	3	1	3	2	4	1	0	4	2	0	2	0	**22**	**13%**
Professional	1	1	2	3	3	5	3	4	5	4	3	3	0	**37**	**22%**
Officer	1	1	1	0	1	0	1	1	1	0	2	1	1	**11**	**7%**
Un-employed	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Housewife	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Businessman	4	3	3	6	2	4	2	3	4	3	4	2	3	**43**	**26%**
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Total	**7**	**8**	**11**	**15**	**10**	**17**	**11**	**18**	**18**	**18**	**12**	**17**	**6**	**168**	**100%**
Average	0.5	0.57	0.79	1.07	0.71	1.21	0.79	1.29	1.3	1.3	0.9	1.2	0.4	12	**7%**

Table 5.2b Sample Distribution of Vehicle Occupant by Occupation (Union Road)

Trip Purpose	Bus Heavy	Bus Light	Bus Mini	Car	Utility	Tempo	Auto Rick	Modified	Motor Cycle	Bicycle	Rickshaw	Rickshaw Van	Animal Cart	Total	UN %
Labor	0	0	0	0	0	1	2	5	2	2	2	3	1	**18**	**10%**
Farming/ Fishing	0	0	0	1	0	2	1	3	1	1	2	5	1	**17**	**10%**
Shop Employee	0	1	0	1	0	0	0	0	0	0	0	0	0	**2**	**1%**
Peon	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Salesman	0	0	0	0	0	0	0	0	0	1	0	0	0	**1**	**1%**
Mechanic/ Driver	0	0	0	0	1	0	0	1	1	1	0	0	0	**4**	**2%**
Office Worker	2	1	1	2	1	3	1	4	2	4	3	2	2	**28**	**16%**
Student	0	2	1	3	2	5	3	0	4	2	0	2	0	**24**	**14%**
Professional	0	3	2	3	3	4	3	2	4	2	2	4	0	**32**	**19%**
Officer	0	1	1	1	1	1	2	3	1	4	1	1	1	**18**	**10%**
Un-employed	0	0	0	0	2	1	0	0	0	0	0	0	0	**3**	**2%**
Housewife	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Businessman	2	2	3	2	3	1	1	0	3	1	3	1	3	**25**	**15%**
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	**0%**
Total	**4**	**10**	**8**	**13**	**13**	**18**	**13**	**18**	**18**	**18**	**13**	**18**	**8**	**172**	**100%**
Average	0.29	0.71	0.57	0.93	0.93	1.29	0.93	1.29	1.3	1.3	0.9	1.3	0.6	12.3	**7%**

***Source**: Travel Time Cost Survey 2007-08, RDP-25, LGED.*

Tables 5.2, 5.2a & 5.2b show the reported monthly household/ Passengers income of the respondents (gross of tax) by vehicle type. The results more or less accord with last years surveys in most cases but show some differences between different buses and between different vehicle types, and as usual, there are differences in income between Upazila & Union Road.

Table 5.3 Sample Distribution by Monthly Income (Upazila & Union Road)

Income Group	Bus Heavy	Bus Light	Bus Mini	Car	Utility	Tempo	Auto Rick	Modified	Motor Cycle	Bicycle	Rickshaw	Rickshaw	Animal Cart	Total	%
<3000	2	0	0	0	0	10	3	5	1	2	3	5	8	**39**	**11%**
3001-6000	0	0	0	1	0	10	8	9	2	6	10	12	3	**61**	**18%**
6001-9000	0	2	1	0	3	10	5	9	5	9	6	6	3	**59**	**17%**
9001-12000	3	8	7	1	7	3	6	10	11	12	5	11	0	**84**	**25%**
12001-15000	3	6	8	9	9	1	2	3	11	6	0	1	0	**59**	**17%**
15001-18000	1	2	3	10	3	1	0	0	6	1	0	0	0	**27**	**8%**
18000+	3	0	0	8	0	0	0	0	0	0	0	0	0	**11**	**3%**
Total	**12**	**18**	**19**	**29**	**22**	**35**	**24**	**36**	**36**	**36**	**24**	**35**	**14**	**340**	**100%**

***Source**: Travel Time Cost Survey 2007-08, RDP-25, LGED.*

Table 5.3a Sample Distribution by Monthly Income (Upazila Road)

Income Group	Bus Heavy	Bus Light	Bus Mini	Car	Utility	Tempo	Auto Rick	Modified	Motor Cycle	Bicycle	Rickshaw	Rickshaw	Animal Cart	Total	%
<3000	2	0	0	0	0	6	2	1	0	1	1	2	5	**20**	**12%**
3001-6000	0	0	0	1	0	5	2	5	1	4	5	6	0	**29**	**17%**
6001-9000	0	0	1	0	2	5	2	4	2	4	3	2	1	**26**	**15%**
9001-12000	1	3	3	0	3	1	4	6	6	6	2	6	0	**41**	**24%**
12001-15000	1	3	4	5	3	0	1	2	6	2	0	1	0	**28**	**17%**
15001-18000	1	2	3	5	2	0	0	0	3	1	0	0	0	**17**	**10%**
<3000	3	0	0	4	0	0	0	0	0	0	0	0	0	**7**	**4%**
3001-6000	**8**	**8**	**11**	**15**	**10**	**17**	**11**	**18**	**18**	**18**	**11**	**17**	**6**	**168**	**100%**

***Source**: Travel Time Cost Survey 2007-08, RDP-25, LGED.*

Table 5.3b Sample Distribution by Monthly Income (Union Road)

Income Group	Bus Heavy	Bus Light	Bus Mini	Car	Utility	Tempo	Auto Rick	Modified	Motor Cycle	Bicycle	Rickshaw	Rickshaw	Animal Cart	Total	%
<3000	0	0	0	0	0	4	1	4	1	1	2	3	3	**19**	**11%**
3001-6000	0	0	0	0	0	5	6	4	1	2	5	6	3	**32**	**19%**
6001-9000	0	2	0	0	1	5	3	5	3	5	3	4	2	**33**	**19%**
9001-12000	2	5	4	1	4	2	2	4	5	6	3	5	0	**43**	**25%**
12001-15000	2	3	4	4	6	1	1	1	5	4	0	0	0	**31**	**18%**
15001-18000	0	0	0	5	1	1	0	0	3	0	0	0	0	**10**	**6%**
18000+	0	0	0	4	0	0	0	0	0	0	0	0	0	**4**	**2%**
Total	**4**	**10**	**8**	**14**	**12**	**18**	**13**	**18**	**18**	**18**	**13**	**18**	**8**	**172**	**100%**

***Source**: Travel Time Cost Survey 2007-08, RDP-25, LGED.*

Table 5.3, 5.3a & 5.3b (in upazila road side 45% and rural road 49% people under poverty line) is derived on the basis of Table 5.4 & 5.4a, where the average wage rates of vehicle occupants are assessed to reflect the value of time of occupants while traveling in different vehicles. An assessment of the number of travelers in Work Time (WT) and Non-Work Time (NWT) is made for each vehicle type from trip purpose tables under different road environment. Accordingly an average time value of traveling passenger irrespective of in work or non-work times is assessed by category of vehicle and road class in Table 5.6, 5.6a & 5.6b. On the other hand average passenger occupancy by category of vehicle and road class is set out in the same table for convenience.

Table 5.4 Travel Time Costs (Financial) Taka per Passenger hour

Category of Vehicles	Upazila Road		Union Road		(Upazila+Union Rd)
	Average Occupancy	TTC (Taka /Passenger hour)	Average Occupancy	TTC (Taka /Passenger hour)	TTC (Taka /Passenger hour)
Bus Heavy	8	23.88	4	16.63	20.26
Bus Light	8	20.61	10	23.75	22.18
Bus Mini	11	22.87	8	20.87	21.87
Car	15	48.83	13	45.93	47.38
Utility	10	27.39	12	30.16	28.78
Tempo	17	19.31	18	17.52	18.42
Auto Rickshaw	11	20.2	13	22.16	21.18
Modifed tempo	18	24.7	18	22.41	23.56
Motor Cycle	18	41.75	18	37.88	39.82

Source: Travel Time Cost Survey 2007-08, RDP-25, LGED.

Table 5.4a Travel Time Costs (Financial) Taka per Vehicle hour

Category of Vehicles	Upazila Road		Union Road		(Upazila+Union Rd)
	Average Occupancy	TTC per Vehicle Taka/hr	Average Occupancy	TTC per Vehicle Taka/hr	TTC per Vehicle Taka/hr
Bus Heavy	8	1059.42	4	1294.84	1177.13
Bus Light	8	365.72	10	446.99	406.36
Bus Mini	11	848.98	8	1037.64	943.31
Car	15	127.94	13	156.37	142.16
Utility	10	78.66	12	96.14	87.40
Tempo	17	165.67	18	202.49	184.08
Auto Rickshaw	11	57.69	13	70.51	64.10
Modifed tempo	18	211.91	18	259.01	235.46
Motor Cycle	18	35.83	18	43.79	39.81

Source: Travel Time Cost Survey 2007-08, RDP-25, LGED.

5.3 Unit Travel Time Costs for Motorized Vehicle

The 2008 TTC are set out in Table 5.5, 5.5a & 5.5b. The bus value is an average of all bus types weighted by annual bus passenger km. The values for all other passenger vehicles have been averaged typically taking category-wise length of network and density of road use into consideration. The unit results worked out are more or less consistent with those of the previous

year. However the occupancy number for all categories of buses has decreased by about 10% resulting in a similar fall of TTC per bus, though the TTC per passenger remains slightly above. TTC value for tempo has increased by 34%, while that for motor cycle has decreased by 11% compared to last 2007 year value.

Table 5.5 Recommended Financial and Economic TTC for FY 2007-08 (Upazila+Union Road) National Average.

Vehicle Category	Occupancy Number	Financial		Economic	
		TTC per Pass Taka/hr	TTC per Vehicle Taka/hr	TTC per Pass Taka/hr	TTC per Vehicle Taka/hr
Motorized					
Bus Heavy	12	20.26	1177.13	14.54	741.20
Bus Light	18	22.18	406.36	19.80	320.32
Bus Mini	19	21.87	943.31	19.80	833.88
Car	28	47.38	142.16	44.24	136.66
Utility	22	28.78	87.40	27.97	83.46
Tempo	35	18.42	184.08	16.85	173.34
Auto Rickshaw	24	21.18	64.10	20.45	61.81
Modifed tempo	36	23.56	235.46	21.56	221.72
Motor Cycle	36	39.82	39.81	36.45	37.49
Sub-Total	**230**	**243**	**3280**	**222**	**2610**
Non-Moto					
Bi-Cycle	36	10.29	7.53	8.53	10.38
Rickshaw	25	14.25	8.60	12.28	28.53
Rickshaw Van	35	15.84	9.79	13.77	96.75
Sub-Total	**96**	**40**	**26**	**35**	**136**
Total	**326**	**284**	**3306**	**256**	**2746**
Average	**163**	**142**	**1653**	**128**	**1373**

***Source**: Travel Time Cost Survey 2007-08, RDP-25, LGED.*
Note: Road Class: LGED Union & Union Rd in 6 Divisions

Table 5.5a Recommended Financial and Economic TTC for FY 2007-08 (Upazila Average)

Vehicle Category	Occupancy Number	Financial		Economic	
		TTC per Pass Taka/hr	TTC per Vehicle Taka/hr	TTC per Pass Taka/hr	TTC per Vehicle Taka/hr
Motorized					
Bus Heavy	8	23.88	1059.42	14.11	667.08
Bus Light	8	20.61	365.72	18.22	288.29
Bus Mini	11	22.87	848.98	20.82	750.49
Car	15	48.83	127.94	47.14	122.99
Utility	10	27.39	78.66	28.79	75.11
Tempo	17	19.31	165.67	17.93	156.01
Auto Rickshaw	11	20.2	57.69	20.96	55.63
Modifed tempo	18	24.7	211.91	22.94	199.55
Motor Cycle	18	41.75	35.83	38.8	33.74
Sub-Total	**116**	**250**	**2952**	**230**	**2349**
Non-Motorised					
Bi-Cycle	18	10.83	7.7	8.28	8.28
Rickshaw	11	15	8.8	12.41	26.03
Rickshaw Van	17	16.67	10.01	14.03	93.55
Sub-Total	**46**	**43**	**27**	**35**	**128**
Total	**162**	**292**	**2978**	**264**	**2477**
Average	**81**	**146**	**1489**	**132**	**1238**

***Source**: Travel Time Cost Survey 2007-08, RDP-25, LGED.*
Note: Road Class: LGED Union & Union Rd in 6 Divisions

Table 5.5b Recommended Financial and Economic TTC for FY 2007-08 (Union Average)

Vehicle Category	Occupancy Number	Financial		Economic	
		TTC per Pass Taka/hr	TTC per Vehicle Taka/hr	TTC per Pass Taka/hr	TTC per Vehicle Taka/hr
Motorized					
Bus Heavy	4	16.63	1294.84	14.97	815.32
Bus Light	10	23.75	446.99	21.38	352.35
Bus Mini	8	20.87	1037.64	18.78	917.27
Car	13	45.93	156.37	41.34	150.33
Utility	12	30.16	96.14	27.14	91.8
Tempo	18	17.52	202.49	15.77	190.67
Auto Rickshaw	13	22.16	70.51	19.94	67.99
Modifed tempo	18	22.41	259.01	20.17	243.89
Motor Cycle	18	37.88	43.79	34.09	41.24
Sub-Total	**114**	**237**	**3608**	**214**	**2871**
Non-Motorised					
Bi-Cycle	18	9.75	7.35	8.78	12.48
Rickshaw	14	13.5	8.4	12.15	31.03
Rickshaw Van	18	15	9.56	13.50	99.95
Sub-Total	**50**	**38**	**25**	**34**	**143**
Total	**164**	**276**	**3633**	**248**	**3014**
Average	**82**	**138**	**1817**	**124**	**1507**

Source*: Travel Time Cost Survey 2007-08, RDP-25, LGED.*
Note: Road Class: LGED Union & Union Rd in 6 Divisions

5.4 Unit Travel Time Costs for Non-Motorized Vehicle

Time values for Non-Motorized vehicle has been derived from the thesis "Quantification of the Effects of Non-motorized Transport and Roadside Activities in 6 Divisions 2008. These are quantified as work time values. Non-work time values are estimated on assuming standard LGED 35%. The average values per person and per vehicle are estimated using the NMV journey characteristics data from the field survey carried out in 2008 by RDP-25, LGED. Table 5.6, 5.6a & 5.6b.

Table 5.6 Travel Time Costs for Non-Motorized Vehicles (Upazila+Union Road)

Division	Vehicle Category	Journey Characteristics		Travel Time Cost Taka per hour			
		Occupancy	Journey in-work time	Work time value	Non-work time value	Average per person	Average per vehicle
Dhaka	Rickshaw	2	13%	10.20	3.70	4.30	8.40
	Bi-Cycle	1	27%	21.20	7.60	10.70	10.70
Chittagong	Rickshaw	2	12%	10.17	3.67	4.27	8.37
	Bi-Cycle	1	26%	21.17	7.57	10.67	10.67
Rajshahi	Rickshaw	2	14%	10.23	3.73	4.33	8.43
	Bi-Cycle	1	28%	21.23	7.63	10.73	10.73
Khulna	Rickshaw	2	14%	10.21	3.71	4.31	8.41
	Bi-Cycle	1	28%	21.21	7.61	10.71	10.71
Barisal	Rickshaw	2	14%	10.24	3.74	4.34	8.44
	Bi-Cycle	1	28%	21.24	7.64	10.74	10.74
Sylhet	Rickshaw	2	13%	10.20	3.70	4.30	8.40
	Bi-Cycle	1	27%	21.20	7.60	10.70	10.70
Average	Rickshaw	2	13%	10.21	3.71	4.31	8.41
	Bi-Cycle	1	27%	21.21	7.61	10.71	10.71

***Source**: Travel Time Cost Survey 2007-08, RDP-25, LGED.*
(1)"Quantification of the Effects of Non-motorized Transport and Roadside Activities
Note: Road Class: LGED Upazila & Union Rd in 6 Divisions

Table 5.6a Travel Time Costs for Non-Motorized Vehicles (Upazila Road)

Division	Vehicle Category	Journey Characteristics		Travel Time Cost Taka per hour			
		Occupancy	Journey in-work time	Work time value	Non-work time value	Average per person	Average per vehicle
Dhaka	Rickshaw	2	12.0%	10.13	3.63	4.23	8.33
	Bi-Cycle	1	26.0%	21.13	7.53	10.63	10.63
Chittagong	Rickshaw	2	11.0%	10.11	3.61	4.21	8.31
	Bi-Cycle	1	25.0%	21.11	7.51	10.61	10.61
Rajshahi	Rickshaw	2	13.2%	10.15	3.65	4.25	8.35
	Bi-Cycle	1	27.2%	21.15	7.55	10.65	10.65
Khulna	Rickshaw	2	12.7%	10.14	3.64	4.24	8.34
	Bi-Cycle	1	26.7%	21.14	7.54	10.64	10.64
Barisal	Rickshaw	2	13.2%	10.16	3.66	4.26	8.36
	Bi-Cycle	1	27.2%	21.16	7.56	10.66	10.66
Sylhet	Rickshaw	2	12.0%	10.13	3.63	4.23	8.33
	Bi-Cycle	1	26.0%	21.13	7.53	10.63	10.63
Average	Rickshaw	2	12.4%	10.14	3.64	4.24	8.34
	Bi-Cycle	1	26.4%	21.14	7.54	10.64	10.64

Note: Road Class: LGED Upazila & Union Rd in 6 Divisions

Table 5.6b Travel Time Costs for Non-Motorized Vehicles (Union Road)

Division	Vehicle Category	Journey Characteristics		Travel Time Cost Taka per hour			
		Occupancy	Journey in-work time	Work time value	Non-work time value	Average per person	Average per vehicle
Dhaka	Rickshaw	2	14.0%	10.26	3.76	4.36	8.46
	Bi-Cycle	1	28.0%	21.26	7.66	10.76	10.76
Chittagong	Rickshaw	2	13.0%	10.22	3.72	4.32	8.42
	Bi-Cycle	1	27.0%	21.22	7.62	10.72	10.72
Rajshahi	Rickshaw	2	15.2%	10.30	3.80	4.40	8.50
	Bi-Cycle	1	29.2%	21.30	7.70	10.80	10.80
Khulna	Rickshaw	2	14.7%	10.28	3.78	4.38	8.48
	Bi-Cycle	1	28.7%	21.28	7.68	10.78	10.78
Barisal	Rickshaw	2	15.2%	10.32	3.82	4.42	8.52
	Bi-Cycle	1	29.2%	21.32	7.72	10.82	10.82
Sylhet	Rickshaw	2	14.0%	10.26	3.76	4.36	8.46
	Bi-Cycle	1	28.0%	21.26	7.66	10.76	10.76
Average	Rickshaw	2	14.4%	10.27	3.77	4.37	8.47
	Bi-Cycle	1	28.4%	21.27	7.67	10.77	10.77

***Source**: Travel Time Cost Survey 2007-08, RDP-25, LGED.*
(1)"Quantification of the Effects of Non-motorized Transport and Roadside Activities
Note: Road Class: LGED Upazila & Union Rd in 6 Divisions

6 ACCIDENT COSTS

6.1 Introduction

In this analysis, accident means road accident and accident costs refer to the costs borne by the economy due to occurrence of a road accident. Research carried out so far has shown that the economic value of road accident costs can easily be equivalent to around one per cent of a country's Gross Domestic Product (GDP), a significant drain on any country's resources. In addition to the overall impact of Road Traffic Accidents (RTA) on the national economy, estimates of accident costs are also needed to measure the safety impacts of road and bridge schemes. The main objective of most road improvement works is to reduce vehicle operating costs and journey time costs, which is achieved by reducing road surface roughness and most often increasing vehicle speeds.

Increased speeds may increase the number and severity of accidents. It is therefore vital to include the cost of accidents in road project appraisals as the failure to do so may result in increased loss of life and economic output.

There are two basic methodologies of costing accidents. They are the Lost Output (or "human capital") approach and the Willingness to Pay (WTP) approach. Lost Output focuses on the economical consequences of road accidents but also includes a component for the pain, grief and suffering (PGS) caused by road accidents. The WTP method, on the other hand, considers the value of preventing an accident, i.e. how much people would pay to avoid an accident altogether. This approach produces much higher cost estimates than the Lost Output Method. WTP has only been used in motorized countries, while the Lost Output method has traditionally been recommended for motorising countries whose primary objective is maximisation of national economic growth.

Our approach is based on the Lost Output method. The methodology follows an established procedure. A conservative approach was adopted as several parameters require additional research to arrive at more accurate values. This additional research is time taking and resource consuming. If necessary time and resources are available further action will be taken in future studies to accomplish this task.

6.2 Estimating the Number of Road Traffic Accidents (RTA)

As per Official Reporting by Bangladesh Police most injury RTA include more than one casualty and loss of many other dimensions, RTA costing is traditionally divided into casualty related costs like lost output, medical costs, pain, grief and suffering, etc and event related costs such as property damage and administration costs. RTA casualties are classified in three basic categories:

- **Fatalities** are limited to deaths that take place from and within 30 days of the occurrence of RTA
- **Grievous/Serious injuries** include injuries which require hospitalisation i.e. an overnight admission and stay in a hospital and those RTA related deaths that take place after the first 30 days from RTA occurrence.
- **Simple/Slight injuries** are those which require medical treatment but not hospitalisation.

The number of RTA as recorded by Bangladesh Police and published in the National Road Traffic Accident Report 2007; Road Safety Cell under BRTA has been presented in table 6.1, 6.2 & 6.3 according to severity and area.

Table 6.1 Nation-wide Recorded Casualties According to Severity and by Division and Cities Area in 2007

Division/ City	Number of Casualties			Total	Percentage	Population ('000,000)	Accident rate (no per 10,000 pop)	
	Fatal	Grievous	Simple Injury				Total accidents	Total+Injury Accidents
Divisions, excluding Cities								
Barisal	105	19	1	125	4%	8,850	0.119	0.141
Chittagong	410	76	30	516	18%	22,713	0.181	0.227
Sylhet	210	46	12	268	9%	8,628	0.243	0.311
Dhaka	830	199	37	1066	37%	36,368	0.228	0.393
Khulna	179	30	10	219	8%	14,958	0.120	0.146
Rajshahi	562	124	35	721	25%	32,338	0.174	0.223
total	2296	494	125	2915	100%	123,855	0.185	0.235
Cities								
Chittagong City	116	15	12	143	17%	3.498	0.332	0.409
Dhaka City	417	151	25	593	72%	5.874	0.710	1.010
Khulna City	31	8	8	47	6%	0.844	0.367	0.557
Rajshahi City	33	11	2	46	6%	0.419	0.766	1.098
total	597	185	47	829	100%	10.635	0.561	0.780
Total	2893	679	172	3744		134,500	0.215	0.278

Source: *National Road Traffic Accidents Report 2007, NRSC& BRTA*

Table 6.2 Recorded Casualties by Division and City

Division/ City	Number of Casualties			Total	Percentage	Population ('000,000)	Accident rate Fatal	
	Fatal	Grievous	Simple Injury				total accidents	total+injury accidents
Divisions, excluding Cities								
Barisal	118	48	28	194	4.53%	8,860	0.119	0.141
Chittagong	504	251	158	913	21.33%	22,713	0.181	0.227
Sylhet	226	127	74	427	9.98%	8,628	0.243	0.311
Dhaka	937	381	96	1,414	33.04%	36,368	0.228	0.393
Khulna	197	84	20	301	7.03%	14,958	0.120	0.146
Rajshahi	645	308	78	1,031	24.09%	32,338	0.174	0.223
sub-total	**2,627**	**1,199**	**454**	**4,280**	**100%**	**123,865**	**0.185**	**0.235**
Cities								
Chittagong City	127	35	26	188	17.54%	3.498	0.362	0.537
Dhaka City	428	267	44	739	68.94%	5.874	0.729	1.126
Khulna City	34	10	15	59	5.50%	0.844	0.403	0.699
Rajshahi City	34	21	31	86	8.02%	0.419	0.811	2.052
sub-tota	**623**	**333**	**116**	**1,072**	**100%**	**10.635**	**0.586**	**1.008**
Total	**3,250**	**1,532**	**570**	**5,352**		**134,500**	**0.798**	**1.354**

Source*: National Road Traffic Accidents Report 2007, NRSC& BRTA*

Table 6.3 RTA According to Severity and by Road Environment in 2007

Collision Type	Number of Accidents								
	Road Environment			Road class					
	Urban	Rural	Total	National	Regional	Feeder	Rural road	City	Total
Head on	149	380	529	264	88	111	36	44	543
Rear end	206	209	415	181	54	62	16	111	424
Right angle	7	9	16	5	2	4	1	4	16
Side swipe	76	129	205	98	32	49	12	19	210
Overturned vehicle	72	200	272	133	35	76	29	13	286
Hit object in road	15	23	38	20	3	5	3	8	39
Hit object off road	16	42	58	32	9	10	4	4	59
Hit parked vehicle	17	34	51	35	4	8	1	7	55
Hit pedestrian	745	1161	1906	819	257	351	172	346	1945
Hit animal	1	4	5	3	2	0	0	0	5
Other	63	86	149	55	18	27	19	33	152
Unknown	34	66	100	3	2	2	1	2	10
TOTAL	**1,401**	**2,343**	**3744**	**1,648**	**506**	**705**	**294**	**591**	**3744**
% total	**37%**	**63%**	**100%**	**44%**	**14%**	**19%**	**8%**	**16%**	**100%**

***Source**: National Road Traffic Accidents Report 2007, NRSC& BRTA*

Estimation of total cost for road accidents should not be limited to only those which are officially reported; it should include both reported and unreported accidents as all accidents incur costs borne by the economy. It is largely admitted that there is large scale under reporting of simple RTA, while the concerned agencies including the Bangladesh Police believe that fatal and grievous RTA are well reported.

6.2.1 IDC Assessment of Under-Reporting

An IDC assessment in 1995/1996 found that only 20% of casualty RTA were included in the official accident statistics of Dhaka Metropolitan Police (DMP). In reality, this statistics of accident recording (20%) appears to be on the higher side. It is possible that the actual accident figure is twice as large which means those only 10% casualties RTA are really being officially recorded. It should be pointed out that the severity ratio i.e. the ratio of RTA injuries to fatality in Bangladesh is less than 8:1 vis-a-vis the recommendations of two recent study in Indonesia with the ratio of 25:1 and 52:1. (Downing, 1997). So again, injuries could be much higher in Bangladesh than is estimated.

The severity ratio will greatly depend upon the extent to which accidents are consistently reported. Fatal accidents are assumed to be the best reported that is almost half the number of accidents really occurred, while only one out of every 15 simple RTA is believed reported to the police.

6.2.2 Update of Bangladesh Road Traffic Casualty Under-Reporting

A survey of 80,000 households throughout Bangladesh was conducted in 2000. The research study was funded by DFID and conducted jointly by TRL, Institute of Child and Mother Health (ICMH) and the Bangladesh Transport Foundation to update the road crash costing guidelines

for low income countries. According to the study results there was a 95% probability that at least 8,000 road deaths occurred in 2000 but the best estimate was of over 12,000 i.e. more than the total number that being reported by the police. Underreporting of injuries is even worse with almost 75 times more serious injuries estimated than that reported by the police for that year. The study also showed that 13-15 serious injuries for every road death identified. This is consistent with WHO's report on Road Traffic Injury which estimates an average of 15 serious injuries for every road death (WHO 2004). The percentage of underreporting is applied to 2003 accident data for costing exercise as shown in Table 6.4.

Table 6.4 Estimated RTA on the Basis of Reporting

Type	BRTA 2007	Percentage of Reporting*	Estimate of 100% Accidents in 2007		
		Conservative Assumption	Best Assumption	Conservative Assumption	Best Assumption
Fatal	3250	87%	24%	7242	11467
Grievous	679	18%	1%	46050	92100
Simple	172	5%	<1%	23900	79664
Total	3744	100%		77,192	183,233

***Source**: (i) Aeron-Thomas (2003), Bangladesh Road Crash Costing Discussion Document, TRL*
(ii) Road Safety Cell (2007), National Road Traffic Accident Report, BRTA, Allenbari, Dhaka
(iii) Economics Circle, RUC, RHD
(VI) National Road Traffic Accidents Report 2007, NRSC& BRTA

In 2003 an even larger household survey was conducted jointly by the Directorate of Health Services, ICMH, UNICEF and The Alliance for Safe Children. The study report published in 2005 is "Bangladesh Health and Injury Survey: Report on Children and Call for Action" shows that over 3,400 children were killed and 110,000 seriously injured in road crashes in 2003. This figure is greater than the number of total fatal deaths and 15 times greater than the total injuries for all ages reported in the RTA 2003 Annual Report.

It has traditionally been assumed that fatal RTA have been the most well reported as this is the case in motorised countries. However in Bangladesh problems of compensation reduce the reporting of fatal accidents. Further research into the extent of underreporting is required before an accurate assessment of the accident occurrence can be made. Accidents causing Property Damage Only (PDO) have also been estimated as they too incur costs. Conservative figures have been used with three PDO RTA being estimated for every casualty RTA. The number of estimated total RTA are set out in Table 6.5.

Table 6.5 Estimated Nationwide Total RTA (Casualty Plus PDO)

Basis	Casualty RTA	PDO multiplier	Estimated PDO	Total RTA
Conservative Assumption	77,192	3	231,576	308,768
Best Assumption	183,233	3	549,699	732,932

***Source**: (i) Aeron-Thomas (2003), Bangladesh Road Crash Costing Discussion Document, TRL*
(ii) Road Safety Cell (2007), National Road Traffic Accident Report, BRTA, Allenbari, Dhaka
(iii) Economics Circle, RUC, RHD
(VI) National Road Traffic Accidents Report 2007, NRSC& BRTA

6.3 Valuation of Cost of Various RTA Components

6.3.1 Lost Output

Lost output refers to the loss to the economy of productive capacity of the persons victimised by a road accident. While most accident analysis rely on accident victim surveys or average wage rate to estimate lost output, average incomes for motorized transport users have been determined by the TTC surveys undertaken in 2004 by the Economics Circle. Only the average income of a pedestrian had to be calculated additionally using an average per capita income of Taka 2,162 per month (BBS 2004). Table 6.6 shows the average incomes estimated for the different road user types and the relative casualty share.

Table 6.6 Estimated Crew Wage Costs/ Av. Monthly Income (Taka 2007 prices)

Cost Parameters	Truck Med	Truck Small	Bus Heavy	Bus Light	Bus Mini	Utility	Car	Tempo	Auto Rick
Driver per month	5980	4123	8872	5648	4523	5704	4079	5031	3994
Helper per month	2412	1892	4729	3081	2118	0	2000	2034	1267
Driver per hour	23	14	31	22	17	15	17	16	12
Helper per hour	7	5	12	9	6	0	8	5	4
Total financial/hour	30	19	44	31	23	15	25	21	16
Total economic/hour	24	25	35	25	19	12	20	17	13

***Source**: National Road Traffic Accidents Report 2007, NRSC& BRTA.*

It is necessary to calculate the average age of accident victim in order to estimate the net average lifetime income lost by a road user due to an accident. The fatal casualty statistics by age in 2003 as available from Bangladesh Police has been presented in the following table.

Table 6.7 Fatal Casualties by Age Group in 2007

Age Group	Number of Fatalities			Total
	Driver	Passenger	Pedestrian	
0 - 5	0	17	91	108
6 - 10	2	34	172	208
11 - 15	10	25	95	130
16 - 20	16	46	78	140
21 - 25	30	102	99	231
26 - 30	52	101	130	283
31 - 35	31	101	102	234
36 - 40	17	79	125	221
41 - 45	28	53	94	175
46 - 50	20	40	88	148
51 - 55	5	26	64	95
56 - 60	6	19	98	123
61 - 65	3	14	64	81
66 - 70	2	10	48	60
70 - 75	0	4	23	27
> 75	1	1	25	27
Unknown	203	258	498	959
Total	426	930	1894	3250
%	13%	29%	58%	100%

***Source**: National Road Traffic Accidents Report 2007, NRSC& BRTA*

- The net lost output for a RTA fatality was based on the following assumptions:
- Average age of RTA fatality = 31 years as calculated on the basis of above table
- Average lost working years = 26 (average retirement age 57 years minus the average age of RTA fatality 31 years)
- Annual discount rate of 12% and average GDP per capita growth rate 3.1% (average of the different growth rates over 26 years as calculated lost output period)
- 30% of per capita income is taken to be personal consumption.
- The present values of lost output for each user category are set out in Table 6.8. The average lost output is Taka 812,795*.*

Table 6.8 Estimated Lost Output by Road User Type Costs in Taka

Lost Output Parameters	Truck	Bus	Car	Rickshaw	Pedestrian	Average
Present Value of Lost Output	1,272,735	1,808,697	2,691,303	1,458,340	382,173	1,522,650
RTA casualty Share in percent	15%	20%	6%	11%	48%	100%
RTA casualty Share in amount	190,910	361,739	161,478	160,417	183,443	211,598

Source*: (i) Aeron-Thomas (2003), Bangladesh Road Crash Costing Discussion Document, TRL*
(ii) Road Safety Cell (2007), National Road Traffic Accident Report, BRTA, Allenbari, Dhaka
(iii) Economics Circle, RUC, RHD
(VI) National Road Traffic Accidents Report 2007, NRSC& BRTA

The lost output for RTA injuries was the daily income multiplied by the number of recovery days. Based on studies in India and Indonesia, a 30-day recovery period was used for grievous injuries while 2 days was used as the estimated average recovering time required for simple injuries. As a 25 day working month has been used in previous RHD economic analyses, the lost output for grievous injuries will be 25 days to be valued at 100% and the remaining 5 days at 25%, i.e. non-working/leisure time. On the other hand both days spent recuperating with simple injuries has been assumed to be working days.

Cost per RTA is definitely higher than that per casualty. Therefore RTA multipliers as assumed on the basis of the economics working paper E8 relating to accident costs are applied to the casualty cost in order to arrive at the RTA cost.

Table 6.9 Estimated Lost Output Casualty Costs in Taka

Category	Per casualty Cost	Fatal RTA		Grievous RTA		Simple RTA	
		Number	Cost	Number	Cost	Number	Cost
Fatality	568,957	1.2	682,748	0	0	0	0
Grievous	6,284	1.0	6,284	1.6	10,055	0	0
Simple	479	1.4	670	2.2	1,053	1.9	910
Total	575,720		689,703		11,108		910

Source*: (i) Aeron-Thomas (2003), Bangladesh Road Crash Costing Discussion Document, TRL*
(ii) Road Safety Cell (2007), National Road Traffic Accident Report, BRTA, Allenbari, Dhaka
(iii) Economics Circle, RUC, RHD
(VI) National Road Traffic Accidents Report 2007, NRSC& BRTA

6.3.2 Medical Costs

The standard cost components of medical services received by RTA casualties include: first aid and rescue services (ambulance), hospital costs (food and bed, operations, xrays, medicines, doctors services), and subsequent rehabilitation costs (treatment, prosthetics).
Rescue services

In Bangladesh, very few of RTA casualties are transported by ambulance services or receive first aid treatment, as roadside first aid posts do not exist. Yet RTA casualties are still transported to medical centres or homes (the police usually transport the bodies of those who died at the scene) and these trips involve a cost. Given the lack of data on hospital transport costs, a token amount of Taka 600 is assigned to each RTA casualty to reflect transport cost.

Hospital care Hospital costs are difficult to calculate and an average in-patient per day cost and average outpatient visit cost are the best working estimates believed possible. The Centre for the Rehabilitation of the Paralysed (CRP) estimates its monthly in-patient cost at Taka 17,280/month (up from 8000/month when costs first began being monitored in 1990). Using the CRP's figure, an average in-patient per day cost of Taka 576 will be used. Average in-patient length of stay is not known for RTA casualties only. However an average in-patient stay of 10 days is assumed, while an average outpatient length of stay of 2 days is assumed with 50% cost of in-patient stay per day. Outpatient visit costs are estimated at 25% of the in-patient per day and outpatient visits will refer to all casualty treatment services, whether hospital or private clinic administered.

Table 6.10 Estimated Medical Costs per RTA Casualty Costs in Taka

Category	Per casualty Cost	Fatal RTA		Grievous RTA		Simple RTA	
		Number	Cost	Number	Cost	Number	Cost
Fatality	600	1.2	720	0	0	0	0
Grievous	6,048	1.0	6,048	1.6	9,677	0	0
Simple	744	1.4	1,042	2.2	1,637	1.9	1,414
Total	7,392		7,810		11,314		1,414

***Source**: (i) Aeron-Thomas (2003), Bangladesh Road Crash Costing Discussion Document, TRL*
(ii) Road Safety Cell (2007), National Road Traffic Accident Report, BRTA, Allenbari, Dhaka
(iii) Economics Circle, RUC, RHD
(VI) National Road Traffic Accidents Report 2007, NRSC& BRTA

6.3.3 Human Costs: Pain, Grief and Suffering (PGS)

The Road User Cost Study conducted in India in the early 1980's estimated PGS at 20 per cent of total lost output. This percentage has been maintained in subsequent Indian costing and was also adopted for the 1995 Nepal accident costing exercise. It has been used in this analysis as a default value pending further research.

As explained under Lost Output, the amount estimated for personal consumption (30% of gross lost output) has been transferred to the traditional PGS Component. This is added to the 30 per cent proportion of lost output taken as the PGS component to give the cost set out in Table 6.9. The term "human costs" is used to refer to this expanded component.

Table 6.11 Estimated Human Costs in Taka

Category	Per casualty Cost	Fatal RTA		Grievous RTA		Simple RTA	
		Number	Cost	Number	Cost	Number	Cost
Fatality	341,374	1.2	409,649	0	0	0	0
Grievous	3,771	1.0	3,771	1.6	6,033	0	0
Simple	287	1.4	402	2.2	632	1.9	546
Total	345,432		546,745		6,665		546

***Source**: (i) Aeron-Thomas (2003), Bangladesh Road Crash Costing Discussion Document, TRL*
(ii) Road Safety Cell (2007), National Road Traffic Accident Report, BRTA, Allenbari, Dhaka
(iii) Economics Circle, RUC, RHD
(VI) National Road Traffic Accidents Report 2007, NRSC& BRTA

6.3.4 Vehicle Damage Costs

One further area of RTA costs is the vehicle and other property damage. This component should also include some costs due to any loss caused to the businesses because of the vehicle being out of commission. This may be referred to as the lost earnings to the vehicle owners. Vehicle damage was known to be a major cost component and data was collected during the 2004 survey of operators conducted by the Economics Circle. This data is summarised in Table 6.12.

Table 6.12 Estimated Average Per Vehicle Damage Costs in Taka

Cost component	Medium Truck	Small Truck	Large Bus	Mini Bus	Utility	Car	Tempo	Auto Rick
Damage	47,438	30,500	55,800	40,000	26,250	90,000	800	1,000
Lost earnings	56,857	25,000	224,000	20,000	5,500	15,000	818	1,000
Total Costs	104,295	55,500	279,800	60,000	31,750	21,500	1,618	2,000

***Source**: (i) Aeron-Thomas (2003), Bangladesh Road Crash Costing Discussion Document, TRL*
(ii) Road Safety Cell (2007), National Road Traffic Accident Report, BRTA, Allenbari, Dhaka
(iii) Economics Circle, RUC, RHD
(VI) National Road Traffic Accidents Report 2007, NRSC& BRTA

In addition, vehicle claim data was provided by one large private insurance company that found that the 1997 average vehicle damage claim cost was Taka 43,500 (265 claims). It needs updating which could not be done during this study. As such estimation of vehicle damage costs was made on the basis of vehicle operators' survey 2004 irrespective of the insurance claim. Given the uncertainty regarding the proportion of vehicle damage involved in an average accident it was decided to adopt a cost which might be incurred due to vehicle damage and lost earnings facing a simple average accident. A value around of Taka 97,500 per simple accident was therefore adopted which accords with the weighted average values from the operators' survey 2004. Then factors 0.05, 1.5 and 2.0 were applied to arrive at the property damage only (PDO), grievous and fatal accidents cost respectively. Table 6.12 sets out the resultant costs.

Table 6.13 Estimated Average Vehicle Related Costs per Accident Costs in Taka

Severity	Factor	Unit costs
Fatal	2.0	195,053
Grievous	1.5	146,289
Simple	1.0	97,526
PDO	0.05	4,876

***Source**: (i) Aeron-Thomas (2003), Bangladesh Road Crash Costing Discussion Document, TRL*
(ii) Road Safety Cell (2007), National Road Traffic Accident Report, BRTA, Allenbari, Dhaka
(iii) Economics Circle, RUC, RHD
(VI) National Road Traffic Accidents Report 2007, NRSC& BRTA

6.3.5 Administrative Costs

Administrative costs include the "handling costs" incurred by police, insurance companies and courts in investigation of road accidents as well as prosecution and the settlement of insurance claims. Related police activity includes at the scene efforts as well as the initial reporting and any subsequent investigation and prosecution. This could include the officer in charge, the accident investigator, the vehicle examiner, and the Coroner's office.

Given the level of under-reporting, the relatively few vehicle insurance claims, and the small number believed to go through the legal system, administrative costs are not assumed to be worth surveying in Bangladesh. However, as it is believed that many if not most of accidents are settled privately and these negotiations do take time, a token amount of Tk 1,500 is suggested for general administrative costs.

6.4 Total Road Accident Cost Estimates

6.4.1 Costs Not Included

RTA cost calculations are almost exclusively focused on the losses to society related to the victim himself and not those of others close to the victim. Some of the other costs not commonly factored in accident costing include:

- loss of earnings of carer (i.e. family member must give up work to provide home care);
- work replacement cost, i.e. training to the replacement;
- travel time delay from accidents, including that from road blockades occasionally created after accidents;
- clearing up of accident spot/scene;
- leisure time lost in the post working years;
- life expectancy reduced of RTA casualties.
- Moreover, this accident costing exercise was limited to the three main casualty types, fatal, grievous and simple. It did not factor those grievously injured who are left disabled and with reduced earning capability.

6.4.2 Average Accident Cost by Severity

As the RTA cost calculation analysis is almost exclusively focused on the losses to society related to the victim himself hence 5 basic components including human cost are considered in this report to quantify. Table 6.14 shows the total cost of each RTA by severity and according to various cost components.

Table 6.14 Estimated Total Accident Costs By Severity Type and Cost Component in ('000 Tk)

Component	Fatal	Grievous	Simple	PDO
Lost output	689.7	11.1	0.9	0.0
Medical costs	7.8	11.3	1.4	0.0
Human costs	413.8	6.7	0.5	0.0
Vehicle damage	195.1	146.3	97.5	4.9
Administration	1.5	1.5	1.5	1.5
Total	1307.9	176.9	101.9	6.4

***Source**: (i) Aeron-Thomas (2003), Bangladesh Road Crash Costing Discussion Document, TRL*
(ii) Road Safety Cell (2007), National Road Traffic Accident Report, BRTA, Allenbari, Dhaka
(iii) Economics Circle, RUC, RHD
(VI) National Road Traffic Accidents Report 2007, NRSC& BRTA

According to the above cost estimates, a fatal RTA costs 7 times that of a grievous RTA and 13 times than that of a simple RTA. Property damage only accidents have been estimated at only 16 per cent of a simple accident. The cost of a grievous RTA is estimated at a value around 2 times higher than that of a simple RTA.

6.4.3 National Road Traffic Accident Costs

Table 5.15 sets out the sum of all cost components for the total number of estimated accidents in 2004. The total cost of all road accidents, including PDO, has been conservatively estimated at Taka 21,529 million or US$ 365 million. The major portion of the costs are due to casualty accidents along with property damage only accidents accounting for 7 per cent of total costs. On the other hand, the total cost of accident stands at Taka 42,910 million or US$ 727 million according to the best estimate of underreporting

Table 6.15 Estimated Annual National RTA Costs in Taka

Item	Average Cost per accident ('000 Tk)	Number of Accidents	Total Cost (million Tk)	Number of Accidents	Total Cost (million Tk)
		Conservative Estimate		Best Estimate	
Fatal RTA	1,308	7,242	9,472	11,467	14,997
Grievous RTA	177	46,050	8,145	92,100	16,290
Simple RTA	102	23,900	2,435	79,667	8,118
Total casualty RTA		77,192	20,052	183,233	39,405
PDO RTA	6	231,576	1,477	549,700	3,505
Total RTA		308,768	21,529	732,933	42,910
Av. Casualty RTA Cost			0.279		0.234

***Source:** (i) Aeron-Thomas (2003), Bangladesh Road Crash Costing Discussion Document, TRL*
(ii) Road Safety Cell (2007), National Road Traffic Accident Report, BRTA, Allenbari, Dhaka
(iii) Economics Circle, RUC, RHD
(VI) National Road Traffic Accidents Report 2007, NRSC& BRTA

According to the conservative estimate the average casualty RTA is estimated to cost Tk 279,000 (US$ 4,729), while the total annual RTA costs amount to Taka 21,529 million (US$ 365 million). It means that the total annual accident cost borne by the country is equal to 0.6 per cent of Gross National Product in 2004-05 (Table 6.15).

According to the best estimate the average casualty RTA is estimated to cost Tk 234,000 (US$ 3,966), while the total annual RTA costs amount to Taka 42,910 million (US$ 727 million). It means that the total annual accident cost of the country is equal to 1.3 per cent of Gross

National Product in 2004-05 (Table 6.16). Thus road accident causes a huge unacceptable waste of life as well as scarce resources of Bangladesh.

Table 6.16 Estimated Total Annual Accident Costs as Proportion of GDP

Item	Taka Million	US$ Million	Taka Million	US$ Million
	Conservative Estimate		Best Estimate	
Estimated Total Annual Accident Costs 2004	21,529	365	42,910	727
Gross Domestic Product at 2003-04 current Market prices	3,325,670	56,367	3,325,670	56,367
Accident Costs %GDP	0.6%	0.6%	1.3%	1.3%

***Source**: (i) Aeron-Thomas (2003), Bangladesh Road Crash Costing Discussion Document, TRL*
(ii) Road Safety Cell (2007), National Road Traffic Accident Report, BRTA, Allenbari, Dhaka
(iii) Economics Circle, RUC, RHD
(VI) National Road Traffic Accidents Report 2007, NRSC& BRTA
(iii) Economics Circle, RUC, RHD
***Note:** US$1=70 Taka*

6.5 Conclusions and Recommendations

Accident cost data in Bangladesh are not properly maintained but these are quite significant and cause a substantial drain on its resources. As traffic volume and the population increase, these costs will increase more than proportionately. Immediate action is required to address the accident problem in Bangladesh.

The estimation of the actual number of road accidents is the main problem in Bangladesh. Some progress was made in respect of knowing the number of accidents according to severity, though further research is required on this fundamental problem as an accurate assessment of the various dimension of RTA has not yet been possible. More research is also required on the weights to be given to a fatal RTA vis-a-vis a grievous RTA or a simple RTA. The size of the sample survey has also to be increased in respect of vehicle damage costs and loss of earnings. Another important component of research is the estimation of RTA related medical costs based on hospital survey both public and private and also household survey of the victim.

A great deal of work is needed on researching the relationships between accident rates as well as fatality of accidents and road design as well as road improvement or development. Without this knowledge it will not be possible to apply the results of accident costs analysis in the economic appraisal of road maintenance and development projects.

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