Government of the People's Republic of Bangladesh
Ministry of Communications
Roads and Highways Department

RHD ROAD USER COST ANNUAL REPORT For 2002 - 2003

Economics Circle
Sarak Bhaban Ramna Dhaka
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Foreward

It is a great pleasure for me to see that the Economics Circle under Roads and Highways Department (RHD) has published the fourth installment of its Annual Road User Costs Report. The Road User Costs (RUC) Report 2002-03 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 percent depending on the volume of traffic on a road segment. RUC is such a vital issue that it is terribly uneconomic to ignore 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 RHD through application of HDM model. Besides, they are also largely used as significant inputs in conducting economic feasibility study of road and bridge projects. I hope the RUC study carried out by the RHD Economics Circle 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 Economics Circle engaged in doing this important task and hope that their efforts will continue to do the same in future as well.

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Preface

RHD has been pursuing a policy of following a planning system to allocate its budget to its highway maintenance and development programs according to economic criteria. An integral part of this system is the estimation of accurate Road User Costs (RUC) annually. The Economics Circle of the Planning and Maintenance Wing under RHD has been studying the task to update the RUC report on regular basis.

RUC report 2002-03 is the fourth annual publication of this type. It contains vehicle operating, travel time and accident costs analysed on the basis of data collected through conducting extensive field surveys in four divisional headquarters in Bangladesh.

The field surveys were conducted in various regions of the country which included among others 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 Economics Circle on various levels in such form as data collection, data entry to the computer, data checking and analysis, model run and report writing. Although care was taken to enrich the report as much as possible, there is still some scope of minor errors which are mainly due to resource constraints and could kindly be treated as inadvertent.

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1 INTRODUCTION

1.1 Background

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.

According to an empirical study carried out by the Organisation for Economic Cooperation and Development (OECD) in 1994 on cost-shares under optimal maintenance 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.

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. Economic Working Papers on three RUC components such as Vehicle Operating Cost (VOC), Travel Time Cost (TTC) and Accident Cost (ACC) were worked out. The first RUC study report was published in 1998-99 and had been updated annually since then. The present report is the fourth update of road user costs for the year 2002-2003.

The input for these studies had to be collected mainly through field surveys conducted in various regions of the country which include among others 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.

1.2 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 travelling that could be used in other activities;
- Accident costs (ACC), that is, the physical costs of an accident and 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.

Bangladesh is developing systems to allocate to its highway maintenance and development budgets according to economic criteria. The Institutional Development

Component (IDC) Project funded by the Department for International Development (DFID, UK) has been helping build this system since 1994. A vital part of this system is to provide an accurate and up-to-date estimate of Road User Costs. The Economics Circle of the Planning and Maintenance Wing under RHD undertakes this task. This is the fourth annual road user cost report published by the Economics Circle. It contains vehicle operating, travel time and accident costs updated on the basis of data collected through conducting 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 2001 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.

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. The main source for data on non-motorised vehicles (NMV) was the IDC funded PhD research completed by Mr. M Bari in 2000. These were based on 6537 roadside interview surveys conducted in 1997-98. It may be mentioned that some sample surveys were conducted on NMV passengers which will be continued to improve the basis of the concerned studies in the future, if resources permit.

1.3 Financial and Economic Costs

All costs in the report are given in financial and economic prices. The financial price is the retail market price to the consumer 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. On the other hand, subsidy elements if any is 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, assemblying and retail cost (profit margin) duly shadow priced. Local inputs of labour and materials were shadow priced using the RHD Standard Conversion Factor of 0.8 (ref: Economics Working Paper E9 for details on shadow pricing.)

1.4 Structure of this Report

The report starts by taking care of the current composition of the Bangladesh vehicle fleet in Section 2 as this data is common to all the components of road user costs. These three components such as vehicle operating costs, travel time costs and accident costs are then described in turn in Sections 3, 4 and 5 respectively.

Detailed accounts of the work on each component are contained in the following IDC Economics Working Papers:

- E6 Vehicle Operating Costs
- E7 Travel Time Costs
- E8 Accident Costs

2 THE BANGLADESH VEHICLE FLEET

2.1 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 NMTs is unknown. However, this report has dealt with the operating costs of both motorised vehicles as well as NMTs.

Table 2.1 shows BRTA figures for vehicles registered in Bangladesh from 1995 to 2001. The BRTA figures indicate that to date some 594,000 motorised vehicles have been registered in the country.

Table 2.1 Number of Registered Vehicles

Type	1995	1996	1997	1998	1999	2000	2001	AAGR (%)
Car/Taxi	63218	74493	82861	88840	94042	98682	106028	9.09
Jeep/Microbus	29207	32015	33774	36479	38748	40260	43337	6.81
Bus	13406	13287	13386	13762	13939	14269	14859	1.74
Minibus	10466	11052	11918	12520	12999	13399	14597	5.72
Truck	33210	35475	36257	38990	41008	43728	46203	5.67
A Rick/Tempo	52340	62548	69094	73497	75637	78767	79144	7.31
Motorcycle	178257	188669	200749	215274	231785	246395	271204	7.25
Other	8161	8685	10286	11534	14151	15511	18402	14.65
Total	388265	426224	458325	490896	522309	551011	593774	7.34

Note: AAGR= Annual average growth rate 1995 to 2001

2.2 Representative Vehicles

The Bangladesh vehicle fleet is characterised by a large number of different vehicle types spanning up to three decades in age. RHD 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 2.2.

No data is published on the makes and models of vehicle registrations by BRTA. A detailed examination of BRTA registration records was undertaken in 1995 to derive this information. This is now out of date and will be reviewed when the next RUC report is issued.

A summary of the results for the two most popular makes of motorised vehicle in each category is shown in Table 2.3. This demonstrates that in all categories over half the vehicles consist of two makes and models. In many categories the fleet is dominated by one make of vehicle. 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 2.2 RHD Vehicle Categories

RHD Category	Description
Articulated Truck	All articulated trucks and trucks with trailers
Medium Truck	Two or three axle rigid > three tonne payload
Small Truck	Two axle rigid < three tonne payload
Large Bus	>40 seats and >36 feet chassis
Mini Bus	16-39 seats and <36 feet chassis
Micro Bus	<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
Tempo	Large passenger & cargo carrying 3 wheelers
Cycle Rickshaw	Three wheeled passenger NMV
Rickshaw Van	Three wheeled cargo NMV
Cart	All animal carts and human drawn/push carts
Bicycle	All two wheeled non-motorised vehicles

Source: MCC Traffic Guide (RHD), October 2001

Table 2.3 Summary of Representative Vehicles by Category and Model (Per Cent of Registered Vehicle Fleet)

RHD Category	Most Popular Make/Model	%	Second Popular Make/Model	%	Total Two Makes %
Articulated Truck	Tata	No data available			
Medium Truck	Tata SE 1612	28%	Bedford England	27%	55%
Small Truck	Isuzu NKR55L	46%	Toyota	13%	59%
Large Bus	Hino AK series	56%	Tata	32%	82%
Mini Bus	Tata LP909	44%	Mitsubishi	19%	63%
Micro Bus	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 Rickshaw	Bajaj Baby Taxi	97%	Other	3%	100%

Source: Bangladesh Road Transport Authority

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) - Autorickshaws/motorcycles

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

Articulated Truck

It was not possible to identify the number of articulated trucks (previously called as heavy truck) from BRTA records, which define Articulated Trucks as those carrying more than 7 tonnes of cargo, which includes the RHD articulated and medium categories. Of those multi-axle trucks that could be identified the majority were Tata tractor units and trailers. As there are still very few multi-axle vehicles in Bangladesh, further works were not carried out on articulated trucks.

Medium Truck

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.

Small Truck

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 RHD 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.

Large Bus

Large buses can be divided into luxury (Air Conditioned and Chair Class) and ordinary categories. Hino of Japan and Tata of India dominate the large bus 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 dominate and as such has been selected as the representative vehicle for modelling.

Minibus

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 makes 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%.

Micro Bus

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 (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 motor cycle engine, manufactured in Bangladesh by Atlas Ltd. However, only a small number of this variety were 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.

Motor Cycle

Honda dominates the motor cycle market with 58 per cent 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 are 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/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/Push 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.

2.3 Characteristics of Representative Vehicles

Table 2.4A and 2.4B set out the physical characteristics of the representative vehicle types identified in the previous section.

Table 2.4A Vehicle Characteristics :Engine and Tyres

Category	Make	Imported as	Fuel	CC	Cylin-ders	Metric HP	No. Tyres	Type of Tyres
Motorised								
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
Large Bus	Hino AK3HMKA	CKD	Diesel	6443	6	195	6	9.00x20-14PR
Mini Bus	Tata LP909/36	CKD	Diesel	4788	6	112	6	7.50x20-12PR
Micro Bus	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 Sedan 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
Motor Cycle	Honda CG125	CBU	Petrol	125	1	11	2	Front 2.5 - 4PR Rear 3.0 -4PR

Table 2.4B 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
Large Bus	Hino AK3HMKA	2	4,145	12,500	10,005	2,430	1,995
Mini Bus	Tata LP909/36	2	3,300	9,000	5,970	2,159	1,900
Micro Bus	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
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
Animal Cart	na	1	nc	1800	nc	nc	nc

Source: Vehicle retailers in Dhaka

Notes:
N = no manufacturers data
TARE = unloaded weight, GVW = gross vehicle weight
CKD = completely knocked down, CBU = completely built unit

3 VEHICLE OPERATING COSTS (VOC)

3.1 Introduction

The prediction of VOCs 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. The method used for deriving the costs is set out in Economics Working Papers E6, E7 and E8.

The HDM-4 Calibration manual (Volume 5) recommends three levels of calibration, as set out in Table 3.1. The model was calibrated to Level 1 fully and level 2 partially. Speed Capacity and PCSE (Passenger Car Space Equivalence) calibrations were carried out by the HDM Circle and are described in their calibration report.

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 an 1 km representative section of road and recording the predicted unit VOCs at different roughness levels.

Table 3.1 Calibration of HDM-4 Road User Effects Model

	Required	**Priority 1**	**Priority 2**	**Assume Defaults**
Level 1	Unit Costs	Mass Capacity Speed Service Life Utilisation	Power Tyre Parameters Depreciation Parameters	All Others
Level 2		Speed Capacity PCSE	Fuel Power Service Life Utilisation	All Others
Level 3		Priorities Depend on Resources and Objectives		

3.2 Selection of Representative Vehicle Types

The RHD vehicle types were selected in 1995 as a balance between having too many categories that it would be difficult for the traffic survey enumerator to classify and getting sufficient vehicle types to accurately model RUC's and traffic effects. This means that some "sub-categories" of vehicles are not recorded (see Table 3.2) especially in the Large Bus, Auto Rickshaw, Cycle Rickshaw and Cart categories. The last column of Table 3.2 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 3.2 RHD Vehicle Categories

RHD Category	Sub Category	Modelled
Articulated Truck		
Medium Truck		
Small Truck		
Large Bus	Ordinary, Chair, Luxury	Chair
Mini Bus		
Micro Bus		
Utility		
Car		
Auto Rickshaw	Baby Taxi, Tempo	Baby Taxi
Motor Cycle		
Cycle Rickshaw	Passenger and Van	Passenger
Cart	Animal and Human	Animal
Bicycle		

The data inputs for the model were collected through field survey during the first quarter of 2002. A total of 50 operators for each type of vehicles were chosen with 20 operators in Dhaka and 10 operators each in Chittagong, Rajshahi and Khulna areas. The data were entered into a computer database and stored in the Economics Circle. 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.

3.3 Utilisation

3.3.1 Existing Characteristics

The way in which a vehicle is utilised is a key parameter in estimating VOC. In Bangladesh commercial vehicles are often intensively utilised. Buses, in particular, are operated around the clock with different sets of crews on day time and night time schedules. Table 3.3 shows utilisation rates for the operators surveyed in 2002. Large buses operating on the intercity routes are utilised for up to 80 per cent of the time available. Most of other vehicles average either around 60 per cent utilisation or more.

For modelling VOC's 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 utilisation collected through 2002 survey by Economics Circle are set out in Table 3.3. This shows that distances travelled by large buses are very high reflecting their higher utilisation ratios, while the smaller vehicles are driven much less as would be normally expected.

Table 3.3 Average Annual Utilisation of Vehicles

Category	Annual Km Driven	Annual Hours in Work	Annual Hours Driven	Utilisation Ratio (1)
Medium Truck	55,000	2,600	2,160	83%
Small truck	25,000	2,100	1,070	51%
Large Bus	120,000	3,350	3,040	91%
Mini Bus	60,000	3,000	2,120	71%
Micro Bus	36,000	2,340	1,250	53%
Utility (Jeep)	36,000	2,700	1,930	71%
Car	40,000	2,240	1,490	66%
Baby Taxi	34,000	3,380	2,350	70%
Tempo	27,000	3,100	2,190	71%
Motor Cycle	13,000	1,490	740	50%
Bicycle	4,000	260	nc	nc
Rickshaw	14,000	1,000	nc	nc
Animal Cart	5,000	1,600	nc	nc

Source: Vehicle operators survey 2002
Note: (1) Hours driven as % of hours in work

Another important aspect of utilisation 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 3.4). Table 3.4 also sets out the percentage of vehicles in the sample that were purchased second-hand.

Table 3.4 Age and Operational Life of Vehicles

Category	Average Age (Years)	Normal Service Life (Years)	Second Hand Purchases %
Medium Truck	9	11	19
Small Truck	9	8	13
Large Bus	4	10	0
Mini Bus	4	12	0
Micro Bus	4	10	16
Utility (Jeep)	5	13	0
Car	3	10	33
Baby Taxi	6	8	3
Tempo	7	7	12
Motor Cycle	4	8	9
Bicycle	Nc	18	nc
Rickshaw	nc	12	nc
Animal Cart	nc	8	nc

Source: Vehicle operators survey 2002

3.3.2 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 programme in general terms and to find out how operators respond to improved conditions of a road. This determines how depreciation is modelled in the economic appraisal system.

The results showed that all operators interviewed had benefited from road and bridge improvements (Table 3.5).

Table 3.5 Operator's Responses to Road Improvements (Percent)

Response	Med Truck	Small Truck	Large Bus	Mini Bus	Micro Bus	Utility	Car	Tempo	Baby Taxi	Motor Cycle
Benefitted	94	64	85	60	85	74	78	33	49	24
Change in operation	92	66	81	60	77	65	71	62	51	19
More trips	60	87	76	86	86	57	75	100	91	91
Longer trips	32	10	22	14	11	39	22	0	9	9
Increased load	6	0	0	0	3	0	0	0	0	0
Addition to fleet	2	3	2	0	0	4	3	0	0	0

Source: Vehicle operators survey 2002

The operators were also asked what specific projects they had benefited from. The three most beneficial general projects are set out in Table 3.6

Table 3.6 Average Savings in Travel Time and VOC to Operators for Specific Road & Bridge Projects (Per cent saving compared with trip before improvement)

Project	M Tuck	S Truck	AC Bus	CC Bus	OC Bus	Mini Bus	Micro Bus	Utility	Car	Average
Dhaka-Chittagong Road										
Time Saving	19	20	25	23	28	25	38	23	25	26
VOC Saving	10	5	10	9	23	15	18	11	12	13
Jamuna Access Rd										
Time Saving	14	20	26	23	0	20	30	34	24	23
VOC Saving	8	8	10	12	0	10	9	15	9	10
Dhaka-Aricha Road										
Time Saving	13	22	21	25	23	20	30	15	20	21
VOC Saving	6	14	13	18	12	10	25	8	8	13

Source: Vehicle operators survey 2002

Table 3.7 Average Savings in Travel Time and VOC to Operators for Improvement of Network in General (Per cent saving compared with trip before improvement)

Saving	M Truck	S Truck	L Bus	Mini Bus	Micro	Utility	Car	Motorcycle	Tempo	Auto Rickshaw	Average
Time Saving	19	16	22	13	30	19	17	27	17	15	19
VOC Saving	12	10	13	15	15	10	11	11	8	9	12

Source: Vehicle operators survey 2002

3.4 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 price (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 an insurance and a landing fee of one per cent 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 are set out in Bangladesh Operative Tariff Schedule issued by the National Board of Revenue. The following five duties and taxes are payable on the AV:

- **Customs Duty (CD)**: Charged at a percentage rate on the AV. These vary between 5.0 and 40 per cent for vehicle imports. Duty on jeep and car have been reduced slightly from 37 to 36 and 38 to 34 per cent, while largely on baby taxi and honda from 25 to 15 and 30 to 16 per cent since 2000. On the other hand duty on micro

bus, large bus and small truck have been increased from 37 to 40, 5 to 8 and 9.5 to 17 per cent respectively.

- **Development Surcharge (DS):** Charged at a uniform rate of 2.5 per cent of AV on medium truck, mini bus, micro bus, jeep, honda and around 4 per cent on other types of MT to directly fund development works;
- **Supplementary Duty (SD)**: Additional charge under the VAT Act on jeep and baby taxi, charged as a percentage rate on AV;
- **Value Added Tax (VAT)**: Charged at a uniform rate of 15 per cent (except jeep whereon 26 per cent and baby taxy 19 per cent) 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 per cent on AV, except for Government imports;
- **Landing Permit Fee (LPF)**: Charged at a flat rate of 2.5 per cent of AV on imports in excess of Taka 100,000, except for Government imports.

Tariffs charged on the representative vehicle categories are set out in Table 3.8. 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 SCF. Table 3.9 sets out breakdown of vehicle purchase costs.

Table 3.8 Tariffs Applicable to Representative Vehicles and Tyres

Category	DS	AIT	LPF	CD	SD	VAT
Medium Truck	2.5%	3%	2.5%	5%	-	15%
Small Truck	3.7%	3%	2.5%	17%	-	15%
Large Bus	3.5%	3%	2.5%	7.5%	-	15%
Mini Bus	2.5%	3%	2.5%	5%	-	15%
Micro Bus	2.7%	3%	2.5%	40%	-	16%
Utility (Jeep)	2.4%	3%	2.5%	35.5%	26%	26%
Car	3.7%	3%	2.5%	34%	-	16%
Baby Taxi	3.6%	3%	2.5%	15%	12%	15%
Motor Cycle	2.6%	3%	2.5%	15.5%	-	19%
All tyres	3.5%	3%	2.5%	32%	-	20%

Source: National Board of Revenue and Dealer's Survey 2002

Table 3.9 New Vehicle Purchase Costs (Taka in 2002 Prices)

Category	CIF	Tariffs	Assembly & Other	Total Financial	Total Economic
Medium Truck	734,600	152,430	652,770	1,539,800	1,256,816
Small Truck	564,000	215,212	465,868	1,245,080	936,694
Large Bus	1,764,576	185,280	1,137,719	3,087,575	2,674,751
Mini Bus	631,646	31,587	592,300	1,255,533	1,105,486
Micro Bus	590,000	385,000	325,000	1,300,000	850,000
Utility (Jeep)	817,824	841,039	930,137	2,589,000	1,561,934
Car	595,000	345,000	175,000	1,115,000	735,000
Baby Taxi	76,994	38,257	92,249	207,500	150,793
Motor Cycle	71,939	26,643	22,468	121,049	89,913

Source: Dealer's Survey 2002

3.5 Consumable Costs

3.5.1 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 not common, as is shown in Table 3.10. Table 3.11 sets out a breakdown of new tyre prices for each of the representative vehicle types.

Table 3.10 Use of Re-treaded Tyres

Item	Med Truck	Small Truck	Large Bus	Mini Bus	Micro Bus	Utility	Car	Tempo	Baby Taxi
% of RT usage	20%	30%	27%	32%	43%	13%	30%	27%	28%
Cost Tk per Tyre	3,190	1,907	2,967	2,193	900	500		433	286

Source: Vehicle operators survey 2002

Table 3.11 Cost of New Tyres (Taka 2002 Prices)

Category	Tyre Size	Make	CIF Cost	Tariffs	Other Costs	Financial Cost	Economic Cost
Medium Truck	10.00x20-16PR	Dunlop	5661	3171	1592	10424	6935
Small Truck	7.50x20-12PR	Dunlop	2752	2147	561	5460	3201
Large Bus	9.00x20-14PR	Dunlop	5121	3614	743	9478	5715
Mini Bus	7.50x20-12PR	Dunlop	2752	2147	561	5460	3201
Micro Bus	5.50x13-6PR	Dunlop	998	742	380	2120	1302
Utility (Jeep)	205-R16	Dunlop	4300	2623	841	7764	4973
Car	155-SR13	Dunlop	1254	933	355	2542	1538
Auto Rick	4.00x8-6PR	Falcon	463	324	51	838	504
Motor Cycle	Front 2.5-18 4PR	Dunlop	346	243	111	700	435
	Rear 3.0 –17 4PR	Dunlop	415	290	139	844	526

Source: Vehicle operators survey 2002

3.5.2 Fuel and Lubricants

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

Table 3.12 Economic and Financial Costs of Fuel (Taka per litre in 2002)

Item	Petrol		Diesel		Lubricating Oil	
	Financial	Economic	Financial	Economic	Financial	Economic
CIF	9.28	9.28	9.28	9.28	20.47	20.47
Tarrifs	8.05	0.00	8.05	0.00	9.57	0.00
Service charge & fees at port area	0.34	0.27	0.34	0.27	15.64	12.51
Estimated implicit tax, service charge at petrol pump and profit margin	10.34	3.10	-0.66	0.66	54.33	26.30
Total	28.00	9.55	17.00	10.21	100.00	32.97

Source: Bangladesh Petroleum Corporation 2002

Notes: (1) $1=Taka 57
(2) 30% of the financial value is taken as service charge & profit margin
(3) Service charge for lubricating oil includes Tk 10.00 more for packaging

(4) Assuming 25% GTX and 75% other types of mobil being used
(5) Assuming 50% mobil and 50% other types of lub. oils being used

3.6 Vehicle Maintenance Policies and Costs

The majority of the operators interviewed maintained their own vehicles as shown in Table 3.13. Most operators serviced vehicles on a time related basis, with some exception in case of car and small truck.

Table 3.13 Vehicle Maintenance Policies

Policy	Med Truck	Small Truck	Large Bus	Mini Bus	Micro Bus	Utility	Car	Motor Cycle	Temp	Baby Taxi
Maintained by owners	100%	100%	100%	100%	100%	100%	100%	100%	100%	98%
Maintained in garage	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%
Time related	86%	70%	86%	92%	75%	88%	73%	98%	84%	96%
Distance related	14%	26%	13%	0%	13%	12%	27%	2%	0%	0%
Requirement related	0%	4%	1%	8%	0%	0%	0%	0%	16%	4%

Source: Vehicle operators survey 2002

The annual costs of maintaining the representative vehicles were estimated from the operators' surveys and is set out in Table 3.14. Costs were highest for large buses, which appears to be realistic from the point of view of their high utilisation. The average maintenance labour cost per hour for all vehicles, assuming a 200 working hours per month, was 56 Taka.

Table 3.14 Annual Financial Cost of Vehicle Maintenance (Taka 2002 prices)

Item	Medium Truck	Small Truck	Large Bus	Mini Bus	Micro Bus	Utility	Car	Motor Cycle	Tempo	Baby Taxi	Average
Spare parts	38,455	24,328	57,236	38,504	22,538	29,814	15,716	2,638	12,262	30,173	27,166
Maint. Labour	17,779	7,889	27,367	17,025	9,528	8,860	8,980	2,619	6,507	4,807	11,136
Total	56,234	32,217	84,603	55,529	32,065	38,674	24,696	5,257	23,213	17,069	36,956

Source: Vehicle operators survey 2002

3.7 Crew Costs

Driver and helper costs are set out in Table 3.15. 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 3.15 Crew Wage Costs (Taka 2002 prices)

Cost Parameters	Med Truck	Small Truck	Large Bus	Mini Bus	Micro Bus	Utility	Car	Baby Taxi
Driver per month	5378	4331	13979	6340	4227	5055	3593	3457
Helper per month	2181	1933	6235	4752	none	none	none	none
Driver per hour	27	21	49	27	23	25	21	17
Helper per hour	10	10	19	14	0	0	0	0
Total financial/hour	36	31	68	40	23	25	21	17
Total economic/hour	29	24	54	33	19	20	17	14

Note: Vehicle operators survey 2000 inflated to 2002 prices

3.8 Overhead Costs

Overhead costs are set out in Table 3.16. 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 over half of overheads in case of medium truck and significant proportions in respect of buses and other trucks.

Table 3.16 Annual Overhead Costs (Taka 2002)

Item	Medium Truck	Small Truck	Large Bus	Mini Bus	Micro Bus	Utility	Car	Motor Cycle	Tempo	Baby Taxi
Insurance	4,000	1,000	9,000	5,000	3,000	5,500	1,000	200	-	500
Taxes	5,000	4,000	2,000	5,500	5,000	3,500	3,500	1,000	-	1,000
Tolls	77,000	11,500	154,333	9,000	8,000	8,000	13,000	2,500	12,000	-
Office	24,000	6,000	50,667	15,000	11,000	17,000	15,000	-	4,000	8,000
Garage	8,000	5,000	50,833	8,000	4,000	4,000	7,000	-	3,000	2,600
Other	17,000	10,000	27,000	2,000	8,000	8,000	8,000	-	3,000	12,000
Total Fin	135,000	37,500	293,833	44,500	39,000	46,000	47,500	3,700	22,000	24,100
Total Econ	76,100	25,450	183,800	32,700	28,400	36,900	34,900	950	13,600	23,100

Source: Vehicle operators survey 2002

3.9 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 3.17

Table 3.17 VOC Inputs

Item Cost	Unit	Medium Truck		Small Truck		Large Bus		Mini Bus		Micro Bus		Utility		Car		Auto Ricksaw		Motor Cycle	
Unit Costs		Fin	Econ	Fin	Econ	Fin	Econ	Fin	Econ	Fin	Econ	Fin	Econ	Fin	Econ	Fin	Econ	Fin	Econ
Purchase cost of vehicle	Tk'000 per vehicle	1540	1257	1245	937	3088	2675	1256	1106	1300	850	2589	1562	1115	735	208	151	121	90
Cost of new tyre	Tk per tyre	10424	6935	5460	3201	9478	5715	5460	3201	2120	1302	7764	4973	2542	1538	838	504	772	480
Maintenance labour cost	Tk per hour	56	45	56	45	56	45	56	45	56	45	56	45	56	45	56	45	56	45
Overhead cost	Tk '000 per annum	135	104	38	27	182	140	44	31	39	28	45	34	47	34	20	14	4	2
Crew cost	Tk per hour	36	29	31	24	68	54	40	33	23	19	25	20	21	17	17	14	Not applicable	
Fuel cost	Tk per litre	17	10	17	10	17	10	17	10	28	10	28	10	28	10	28	10	28	10
Lubricant cost	Tk per litre	100	33	100	33	100	33	100	33	100	33	100	33	100	33	100	33	100	33
Utilisation																			
Annual km driven	Kms per annum	55,000		25,000		120,000		60,000		36,000		36,000		40,000		31,000		13,000	
Annual hours driven	Hrs per annum	2,600		2,100		3,350		3,000		2,340		2,700		2,240		3,240		1,490	
Average service life	Years	11		8		10		12		10		13		10		8		8	
Physical Characteristics																			
Manufacturers GVW	Kg	15,660		5,200		12,500		9,000		2,150		2,800		1,510		580		Not available	
TARE weight	Kg	4,015		2,750		4,145		3,300		1,180		1,930		998		200		96	
Axles	Number	2		2		2		2		2		2		2		2		2	
Tyres	Number	6		6		6		6		4		4		4		3		2	
Fuel type	Type	Diesel		Diesel		Diesel		Diesel		Petrol		Petrol		Petrol		Petrol/Oil		Petrol	
HDM Parameters																			
HDM- 4 vehicle type	Code	10		8		15		14		12		7		4		1		1	
MaintenanceModel	Rotation Coefficient	1.00		1.00		0.85		1.00		1.00		0.85		1.00		1.00		1.00	
Life Model	Type	Constant		Constant		Constant		Constant		Constant		Constant		Constant		Constant		Constant	

3.10 Estimation of Unit Vehicle Operating Cost

3.10.1 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 3.18).

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 modelled represents a Baby Taxi and that the larger Tempo will have higher operating costs.

Non Motorised Transport costs have been incorporated in the modelling 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 3.18 Assignment of Representative Vehicle Types

RHD Category	HDM Representative Vehicles	HDM Vehicle Code
Articulated Truck	Articulated Truck	11
Medium Truck	Heavy Truck	10
Small Truck	Light Truck	8
Large Bus	Heavy Bus	15
Mini Bus	Medium Bus	14
Micro Bus	Mini Bus	12
Utility	Four Wheel Drive	7
Car	Large Car	4
Auto Rickshaw	Motorcycle	1
Motor Cycle	Motorcycle	1
Cycle Rickshaw	Rickshaw	NMT 2
Cart	Cart	NMT 3
Bicycle	Bicycle	NMT 1

3.10.2 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 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 per cent and the constant life model was therefore adopted for all vehicle types.

The economic VOC per km resulted through HDM run at different roughness levels are presented according to vehicle type (motorised and non-motorised) in Table 3.19 and 3.21 respectively.

Table 3.19 Sensitivity of Motorised VOC to Road Roughness (Taka/km)

International Roughness Index (IRI)	Medium truck	Small Truck	Large Bus	Minibus	Microbus	Utility	Car	Auto Rickshaw	Motor Cycle
2	10.82	7.94	10.00	5.79	6.09	7.22	5.23	1.49	1.45
3	10.91	7.98	10.10	5.84	6.12	7.28	5.26	1.49	1.46
4	11.37	8.24	10.79	6.14	6.35	7.67	5.46	1.54	1.49
5	11.83	8.60	11.50	6.45	6.61	8.13	5.69	1.60	1.53
6	12.23	9.10	12.17	6.76	6.89	8.66	5.95	1.66	1.58
7	12.55	9.65	12.82	7.06	7.20	9.21	6.25	1.73	1.64
8	12.95	10.23	13.53	7.37	7.55	9.80	6.58	1.80	1.69
9	13.44	10.81	14.31	7.70	7.93	10.42	6.93	1.88	1.76
10	14.00	11.39	15.13	8.05	8.32	11.04	7.29	1.97	1.82
11	14.62	11.96	15.99	8.42	8.72	11.65	7.66	2.06	1.90
12	15.26	12.52	16.86	8.80	9.12	12.27	8.03	2.06	1.97
13	15.93	13.06	17.74	9.18	9.52	12.87	8.40	2.25	2.04
14	16.61	13.59	18.63	9.57	9.92	13.46	8.77	2.35	2.11
15	17.30	14.10	19.52	9.96	10.32	14.05	9.13	2.45	2.18

Unit operating costs for all types of motorised vehicle except car are somewhat higher than those of the previous year. The main reason for this is the higher vehicle, particularly the CIF price. Besides, there is some increase in the overhead and fuel costs. However, the unit cost is found lower in case of car. This is because of the fact that in the last year study report there was some over estimation in the pricing of car.

It may be mentioned that though the unit operating costs are generally higher this year, they are still below the tariff and fair in the transport market as set out in the following table.

Table 3.20 Comparison of Tariffs and Economic VOC (Taka/km)

Tariff & Economic VOC	Medium Truck	Large Bus	Mini Bus
Average Tariff & Fare*	13.4	28.8	16.0
Average of VOC at IRI=4 to 10	12.6	12.9	7.1

*Source: Vehicle operators survey 2002

Table 3.21 Sensitivity of NMT VOC to Road Roughness (Taka/km)

International Roughness Index (IRI)	Bicycle	Rickshaw	Animal Cart
2	0.37	0.78	3.44
3	0.41	0.90	3.79
4	0.45	1.02	4.15
5	0.49	1.14	4.51
6	0.53	1.27	4.89
7	0.57	1.39	5.25
8	0.61	1.51	5.63
9	0.65	1.64	6.02
10	0.70	1.76	6.43
11	0.74	1.89	6.83
12	0.79	2.01	7.25
13	0.83	2.14	7.69
14	0.88	2.27	8.15
15	0.93	2.40	8.63

Cost of energy item i.e fodder for the bullock as well as food for cyclist/ ricksaw puller have not been taken into account. No overhead cost is generally involved for this type of vehicles. Parameters like repair and maintenance of NMT, depreciation, interest and crew costs have been taken into consideration for estimation of VOC as produced through HDM run. It may be mentioned that the VOC for the animal cart is relatively more sensitive to roughness mainly due to its typical operating characteristics.

The economic VOC per km for motorised and non-motorised vehicles are presented according to vehicle type in Figures 3.1 and 3.2 respectively. Share of various components of motorised voc in respect of two different levels of road roughness are presented in figure 3.3 and 3.4.

FIGURE 3.1 SENSITIVITY OF MOTORISED VOC TO ROAD ROUGHNESS

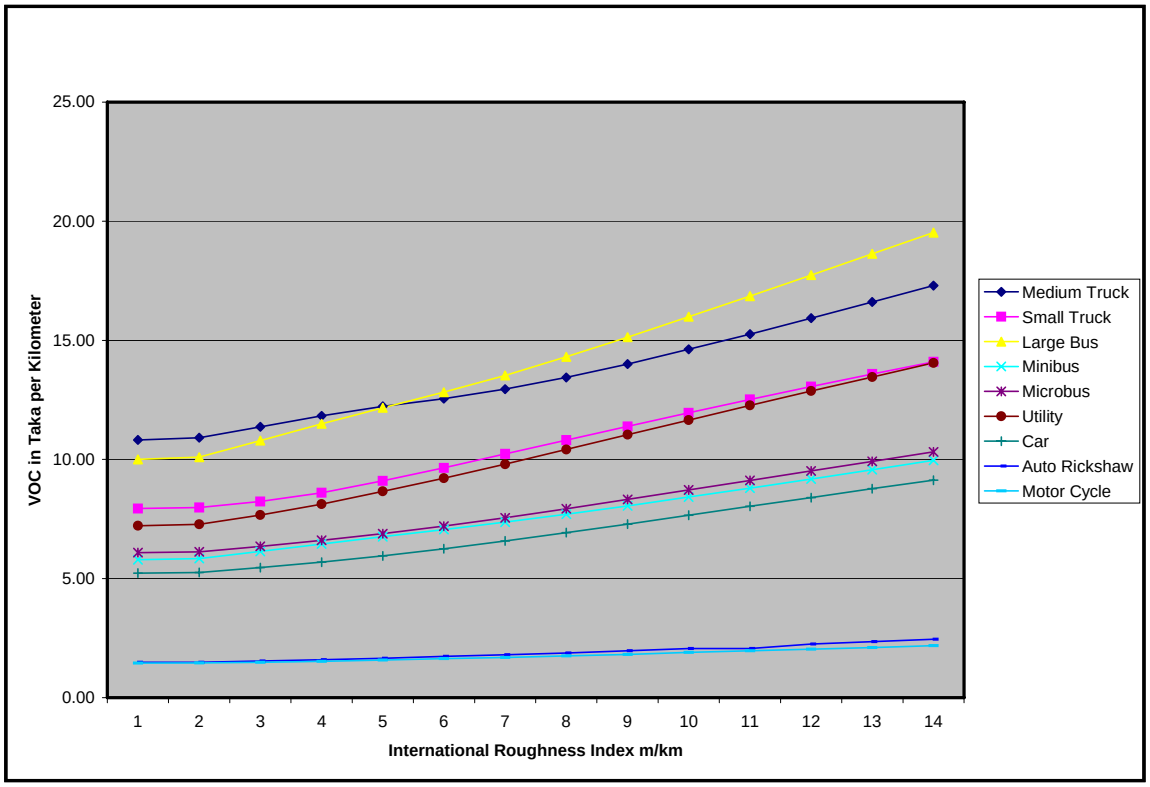


FIGURE 3.2 SENSITIVITY OF NON-MOTORISED VOC TO ROAD ROUGHNESS

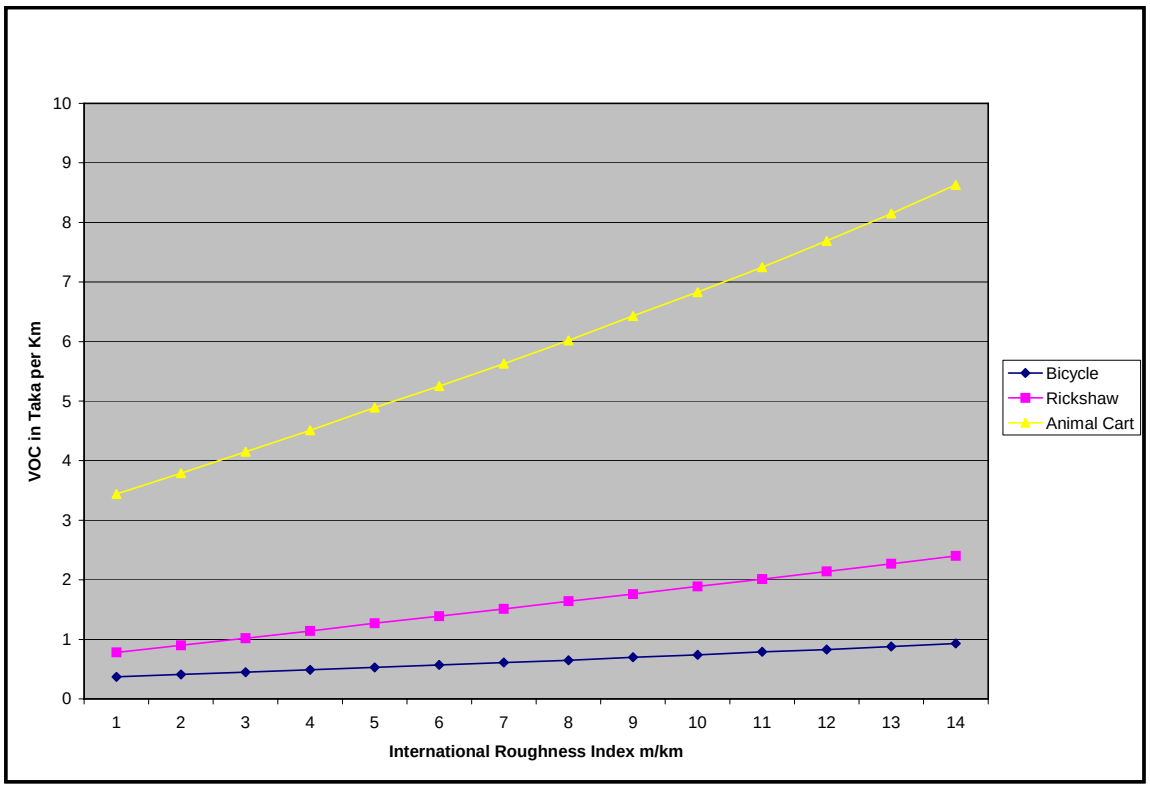


FIGURE 3.3 BREAKDOWN OF MOTORISED VOC COMPONENTS at IRI 4

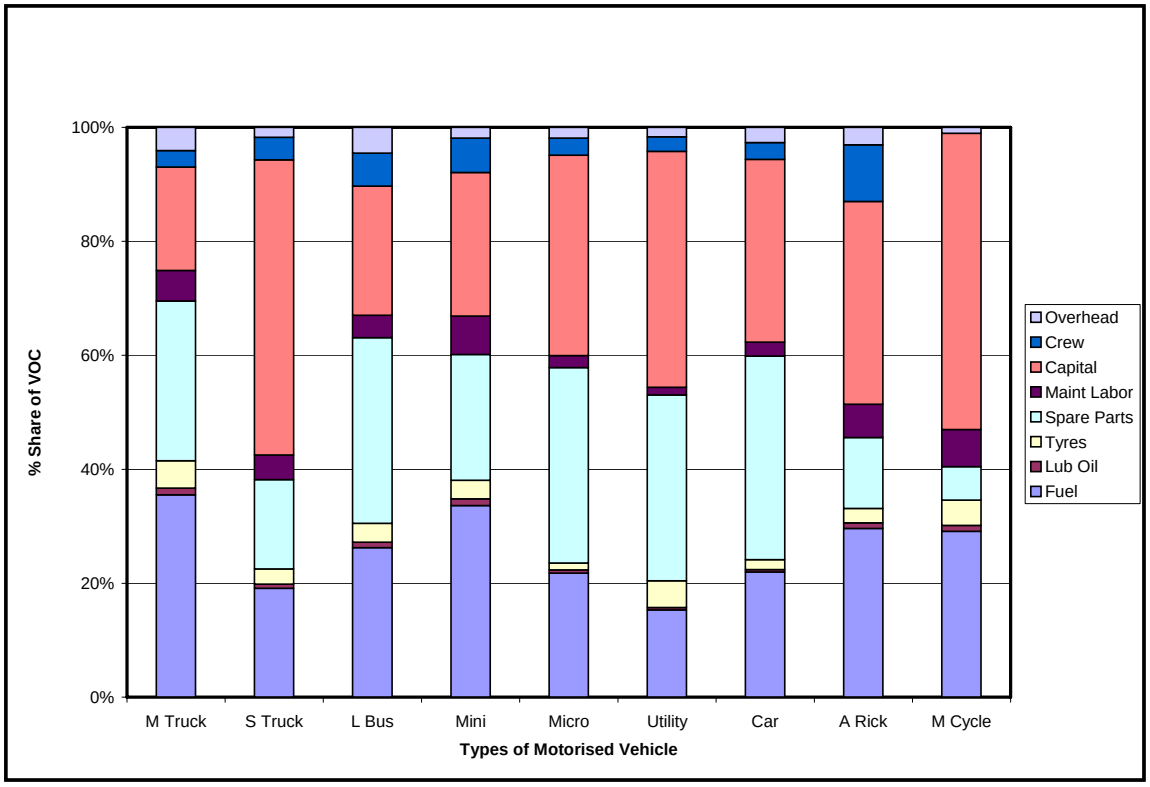
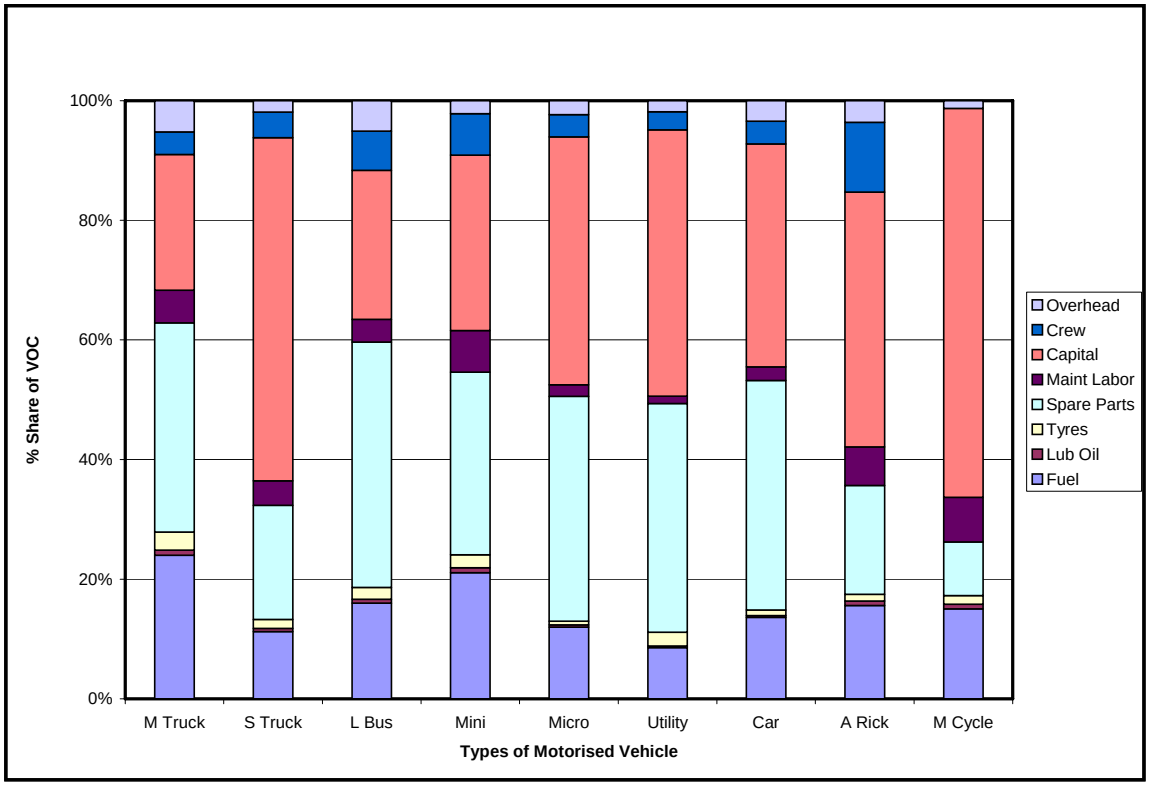


FIGURE 3.4 BREAKDOWN OF MOTORISED VOC COMPONENTS at IRI 10



4 TRAVEL TIME COSTS

4.1 General

Travel Time Costs (TTC) also referred to as Values of Time (VOT) are an important component of road user costs. The concept of travel time costs is based around the premise that time spent in travelling has an “opportunity cost” and could be used in an alternative activity which also produce or may produce some significant utility (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.

TTC may vary from country to country, even from project to project in the same country. This can vary in size from 20 per cent of total RUC to over 80 per cent 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 road users. In case of the construction of a major new bridge to replace a ferry for example, TTC will be very significant compared to a road improvement project without any change in its alignment. 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 specialised in its application and is not considered in the RHD 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 Thana in Dinajpur. 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.

4.2 Methodology

The Economics Circle started to undertake annual TTC surveys in four major divisional cities since 1997 both on main and feeder 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.

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 travellers 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 (net of tax but including employers costs directly associated with the employment) and the value for NWT as a proportion of the wage rate (35 per cent according to advice from the United Kingdom's Transport Research Laboratory).

The Economics Circle has been undertaking TTC survey every year as a part of RHD RUC Annual Report. The circle has already published three RUC reports for the years 1998/99, 1999/2000 and 2000/01. As a part of this study report, TTC survey was conducted by the Economics Circle during first quarter of 2002.

4.3 Summary of Survey Results

This section sets out a summary of the main and feeder road travel time surveys conducted in 2002. Details of TTC methodology can be found in Economics Working Paper E7. Tables 4.0 and 4.1 set out the distribution of trip purpose for main road and feeder roads respectively.

Table 4.0
Percentage Distribution of Vehicle Occupants by Trip Purpose (Main Road)

Trip Purpose/ Vehicle Type	A/C Bus	C/C Bus	O/C Bus	Mini Bus	Micro Bus	Car	Tempo	Auto Rick	Motor Cycle
Journey to Work	7	17	9	16	7	5	37	18	10
Employers Business	22	15	12	9	5	6	14	11	29
Own Business	26	17	15	12	14	18	14	15	25
Family and Social	36	50	54	55	63	54	24	44	28
Other	9	1	10	8	12	17	10	12	8
Total	100	100	100	100	101	100	99	100	100

Note: A/C =Air Conditioned, C/C= Chair Class, O/C= Ordinary Class.

Table 4.1
Percentage Sample Distribution of Vehicle Occupants by Trip Purpose (Feeder Road)

Trip Purpose/ Vehicle Type	O/C Bus	Mini Bus	Micro Bus	Car	Auto Rick	Tempo	Motor Cycle
Journey to/from Work	7	14	10	0	15	17	9
Employers Business	16	12	25	0	8	12	52
Own Business	18	14	0	0	31	19	28
Family and Social	56	57	55	67	41	47	10
Other	2	4	10	33	5	6	2
Total	99	101	100	100	100	101	101

Source: Travel Time Cost Survey 2002.

Tables 4.2 and 4.3 show the distribution of occupations according to main road and feeder road users respectively.

Table 4.2
Percentage Sample Distribution of Vehicle Occupants by Occupation (Main Road)

Occupations/ Vehicle Type	A/C Bus	C/C Bus	O/C Bus	Mini Bus	Micro Bus	Car	Auto Rick	Tempo	Motor Cycle
Labor	0	1	2	2	0	0	4	1	0
Farming/Fishing	0	1	7	7	0	0	0	6	0
Shop Employee	0	1	3	1	2	0	10	4	0
Peon	0	0	1	1	0	0	1	1	0
Salesman	0	2	2	6	0	0	10	7	0
Mechanic/Driver	0	1	5	6	0	0	5	5	0
Office Worker	9	15	12	16	2	12	23	12	26
Student	14	16	14	12	12	5	12	12	8
Professional	3	6	5	4	5	11	6	7	4
Officer	25	21	11	8	26	20	3	9	19
Unemployed	1	1	0	1	2	2	2	2	4
Housewife	9	8	11	9	7	12	2	7	0
Guard	0	0	1	0	0	0	1	0	0
Domestic Servant	0	0	0	0	0	0	1	0	0
Businessman	34	25	20	23	42	35	16	24	38
Other	5	2	6	4	2	3	3	3	0
Grand Total	100	100	100	100	100	100	100	100	100

Source: Travel Time Cost Survey 2002.

Table 4.3
Percentage Sample Distribution of Vehicle Occupants by Occupation (Feeder Road)

Occupations/ Vehicle Type	O/C Bus	Mini Bus	Micro Bus	Car	Auto Rick	Tempo	Motor Cycle
Labor	4	5	0	0	0	2	0
Farming/Fishing	14	13	5	0	13	13	3
Shop Employee	2	2	0	0	0	3	0
Peon	0	0	0	0	0	1	0
Salesman	1	5	0	0	3	0	0
Mechanic/Driver	2	4	10	0	13	3	0
Office Worker	17	14	10	0	13	13	17
Student	9	9	10	0	13	19	0
Professional	9	9	10	33	5	8	12
Officer	8	5	25	0	0	1	33
Unemployed	2	1	0	0	3	0	2
Housewife	3	8	5	0	3	7	0
Businessman	20	19	25	67	33	27	29
Other	7	8	0	0	3	4	3
Grand Total	100	100	100	100	100	100	99

Source: Travel Time Cost Survey 2002.

Tables 4.4 and 4.5 show the reported monthly household income of the respondents (gross of tax) by vehicle type. The results more or less accord with last years surveys and show the significant differences between main road and feeder road incomes and between different bus and vehicle types.

Table 4.4
Percentage Sample Distribution by Monthly Income (Main Road)

Income/ Vehicle Type	A/C Bus	C/C Bus	O/C Bus	Mini Bus	Micro Bus	Car	Tempo	Auto Rick	Motor Cycle
<1000	0	0	0	0	0	0	0	0	0
1001-2000	0	0	7	4	0	0	7	0	0
2001-5000	0	13	13	28	13	0	43	31	0
5001-10000	39	42	53	52	20	21	33	28	50
10001-20000	44	32	20	12	40	58	17	38	41
20001-30000	13	13	4	4	27	11	0	3	9
30000+	4	0	3	0	0	10	0	0	0
Total	100	100	100	100	100	100	100	100	100

Source: Travel Time Cost Survey 2002.

Table 4.5
Percentage Sample Distribution by Monthly Income (Feeder Road)

Income/ Vehicle Type	O/C Bus	Mini Bus	Micro Bus	Car	Tempo	Auto Rick	Motor Cycle
<1000	3%	5%	0%	0%	0%	0%	0%
1001-2000	5%	10%	0%	0%	13%	13%	2%
2001-5000	52%	50%	30%	0%	54%	54%	26%
5001-10000	33%	21%	45%	0%	21%	21%	40%
10001-20000	6%	11%	15%	100%	5%	5%	24%
20001-30000	0%	2%	10%	0%	8%	8%	9%
30000+	1%	1%	0%	0%	0%	0%	0%
Total	100%	100%	100%	100%	100%	100%	100%

Source: Travel Time Cost Survey 2002.

4.4 Unit Travel Time Costs for Motorised Vehicle

The 2002-03 TTC are set out in Table 4.6. 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 the category 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 10.6% compared to last year value.

Table 4.6
Recommended Financial and Economic TTC For 2002-03 (National Average)

Vehicle Category	Occupancy Number	Financial		Economic	
		TTC per pass Taka/hr	TTC Taka per vehicle	TTC per pass Taka/hr	TTC Taka per vehicle
All Buses	40.7	18.3	745.3	14.7	596.2
Micro Bus	8	29.1	245.0	23.3	196.0
Car/Utility	4	32.9	118.6	29.0	116.0
Tempo	10	13.3	139.3	10.6	111.5
Auto Rickshaw	4	17.8	68.7	16.9	67.6
Motor Cycle	1	36.6	38.3	29.3	30.7

Observations:

- The unit TTC values are more or less consistent with the values of the previous study
- The large differences between the feeder road and main road transport markets as identified in the previous reports are considerably reduced in 2002 surveys

4.5 Unit Travel Time Costs for Non-Motorised Vehicle

Time values for non-motorised vehicle has been derived from the thesis "Quantification of the Effects of Non-motorised Transport and Roadside Activities" M Bari, November 1999. These are quantified as work time values. Non-work time values are estimated on assuming standard RHD 35%. The average value per person and per vehicle are estimated using the NMV journey characteristics data from Economics Circle survey in 2002.

Table 4.7 Travel Time Costs for Non Motorised Vehicles (1997 prices)

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
Rickshaw	2	9%	10	3.5	4.1	8.2
Bi-Cycle	1	23%	21	7.4	10.5	10.5

5 ACCIDENT COSTS

5.1 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 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 motorised 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 of the parameters require additional research which is hoped to be accomplished in future studies.

5.2 Estimating the Number of Road Traffic Accidents (RTA)

As 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 taking 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 in 2001 and published in the National Road Traffic Report 2001, Road Safety Cell under BRTA has been presented in table 5.0 and 5.1 according to severity and area.

Table 5.0
Nation-wide Casualties According to Severity and by Division and Metropolitan Area in 2001

Metropolitan Area /Division (excluding Metropolitan Area)	Number of Casualties			Total	Percentage
	Fatal	Grievous	Simple		
DMP	252	186	11	449	16
CMP	37	20	6	63	2
KMP	25	11	2	38	1
RMP	27	18	1	46	2
Dhaka	596	157	27	780	28
Chittagong	224	56	26	306	11
Sylhet	217	60	25	302	11
Khulna	181	38	13	232	8
Barisal	46	17	4	67	2
Rajshahi	424	79	22	525	19
Total	2029	642	137	2808	100

Source: National Road Traffic Accidents Report 2001

Table 5.1
Casualties According to Severity and by Road Environment in 2001

Road Environment	Casualties		Total	Percentage
	Fatal	Grievous & Simple		
Urban	542	331	873	31
Rural	1487	448	1935	69
Total	2029	779	2808	100

Source: National Road Traffic Accidents Report 2001

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 wide scale under-reporting of simple RTA, while the concerned agencies including the Bangladesh Police believe that fatal and grievous RTA are well reported.

But 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 that only 10% casualty 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. The percentages used in this accident costing exercise are shown in Table 5.2. 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.

Table 5.2
Estimated RTA on the basis of Reporting

Type	Bangladesh Polish 2001	Percentage of Reporting	Estimate of 100% Accidents in 2001
Fatal	2029	49%	4141
Grievous	642	19%	3379
Simple	137	7%	1957
Total	2808		9477

Source: National Road Traffic Accidents Report 2001

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 under-reporting 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. This is lower than that used at any time in the UK (early costings assumed a 6:1 ratio) and lower than that currently estimated for Nepal. Total RTA are set out in Table 5.3.

Table 5.3
Estimated Nationwide Total RTA (Casualty Plus PDO)

Casualty RTA	PDO multiplier	Estimated PDO	Total RTA
9,477	3	28,431	37,908

5.3 Valuation of Cost of Various RTA Components

5.3.1 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 surveys rely on accident victim surveys or average wage rate to estimate lost output, average incomes for motorised transport users have been determined by the TTC surveys undertaken in 2002 by the Economics Circle. Only the average income of a pedestrian had to be calculated additionally using an average per capita income of Taka 1,696 per month (BBS 2000) and 3% inflation rate to arrive at 2002 value. Table 5.4 shows the average incomes estimated for the different road user types and the relative casualty share estimated.

Table 5.4
Average Income and RTA Casualty Share by Road User Type (Taka 2002)

Item	Truck	Bus	Car	Rickshaw	Pedestrian
Average monthly income*	6,530	9,950	14,400	7,500	1,747
Average annual income	78,360	119,400	172,800	90,000	20,968
RTA casualty share**	5%	25%	5%	15%	50%

* Source: TTC survey 2002 & BBS 2000
** Source: As estimated by Accident Costs Specialist IDC 1998

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 2001 as available from Bangladesh Police has been presented in the following table.

Table 5.5
Fatal Casualties by Age Group in 2001

Age Group	Number of Fatalities			Total
	Driver	Passenger	Pedestrian	
0 - 5	1	14	54	69
6 - 10	2	17	154	173
11 - 15	7	21	74	102
16 - 20	29	64	55	148
21 - 25	20	91	70	181
26 - 30	40	91	71	202
31 - 35	53	101	66	220
36 - 40	22	51	49	122
41 - 45	13	51	51	115
46 - 50	11	42	56	109
51 - 55	4	16	37	57
56 - 60	2	15	41	58
61 - 65	1	8	36	45
66 - 70	2	9	28	39
70 - 75	1	5	9	15
> 75	0	3	8	11
Unknown	136	260	326	722
Total	344	859	1185	2388
%	14%	36%	50%	100%

The net lost output for a RTA fatality was based on the following assumptions:

- Average lost working years = 27 (average retirement age 57 years - average age of RTA fatality 30 years as calculated on the basis of above table)
- Annual discount rate of 12% and average GDP per capita growth rate 3.1% (average of the different growth rates over the analysis period considered)
- 30% of per capita is taken to be personal consumption.

The present values of lost output for each user category are set out in Table 5.6. The average lost output is Taka 758,394.

Table 5.6
Lost Output by Road User Type (Taka in 2002)

Lost Output Parameters	**Truck**	**Bus**	**Car**	**Rickshaw**	**Pedestrian**	**Average**
Present Value of Lost Output	895107	1363907	1973895	1028070	239514	1100098
RTA casualty Share in percent	5	25	5	15	50	100
RTA casualty Share in amount	44755	340977	98695	154211	119757	758394

Injuries and Recovery time

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. Both days spent recuperating with simple injuries have 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 prepared by IDC consultant are applied to the casualty cost in order to arrive at the RTA cost.

Table 5.7
Lost Output Casualty Costs (Taka in 2002)

Category	Per casualty Cost	Fatal RTA		Grievous RTA		Simple RTA	
		Number	Cost	Number	Cost	Number	Cost
Fatality	530,876	1.7	902,489	0	0	0	0
Grievous	5,809	1.4	8,133	1.7	9,876	0	0
Simple	443	1.4	620	2.2	974	1.5	664
Total	537,128		911,242		10,850		664

5.3.2 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, x-rays, 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 out-patient 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 14,400/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 480 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 out-patient 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 5.8
Medical Costs per RTA Casualty (Taka 2002)

Category	Per casualty Cost	Fatal RTA		Grievous RTA		Simple RTA	
		Number	Cost	Number	Cost	Number	Cost
Fatality	600	1.7	1,020	0	0	0	0
Grievous	5,040	1.4	7,056	1.7	8,568	0	0
Simple	720	1.4	1,008	2.2	1,584	1.5	1,080
Total	6,360		9,084		10,152		1,080

5.3.3 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 costings 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 5.9. The term "human costs" is used to refer to this expanded component.

Table 5.9
Human Costs (Taka 2002)

Category	Per casualty Cost	Fatal RTA		Grievous RTA		Simple RTA	
		Number	Cost	Number	Cost	Number	Cost
Fatality	318,526	1.7	541,494	0	0	0	0
Grievous	3,486	1.4	4,880	1.7	5,925	0	0
Simple	266	1.4	372	2.2	584	1.5	398
Total	322,277		546,745		6,510		398

5.3.4 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 2002 survey of operators conducted by the Economics Circle. This data is summarised in Table 5.10.

Table 5.10
Average Vehicle Damage Costs from 2002 Operators Survey
(Taka per vehicle 2002)

Cost component	Medium Truck	Small Truck	Large Bus	Mini Bus	Utility	Car	Tempo	Auto Rick
Damage	63,700	68,300	10,5000	11,000	13,500	13,000	7,000	3,000
Lost earnings	18,000	27,000	136,000	8,000	-	8,500	4,750	2,350
Total Costs	81,700	95,300	241,000	19,000	13,500	21,500	11,750	5,350

In addition, vehicle claim data was provided by one large private insurance company which 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 2002 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 61,000 per simple accident was therefore adopted which accords with the weighted average values from the operators' survey. Then factors 1.5 and 2.0 were applied to arrive at the grievous and fatal accidents cost respectively. Table 5.11 sets out the resultant costs.

Table 5.11
Average Vehicle Related Costs per Accident (Taka 2002)

Severity	Unit costs
Fatal	122,275
Grievous	91,706
Simple	61,138
PDO	3,057

5.3.5 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 1,200 is suggested for general administrative costs.

5.4 Total Road Accident Cost Estimates

5.4.1 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 costings include:

1. loss of earnings of carer (i.e. family member must give up work to provide home care);
2. work replacement cost, i.e. training to the replacer;
3. travel time delay from accidents, including that from road blockades occasionally created after accidents;
4. clearing up of accident spot/scene;
5. leisure time lost in the post working years;
6. 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.

5.4.2 Average Accident Cost by Severity

Table 5.12 shows the total cost of each RTA by severity and according to various cost components.

Table 5.12
Total Accident Costs By Severity Type And Cost Component
(Taka '000)

Component	Fatal	Grievous	Simple	PDO
Lost output	911.2	10.8	0.7	0.0
Medical costs	9.1	10.2	1.1	0.0
Human costs	546.7	6.5	0.4	0.0
Vehicle damage	122.3	91.7	61.1	3.1
Administration	1.2	1.2	1.2	1.2
Total	1590.5	120.4	64.5	4.3

According to the above cost estimates, a fatal RTA costs 13 times that of a grievous RTA and 25 times than that of a simple RTA. Property damage only accidents have been estimated at only 7% 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.

5.4.3 National Road Traffic Accident Costs

Table 5.13 sets out the sum of all accident cost components for the total number of estimated accidents in 2001. The total cost of all road accidents, including PDO, has been conservatively estimated at Tk 7,240 million (Tk 724 Crore or US$125 million). The vast majority of the costs are due to casualty accidents with property damage only accidents accounting for less than 1.67 per cent of total costs.

Table 5.13
Annual National RTA Costs in 2002 (Taka)

Item	Number of Accidents	Average Cost per accident ('000 Tk)	Total Cost (million Tk)
Fatal RTA	4,141	1,591	6,586
Grievous RTA	3,379	120	407
Simple RTA	1,957	64	126
Total casualty RTA	9,477		7,119
PDO RTA	28,431	4	121
Total RTA	37,908		7,240
Average Casualty RTA Cost			0.76

The average casualty RTA is estimated to cost Tk 764,000 (US $13,000), while the total annual RTA costs amount to Taka 7,240 million (US$ 127 million). It means that the total annual national accident cost is equal to 0.3 per cent of Gross National Product in 2000-01 (see Table 5.14.) This is 50% less than the previously assumed global amount of 0.6 per cent. The main reason for the fall of the total accident costs during year under study is the reduction of the number of accident as published in the National Road Traffic Accident Report 2001. Perhaps this is due to the large scale under-reporting /recording of the accident as is mentioned in the national accident report. It may also be due to the road improvement and safety measures taken by the government in recent years, showing a positive impact on national road traffic accident rate.

However, when it is considered that the whole analysis is based on conservative assumptions the amount estimated in Table 5.14 is almost certainly the minimum cost to society. The true cost is probably much higher and causes an unacceptable waste of life as well as scarce resources of Bangladesh.

Table 5.14
Total Annual Accident Costs as Proportion of GDP

Item	Taka Million	US$ Million
Estimated Total Annual Accident Costs	7,240	127
Gross Domestic Product at 2000-01 current market prices	2,582,679	45,310
Accident Costs %GDP	0.3%	0.3%

Note: US$1=57 Taka

5.5 Conclusions and Recommendations

5.5.1 Significance of this findings

Accident cost analysis in Bangladesh is still in its premature stage. A good many assumptions had to be made in carrying out the exercise. However efforts are always active to reduce the number of such assumptions and to make the analysis more fact-based.

The analysis has proved that accident costs are quite significant in Bangladesh and represent 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 if the scale of the losses is not to hold back the wheel of development and if there is an intention to reduce the loss of human life.

5.5.2 Areas for Further Research

A main area of work in this accident costing business was the estimation of the actual number of road accidents. Some progress could however be made in respect of knowing the number of accidents according severity, though further research is required on this fundamental problem as an accurate assessment of the overall accident situation has not yet been possible. More research is also required on the weightage 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.

5.5.3 Application of Accident Costs

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. It is hoped that the accident reporting system introduced under IDC using the MAAP5 accident analysis software will provide the data to derive these relationships. This will be a longer-term exercise as a reliable time series of data will have to be recorded before realistic relationships can be established.