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RHD ROAD USER COST ANNUAL REPORT For 1999-2000

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APPENDIX A UNIT VEHICLE OPERATING COSTS

1 INTRODUCTION

1.1 Background

Road user costs (RUC) consist of three components:

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

The importance of controlling road user costs is evident just when it is considered that the Bangladesh transport sector consumes some 1.4 million tonnes of petroleum products annually. And this is only one component of vehicle operating costs, which include among others vehicle capital and maintenance costs, all of which are a severe drain on scarce foreign exchange.

Bangladesh is developing a process of allocating to its highway network maintenance and development budgets according to an economic appraisal system HDM as well as RBEMS (Road and Bridge Economic Modelling System) aimed at minimising costs to road users. This system is now under a functional stage of development in Roads and Highways Department (RHD). The Institutional Development Component (IDC) Project funded by the Dpartment for International Development (DFID, UK) has been helping build this system since 1994 and is continuing to provide support over the next 3-4 years.

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 Network Management Wing under RHD undertakes this task. **This is the second annual road user cost report published by the Economics Circle.** It contains new vehicle operating and travel time costs updated on the basis of data collected through conducting field surveys of road users, transport owners/operators, garages and transport businesses.

The accident costs have not been changed from last years report pending a major research project by the Transport Research Laboratory of the United Kingdom in Bangladesh, though surveys were undertaken in 1999 to collect necessary data for this purpose.

Every vehicle on the road, whether it is motorised or non-motorised, incurs road user costs. The analysis systems used to date have concentrated on quantifying motorised RUC, and this report only considers motorised vehicles. However, a considerable effort has been made to develop RUC for non-motorised vehicles in Bangladesh under an IDC sponsored research project. These values may be available in 2000 and will hopefully be included in the next annual RUC report. This will tie in with the release of the World Bank's up-dated economic appraisal model, HDM-4, which includes provision for the modelling of non-motorised vehicle costs. The new RHD road maintenance planning management system is being constructed around HDM-4.

1.2 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 value of the resource to the economy. In the

economic jargon, this is temed as a “shadow” or "accounting" price of the resources in the economy. The shadow price of an 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 taxation elements as they reflect mostly a transfer of resources from one sector of the economy to another. On the other hand, subsidy element if any is included with the economic price . In case of imported inputs, economic costs were based on the border prices plus port handling, transport, assembly and retail costs (profit margin) duly shadow-priced. Local inputs of labour and materials were shadow-priced using the RHD Standard Conversion Factor of 0.8 (see Economics Working Paper E9 for details on shadow pricing.)

1.3 Structure of This Report

The report starts by examining 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.

A more detailed account of the work on each component is contained in the following IDC Economics Working Papers:

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

Appendix A contains detailed tables of unit VOC.

2 THE BANGLADESH VEHICLE FLEET

2.1 Vehicles Registered

Information on the Bangladesh vehicle fleet was collected from Bangladesh Road Transport Authority (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 vehicle (NMV) registrations, which are left to the local authorities to regulate. Non-registration is common and the actual number of NMV's is unknown. Given that this report is concerned with the operating costs of motorised vehicles no further consideration is put to NMV's in this report.

Table 2.0 shows BRTA figures for vehicles registered in Bangladesh between 1989 and 1998. It transpires from the table that motorcycles and autorickshaws account for nearly 59 per cent of the total fleet. Cars and Jeeps account for 26 per cent of registrations, while trucks/buses constitute 13 per cent.

The BRTA figures indicate that to date some 490,000 motorised vehicles have been registered in Bangladesh, equivalent to some four vehicles per 1000 capita, a very low level compared to other Asian countries. However, growth rates in registrations have been considerable: total vehicle registrations have grown at an average rate of 7.7 per cent per annum since 1989. The fastest growing category has been auto-rickshaws.

Table 2.0 Number of Registered Vehicles in Selective Years

Type	1989	1998	AAGR (%)
Car/Taxi	43,222	88,840	8.33
Jeep/Microbus	18,090	36,479	8.10
Bus	11,734	13,672	1.17
Minibus	7,542	12,520	5.79
Truck	23,978	38,900	5.52
Autorickshaw	19,796	73,497	15.69
Motorcycle	120,301	215,274	6.68
Other	7,102	11,534	5.54
Total	**251,765**	**490,806**	**7.70**

Source: Bangladesh Road Transport Authority (BRTA)
Note: AAGR=Average Annual Growth Rate

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 for traffic counting which categorises vehicles into one of ten standard groups, as set out in Table 2.1. No data is published on the makes and models of vehicle registrations by BRTA. It was, therefore, necessary to examine BRTA registration records to derive this information. This was a time consuming exercise as all records prior to 1995 are on paper. Registrations following this date are computerised which makes the task a lot easier.

A summary of the results for the two most popular makes of vehicle in each category is shown in Table 2.2. 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. 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 2.1 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, >36 foot chassis
Mini Bus	16-39 seats, <36 foot 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	All three wheeled motorised vehicles

Source: MCC Traffic Guide, P&D Wing RHD, June 1995
Note: The previous heavy truck category is re-named as articulated truck.

Table 2.2 Summary of Representative Vehicle Models by Category (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%	88%
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: Derived from BRTA data

As Bangladesh has no vehicle manufacturing sector all vehicle are imported, either completely built up (CBU) or completely knocked down (CKD). Most trucks, buses and auto-rickshaws are imported knocked down as chassis and engines, 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 (previously called heavy truck)

It was not possible to identify the number of articulated trucks 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, articulated trucks are not considered further in this report. However, it is intended to include them in next years report as the number is expected to increase in the future.

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 increase is symptomatic of the development of the economy and commercial liberalisation. At present the small truck market is dominated by second hand vehicles, and most especially converted ex-military Willy's Jeeps and old model Toyota Land Cruisers which have had a locally made flat bed added. It is not possible to identify the proportions of these vehicles from the BRTA registration statistics, which only show the number of new registrations. However, new vehicles are been 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. The chair class bus was 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 do not operate as public transport. Toyota dominates this category with its Hiace and Liteace 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 only account for a small proportion of the utility market and are not considered for separate modelling. A mid-range Pajero (2400 CC) was chosen for modelling. In 1999 a joint venture between Mitsubishi and Progati Industries Ltd, Bangladesh started to import Pajero's knocked down and manufacture bodywork locally. The cost of these vehicles is significantly less than the completely built up versions. The proportion of these vehicles in the market will be monitored and future costs adjusted if they achieve a significant market share.

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., part of the Bangladesh Steel and Engineering Corporation. However, only a small number were constructed and the market is now 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.

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.

2.3 Characteristics of Representative Vehicles

Table 2.3 sets out the physical characteristics of the representative vehicle types identified in the previous section.

Table 2.3A Vehicle Characteristics -Engine and Tyres

Category	Make	Imported as	Fuel	CC	Cylinders	Metric HP	No. Tyres	Type of Tyres
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/CKD	Petrol	2400	4	132	4	205 - R16
Car	Toyota Corolla Sedan 1300GL	CBU	Petrol	1300	4	110	4	155 - SR13
Auto Rick	Bajaj Baby Taxi	CKD	Petrol/ 5%Oil	145	1	5.52	3	4.0x8-6PR
Motor Cycle	Honda CG125	CBU/CKD	Petrol	125	1	11	2	Front 2.5 - 4PR Rear 3.0 -4PR

Table 2.3B 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 Rick	Bajaj Baby Taxi	1	200	580	1,900	745	1,020
Motor Cycle	Honda CG125	-	96	a	1900	745	1020

Source: Vehicle dealers' in Dhaka

Notes:

a - 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 VOC's is a complex procedure as costs are needed for the entire Bangladesh vehicle fleet, which consists of a plethora of vehicle types, and 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.

Given that the economic prioritisation of maintenance management is based on the World Bank's HDM programme, it follows that all other analyses should be conducted using the HDM parameters. This task is facilitated by the fact that the World Bank has produced a stand-alone version of the VOC sub model, the VOCM model, which is currently in its fourth version (VOCM4). This model will predict VOC's per km for a number of vehicle groups as a function of the physical characteristics of a road (structural number, geometry, surface type and current pavement condition) as specified by the model. Traffic congestion effects are not currently included in VOCM4 and are not modelled in this report.

It was intended to use the HDM-4 model, with its increased number of VOC relationships, in this second road user cost report but it was not fully released at the time of publication. Following its release the new relationships will be tested and calibrated for Bangladesh and the results published either in an interim report or next year's annual report.

This model, and the procedure set out in the World Bank Technical Paper 234 on Vehicle Operating Costs, were adopted for the derivation of the Bangladesh VOC's as follows:

1. Divide the vehicle fleet into groups of similar vehicles (Section 2.2);
2. Identify representative vehicle types for each group (Section 2.3);
3. Establish unit costs and characteristics of representative vehicles (Sections 3.2-3.6);
4. Compute average operating speed for each vehicle group (Section 3.7);
5. Compute amounts of resources used per vehicle kilometre by each group for each of the following components (Section 3.7):

    a. Fuel
    b. Tyres
    c. Maintenance parts
    d. Maintenance labour
    e. Lubricants
    f. Crew
    g. Depreciation
    h. Interest
    I. Overhead

6. Apply unit costs to the resource consumption amounts to obtain cost per vehicle kilometre for each vehicle group (Section 3.8).

The data inputs for the model were collected during May-June !999 in a survey of 480 owners/operators and various retail outlets in Dhaka, Chittagong, Rajshahi and Khulna city. The data was entered, processed and analysed and stored in the computer database of the Economics Circle .

3.2 Utilisation

3.2.1 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 3.0 shows utilisation rates for the operators surveyed. Large buses, operating on the intercity routes, are utilised for up to 81 per cent of the time available. Most other vehicles average around 60 per cent.

For modelling VOC's it is necessary to estimate how many kilometres a vehicle is driven for on average in a year and how many hours the vehicle is operated for. The data on vehicle utilisation colleceted through 1999 survey appear to be more or less same as that from the 1998 survey and is set out in Table 3.0. This shows that distances travelled by large buses are very high, reflecting their higher utilisation ratios. As would be expected the smaller vehicles are driven much less, with the exception of baby taxis, which are on the higher side of utilisation.

Table 3.0 Average Vehicle Utilisation

Category	Annual Km Driven	Annual Hours available	Annual Hours Driven	Utilisation Ratio (1)
Medium Truck	51,000	3100	1830	59%
Small truck	21,000	1900	1140	60%
Large Bus	120,000	3000	2440	81%
Mini Bus	56,000	3000	1710	57%
Micro Bus	31,000	3000	1652	55%
Utility (Jeep)	42,000	2800	1652	59%
Car	24,000	3300	2145	65%
Baby Taxi	52,000	3300	2079	63%
Tempo	14,000	3000	1800	60%
Motor Cycle	14,000	1348	809	60%

Source: Vehicle operators survey 1999
Note: (1) Hours driven as % of hours available

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 their vehicles (see Table 3.1). The results show quite long service lives with a minimum of seven years and maximum of thirteen years. On average the current ages of vehicles are half the service life. Table 3.1 also sets out the percentage of vehicles in the sample that were purchased second-hand. This shows that fifty six per cent trucks were purchased second hand. Most buses were purchased new as were microbuses, utilities and motorcycles. A small proportion of cars and autorickshaws were purchased second hand.

Table 3.1 Vehicle Age and Operational Life

Category	Average Age (Years)	Normal Service Life (Years)	Second Hand Purchases %
Medium Truck	9	11	45
Small Truck	9	8	67
Large Bus	4	10	5
Mini Bus	4	12	18
Micro Bus	4	10	13
Utility (Jeep)	5	13	0
Car	3	10	3
Baby Taxi	6	8	13
Tempo	7	7	8
Motor Cycle	4	8	0

Source: Vehicle operators survey 1999

3.2.2 Response of Operators to Road and Bridge Improvements

As part of the survey operators were asked what benefits they had experienced from 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. This determines how depreciation is modelled in the economic appraisal system.

The results showed that all operators interviewed had benefitted from road and bridge improvements (see Table 3.2). Most of the truck operators had changed operations, mainly by increasing the load. Large bus operators increased both the number and length of trips. Minibus operators made more trips whilst utility and car operators generally made longer trips.

Table 3.2 Operators Responses to Road Improvements (Percent of operators interviewed)

Response	Med Truck	Small Truck	Large Bus	Mini Bus	Utility	Car	Tempo	Baby Taxi
Benefitted	78	70	100	68	18	43	0	0
Change in operation	70	100	79	64	95	82	0	0
- More trips	15	0	48	86	0	22	0	0
- Longer trips	20	73	41	10	67	72	0	0
- Increase load	65	27	11	5	33	6	0	0

Source: Vehicle operators survey 1999

The operators were also asked what specific projects they had benefitted from. The three most beneficial projects are set out in Table 3.3. These are all new/recently constructed bridges, which replaced ferry services and hence gave substantial savings, especially in terms of travel time. On average the three bridges saved operators about 20 per cent of the travel time prior to opening.

Table 3.3 Savings in Travel Time and VOC to Operators For Specific Projects (Per cent saving compared with trip before opening)

Project	Saving	Med Truck	Large Bus	Mini Bus	Utility
Meghna-Gumpti Bridge	Time	20	20	8	17
	VOC	7	9	5	5
Kamarkhali Bridge	Time	15	18		20
	VOC		10		
Jamuna Bridge	Time	23			
	VOC	10			

Source: Vehicle operators survey 1999

3.3 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) had 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 is the Cost Insurance and 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 this 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)**: Customs duty charged at a percentage rate on the AV. These vary between 7.5 and 42.5 per cent for vehicle imports. Duty on trucks and buses has been reduced from 15 to 7.5 per cent since 1997 and increased from 15 to 42.5 per cent for baby taxis.
- **Development Surcharge (DS):** Charged at a uniform rate of 2.5 per cent of AV to directly fund development works;
- **Value Added Tax (VAT)**: Charged at a uniform rate of 15 per cent on the AV inclusive of customs duty;
- **Supplementary Duty (SD)**: Additional charge under the VAT Act, charged as a percentage rate on AV;
- **Advance Income Tax (AIT)**: Charged at a flat rate of 3.0 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 3.4. The CIF prices of the vehicle to Chittagong port are paid either in US dollar or Japanese Yen. Other costs include port dues, transport, assembly (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 3.5 sets out the cost breakdown.

Table 3.4 Tariffs Applicable to Representative Vehicles and Tyres November 1999

Category	DS	AIT	LPF	CD	SD	VAT

Medium Truck	2.5%	3%	2.5%	15%	-	15%
Small Truck	2.5%	3%	2.5%	30%	-	15%
Large Bus	2.5%	3%	2.5%	5%	-	15%
Mini Bus	2.5%	3%	2.5%	15%	-	15%
Micro Bus	2.5%	3%	2.5%	37.5%	-	15%
Utility (Jeep)	2.5%	3%	2.5%	37.5%	127.5%	15%
Car	2.5%	3%	2.5%	37.5%	52.5%	15%
Baby Taxi	2.5%	3%	2.5%	42.5%	25%	15%
Motor Cycle	2.5%	3%	2.5%	15%	-	15%
All tyres	2.5%	3%	2.5%	30%	-	15%

Source: National Board of Revenue

Key : DS = Development Surcharge charged on AV
AIT = Advanced Income Tax charged on AV
LPF = Landing Permit Fee charged on AV
CD = Customs Duty charged on AV
SD = Supplementary Duty charged on AV
VAT = Value Added Tax charged on AV+CD

Table 3.5 New Vehicle Purchase Costs – Taka 1999 Prices

Category	CIF	Tariffs	Assembly & Other Costs	Total Financial	Total Economic
Medium Truck	576,400	213,000	570,600	1,360,000	1,032,880
Small Truck	399,350	209,659	205,991	815,000	564,143
Large Bus	1,351,200	439,250	192,000	2,990,000	2,314,350
Mini Bus	469,700	174,200	651,100	1,295,000	990,580
Micro Bus	657,633	397,868	44,500	1,100,000	693,232
Utility (Jeep)	1,966,961	3,467,998	332041	5,700,000	2,232,594
Car	753,760	851,749	44,500	1,650,000	789,351
Baby Taxi	42,750	48,094	40,656	131,500	75,275
Motor Cycle	65,187	28,693	20,120	114,000	81,283

Source:Vehicle dealers' survey November 1999
Note: Small Truck and Baby Taxi presented as 1998 value

3.4 Consumable Costs

3.4.1 Tyre Costs

Tyres are imported from India, Japan, Malaysia and Taiwan with Indian tyres dominating the market (mainly because they are the cheapest.). The use of re-treaded tyres is not common, as is shown in Table 3.6. Table 3.7 sets out a breakdown of new tyre prices for each of the representative vehicle types. Tyres are subject to 53 per cent duties and taxes (see Table 3.4.)

Table 3.6 Use Of Re-treaded Tyres

Item	Med Truck	Large Bus	Mini Bus	Utility	Car	Tempo	Baby Taxi
Operators Using	-	13%	53%	3%	-	10	28%
Cost Tk per Tyre	-	3,500	2,800	460	-	400	380

Source: Vehicle operators survey 1999

Table 3.7 New Tyre Costs in Taka November 1999

Category	Tyre Size	Make	CIF	Tariffs	Other	Financial	Economic

			Cost		Costs	Cost	Cost
Medium Truck	10.00x20-16PR	Dunlop	4,001	3,077	3,077	10,258	6,565
Large Bus	9.00x20-14PR	Dunlop	3,204	2,361	2,783	8,432	5,093
Mini bus/small truck	7.50x20-12PR	Apollo	2,660	2,011	1,687	6,488	4,464
Micro Bus	5.50x13-6PR	Dunlop	547	419	820	1,823	839
Utility (Jeep)	205-R16	Dunlop	2,745	2,039	2,981	7,844	4,267
Car	155-SR13	Dunlop	830	629	1,031	2,515	1,278
Auto Rick	4.00x8-6PR	Falcon	270	202	354	843	418
Motor Cycle	Front 2.5-18 4PR	Dunlop	376	196	173	752	544
	Rear 3.0 -17 4PR	Dunlop	437	227	201	874	633

Source: Tyre dealers' survey November 1999

3.4.2 Fuel and Lubricants

Interviews with Bangladesh Petroleum Corporation (BPC) and an analysis of their data resulted in the breakdown of unit fuel costs set out in Table 3.8.

Table 3.8 Economic and Financial Costs of Fuel Taka per litre

Item	Petrol	Diesel	Lubricating Oil
CIF Chittagong	6.98	6.84	12.30
Port/refinery/retail	1.41	1.18	25.94
Tariffs	12.61	4.93	37.48
Financial price	**21.00**	**12.95**	**75.72**
Economic price	**8.39**	**8.02**	**38.24**

Source: Bangladesh Petroleum Corporation, July 1999

3.5 Vehicle Maintenance Policies and Costs

The majority of the operators interviewed maintained their own vehicles (see Table 3.9). Most operators serviced vehicles on a time related basis, with the exception of large buses which required distance related maintenance due to very high utilisation.

Table 3.9 Vehicle Maintenance Policies

Policy	Med Truck	Small Truck	Large Bus	Mini Bus	Utility	Car	Baby Taxi
Maintain own vehicles	90%	90%	90%	90%	60%	90%	75%
Garage maintained	10%	10%	10%	10%	40%	10%	25%
Time related servicing	95%	100%	97%	98%	70%	85%	100%
Distance related servicing	5%	0	3%	2%	30%	15%	0

Source: Vehicle operators survey 1999

The annual costs of maintaining the representative vehicles was estimated from the operators surveys and is set out in Table 3.10. Costs were highest for large buses, which is to be expected given their high utilisation. The average maintenance labour cost per hour was 50 Taka.

Table 3.10 Financial Cost Of Vehicle Maintenance (Taka)

Cost per annum	Medium	Small	Large	Mini	Micro	Utility	Car	Baby

	Truck	Truck	Bus	Bus	Bus			Taxi
Spare parts	55,100	17,400	100,325	52,100	29,733	46,887	22,770	9,160
Maintenance labour	22,164	9,240	13,788	18,936	16,092	22,200	11,436	5,520
Total	**77,264**	**26,640**	**114,113**	**71,036**	**45,825**	**69,087**	**34,206**	**14,680**

Source: Vehicle operators survey 1999

3.6 Crew and Overhead Costs

Driver and helper costs are set out in Table 3.11. Nearly all trucks and buses have a permanent helper in addition to the driver. The driver and helper costs for large buses are based on two sets of crews per vehicle. Driver's wages for buses and trucks average around Taka 5,000 per month which is double the national average monthly wage of Taka 2,000 - 2,500 for skilled labour. Wages for car drivers are lower. Figure showing wages in the following table are only salary excluding some unofficial/extra earnings.

Table 3.11 Crew Wage Costs Taka in 1999 prices

Item	Med Truck	Small Truck	Large Bus	Mini Bus	Micro Bus	Utility	Car	Baby Taxi
Driver per month	4794	3984	12128	5307	3993	4408	3630	4256
Helper per month	2113	1811	7031	4483	None	None	None	None
Driver per hour	18	16	41	24	20	26	20	16
Helper per hour	7	7	23	16	-	-	-	-
Total/hour financial	**25**	**23**	**64**	**40**	**20**	**26**	**20**	**16**
Total/hour economic	**20**	**18**	**51**	**32**	**16**	**21**	**16**	**13**

Source: Vehicle operators survey 1999

Overhead costs are set out in Table 3.12. These consist of office and garaging administration and rental charges, vehicle excise duty/VAT, route permit fees and tolls. Overhead costs are high in Bangladesh, in part due to ferry and bridge tolls that account for over half of medium truck overheads and significant proportions of other trucks and buses.

Table 3.12 Overhead Costs (Taka per annum)

Item	Med Truck	Small Truck	Large Bus	Mini Bus	Micro Bus	Utility	Car	Baby Taxi	Motor Cycle
Insurance	9,048	3,555	37,145	7,602	2,728	8,421	2,141	488	174
Taxes	8,356	9,310	12,770	5,680	22,570	37,570	18,065	1,340	2,078
Tolls	86,259	14,285	226,780	24,645	5,240	28,646	21,509	-	8,850
Office	26,740	22,171	75,780	36,261	9,090	2,144	8,936	2,455	-
Other	29,004	9,627	39,271	9,452	5,550	3,000	4,610	1,786	-
Total Fin	**159,408**	**53,548**	**391,746**	**83,639**	**45,179**	**79,781**	**55,260**	**6,069**	**11,103**
Tot. less tax	151,052	44,238	378,976	77,959	22,609	42,211	37,195	4,729	9,025
Total Econ	**120,841**	**35,390**	**303,180**	**62,367**	**18,087**	**33,768**	**29,756**	**3,783**	**7,220**

Source: Vehicle operators survey 1999

3.7 Unit Vehicle Operating Costs

3.7.1 Selection of HDM Relationship

In order to model VOC's using the VOCM4 model it is necessary to allocate one of the ten HDM-3 VOC relationships to each vehicle. Table 3.13 shows a comparison of the HDM and Bangladesh vehicle characteristics for the closest vehicle match. HDM III does not currently model motor cycle or auto rickshaw VOC's which are to be included in HDM-4. The comparison shows that in terms of physical characteristics RHD trucks are broadly consistent with the HDM specifications. The HDM bus (HDM only has one bus relationship) lies midway between the RHD bus categories in terms of weight and power. The HDM utility is similar to the RHD microbus and utility categories whilst the HDM car is relatively lighter and under powered. HDM has a larger car category (2) but this has a very high petrol consumption. HDM-4 will contain an increased number of vehicle categories for modelling and these will be considered in next years annual RUC report.

Table 3.13 Selection of Appropriate HDM VOC Relationship

RHD Category	**HDM Category**	**Fuel Diesel/Petrol**		**Gross Vehicle Weight-tonnes**		**Cylinders**		**Metric Horse Power**	
		HDM	RHD	HDM	RHD	HDM	RHD	HDM	RHD
Artic Truck									
Medium Truck	8	D	D	15	15.7	6	6	149	120
Small Truck	7	D	D	6.1	6.0	4	4	103	72
Large Bus	5	D	D	11.5	12.5	6	6	149	195
Mini Bus	5	D	D	11.5	9.0	6	6	149	112
Micro Bus	4	P	P	2.1	2.1	4	4	61	79
Car	1	P	P	1.2	1.5	4	4	49	110
Utility	4	P	P	2.1	2.8	4	4	61	79
Autorickshaw									
Motorcycle									

Source: World Bank Technical Note 234 and retailers data

3.7.2 VOC Modelling

The input data necessary to run the VOCM4 model is summarised in Table 3.14 and unit outputs in Table 3.15. Figures 3.1, 3.2 and 3.3 show the results graphically. It was not easy to accurately calibrate the model with the level of data available. A global calibration was carried out by comparing the mid-range unit financial VOC with average goods tariffs and fares by vehicle type (see Table 3.16.) This showed a good correlation between tariff and VOC and gives confidence that the VOC predictions are of the correct magnitude.

Table 3.16 Comparison of Tariffs and Financial Vehicle Operating Costs

Tariff per km	**Medium Truck**	**Large Bus**	**Mini Bus**
Average Tariff (Tk/km)	15.00	19.00	12.00
Average VOC(IRI4)	14.26	16.01	10.15

Source: Vehicle operators survey 1999

It was observed that the maintenance parts consumption predictions were very high for medium trucks and utilities. The maintenance parts model was therefore adjusted to reduce consumption. The fuel consumption model was also modified as the HDM relationships, based on 1970's vehicle technologies, over predict fuel consumption for modern vehicles. In this case the energy efficiency factor was adjusted for each vehicle type according to Technical Note 234 recommendations.

TABLE 3.14 VOC INPUTS

Item Cost	Unit	Medium Truck		Small Truck		Large Bus		Mini Bus		Micro Bus		Utility (Jeep)		Car		Auto Rickshaw		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 vehicles	Tk '000 per veh	1,360	1,033	815	564	2,990	2,314	1,295	991	1,110	693	5,700	2,232	1,650	789	132	75	114	81
Cost of new tyre	Tk per tyre	10,258	6,565	6,488	4,464	8,432	5,093	6,488	4,464	1,823	839	7,844	4,267	2,515	1,278	843	418	813	589
Maintenance labour cost	Tk per hr	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40	50	40
Overhead cost	Tk '000 per annum	159	121	54	35	392	303	84	62	45	18	70	34	55	30	6	4	11	7
Crew cost	Tk per hr	25	20	23	18	64	51	40	32	20	16	26	21	20	16	16	13	Nil	
Fuel cost	Tk per litre	12.95	8.02	12.95	8.02	12.95	8.02	12.95	8.02	21.00	8.39	21.00	8.39	21.00	8.39	21.00	8.39	21	8.39
Lubricant cost	Tk per litre	75.72	38.24	75.72	38.24	75.72	38.24	75.72	38.24	75.72	38.24	75.72	38.24	75.72	38.24	75.72	38.24	75.72	38.24
Utilisation																			
Annual km driven	Kms per annum	51000		21000		120000		56000		31000		42000		24000		52000		13600	
Annual hours driven	Hrs per annum	1830		1140		2440		1710		1652		1652		2145		2079		809	
Free running speed (paved)	Km per hour	70		70		70		70		80		80		90		No data		No data	
Average service life	Years	11		8		10		12		10		13		10		8		8	
Physical Characteristics																			
Manufacturers GVW	Kg	11000		5200		12500		9000		2150		2800		1510		580		No data	
TARE weight	Kg	4015		2750		4145		3300		1180		1930		998		200		96	
Axles	Number	2		2		2		2		2		2		2		1		0	
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-3 Calibrations (use defaults for other coefficients)																			
HDM vehicle type	Code	8		7		5		5		4		4		1					
Energy efficiency factor	alpha 1	0.95		0.95		0.95		0.95		0.85		0.85		0.85		Not modeled in HDM-3			
Maintenance parts model	CPq	200		Default		Default		Default		20		20		Default					
Maintenance parts model	Cpo	Default		Default		Default		Default		9		9		Default					

Table 3.15: Sensitivity of Vehicle Operating Costs to Road Roughness With Zero Horizontal and Vertical Curvature

	Medium Truck		Small Truck		Large Bus		Mini Bus		Micro Bus		Utility/Jeep		Car	
IRI m/km	VOC Taka/km	Speed km/h	VOC Taka/km	Speed km/h	VOC Taka/km	Speed km/h	VOC Taka/km	Speed km/h	VOC Taka/km	Speed km/h	VOC Taka/km	Speed km/h	VOC Taka/km	Speed km/h
2	10.04	60	7.61	68	13.55	62	8.55	74	4.53	74	9.82	67	5.22	82
3	10.73	59	7.93	67	13.78	62	8.69	74	4.67	73	10.29	66	5.48	81
4	11.43	59	8.25	66	14.03	61	8.83	73	4.82	72	10.83	65	5.79	81
5	12.13	57	8.57	65	14.30	60	8.99	71	4.99	71	11.42	64	6.15	80
6	12.84	56	8.91	63	14.59	60	9.16	70	5.19	69	12.10	63	6.59	78
7	13.57	54	9.26	60	14.92	58	9.35	67	5.40	67	12.85	61	7.10	76
8	14.32	51	9.62	57	15.28	57	9.56	64	5.65	64	13.69	59	7.70	73
9	15.08	49	10.00	54	15.68	55	9.81	61	5.92	62	14.64	57	8.42	70
10	15.88	46	10.39	51	16.12	53	10.08	58	6.22	59	15.67	55	9.24	67
11	16.69	44	10.80	49	16.60	50	10.38	54	6.53	56	16.71	52	10.06	64
12	17.52	42	11.22	46	17.13	48	10.72	51	6.85	53	17.78	50	10.88	61
13	18.37	39	11.66	43	17.70	46	11.09	48	7.18	51	18.85	48	11.71	57
14	19.24	37	12.10	41	18.32	44	11.48	46	7.51	48	19.94	46	12.53	54
15	20.11	35	12.55	39	18.97	41	11.91	43	7.85	46	21.04	44	13.36	51

Source: VOCM4 model

Figure 3.1: Sensitivity of VOC to Road Roughness

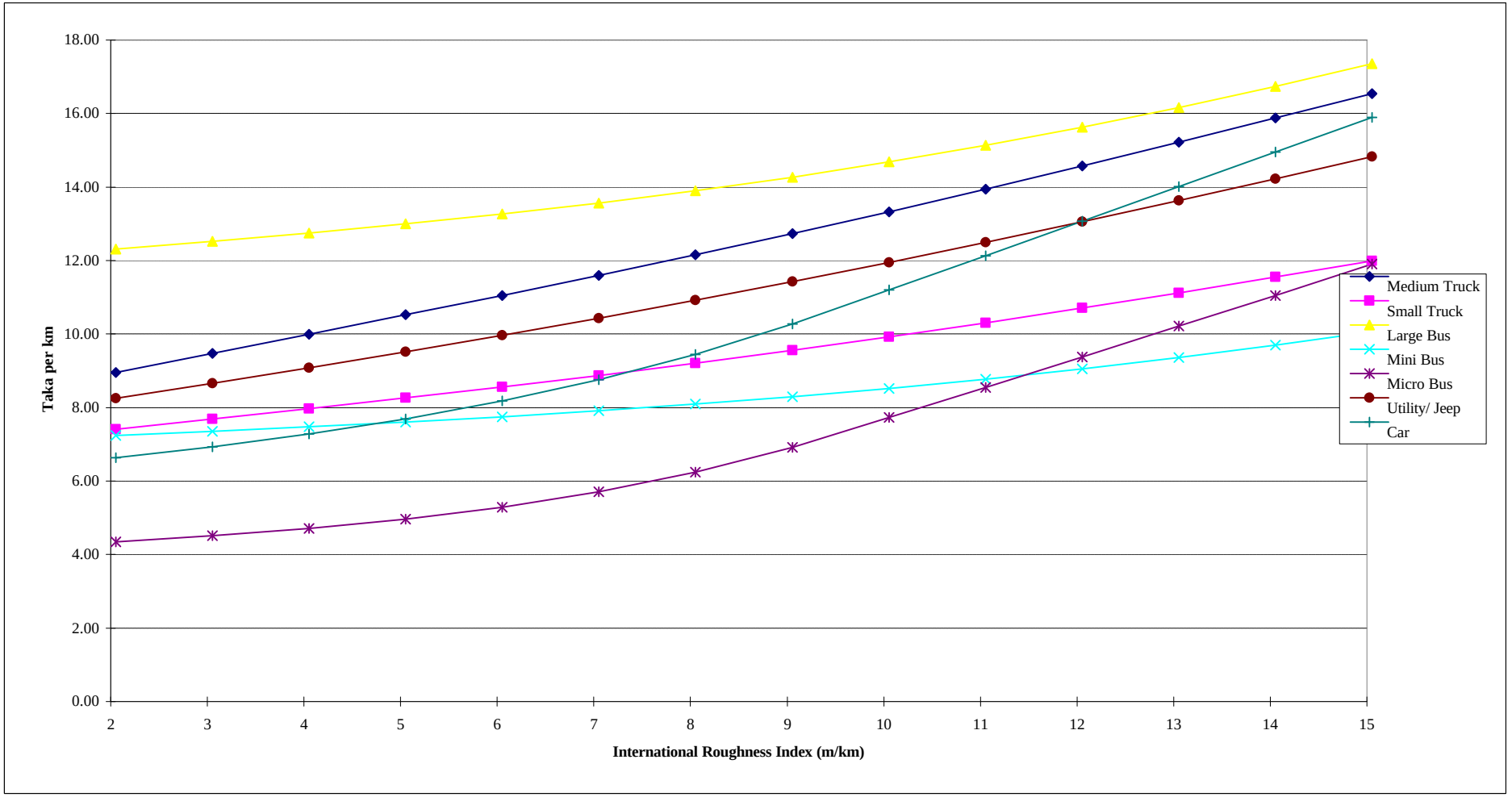


Figure 3.2: Sensitivity of Free Flow Speed to Road Roughness

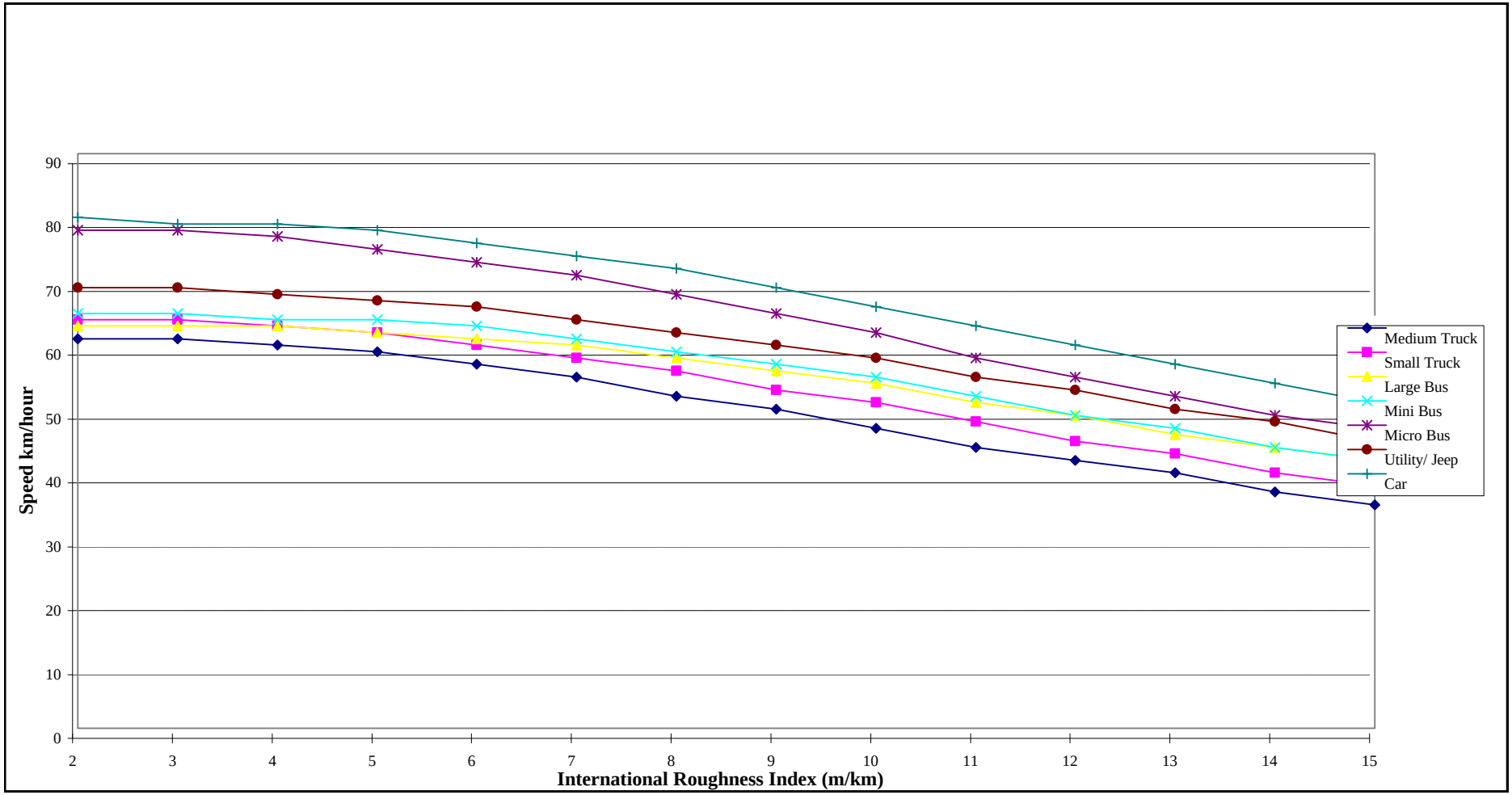
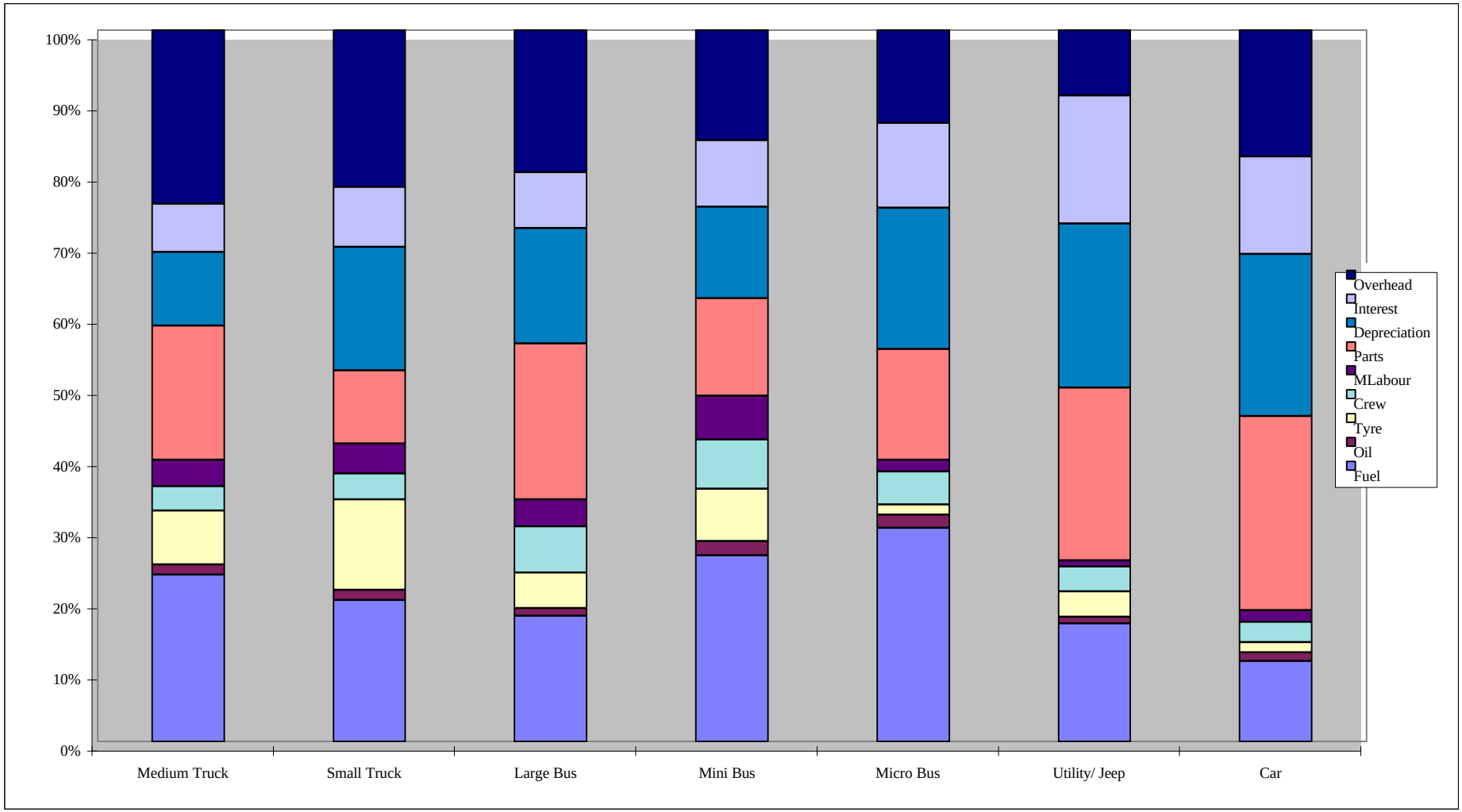


Figure 3.3: Breakdown of VOC Components



4 TRAVEL TIME COSTS

4.1 Introduction

Travel time costs (TTC), also referred to as Value of Time (VOT) are an important component of road user costs. This can vary from country to country and from project to project in the same country.TTC can vary in size from 20 per cent of total RUC to over 80 per cent in the appraisal of schemes that reduce time delays significantly (such as the construction of a new bridge to replace a ferry). The theory 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 RUC in an economic appraisal.

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 value.

Time costs will vary between different vehicle types according to the socio-economic characteristics of the occupants, 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 vehicle 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 (i.e. a road with many high income car users will generate much greater time savings than a road with many low value rickshaw users). In this case the TTC is referred to as an "equity" value. This approach has not been adopted in Bangladesh to date.

It should also be noted that TTC will vary geographically according to the socio-economic characteristics of the region. It would be expected, for instance, that road users in Dhaka will value their time more than those in a remote Thana in Barisal. It is usual practice, in this case, to adopt a set of national average TTC applicable to all analyses to avoid the sort of biases referred to in the preceding paragraph. This approach will continue to be used in Bangladesh in line with current methodology.

4.2 Previous Work

Until the IDC initiative TTC were estimated in feasibility studies according to the projects requirements. Costs were often based on small surveys or updated from previous studies. Table 4.0 sets out the principal transport studies to date that have conducted some original work on TTC. An average wage base approach was used by the first four studies. This was changed in the Dhaka Eastern Bypass Study which used a Stated Preference interview technique which gave very high TTC.

Table 4.0 Previous Work on TTC in Bangladesh

Study	Author	Year
Jamuna Bridge Feasibility Study	Rendel Palmer & Tritton et al	1989
Road Master Plan Project	Transroute et al	1992
Road Materials & Standards Study	Howard Humphreys et al	1994
Dhaka Urban Transport Study Phase 2	Mott MacDonald et al	1996
Dhaka Eastern Bypass	Halcrow Fox et al	1997

Table 4.1 Results of Previous Work on TTC in Bangladesh
(Values per vehicle occupant in Taka, not adjusted for inflation)

Study	Year	Bus	Car
Jamuna Bridge Feasibility Study	1989	7.84	-
Road Master Plan Project	1992	8	20
Road Materials & Standards Study	1994	9	23
Dhaka Urban Transport Study Phase 2	1996	5.52	19.17
Dhaka Eastern Bypass	1997	28.8-35.6	74.4

4.3 Methodology

The Dhaka Eastern Bypass Study (DEBS) work derived TTC higher than previously estimated and as the reasons for this were not completely clear they were not used in the economic appraisal for the study. It was considered that the results might have been biased by the high incomes in the Dhaka area and/or the previously unused "Stated Preference" interview technique. The Economics Circle, therefore, organised to undertake surveys in four divisional cities in 1997 and also in early 1999 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 average rates 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 (TRL). The summary results of the 1999 TTC survey are published in this RUC report.

4.4 Summary of Survey Results

This section sets out a summary of the main and feeder road travel time surveys conducted in 1999. More details of methodology can be found in Economics Working Paper E7. Tables 4.2 and 4.3 set out the distribution of trip purpose for main road and feeder roads respectively.

Table 4.2 Main Road - Percentage Sample Distribution by Trip Purpose

Trip Purpose	A/C Bus	C/C Bus	O/C Bus	Mini Bus	Micro Bus	Car	Auto Rick	Tempo	Motor Cycle
Journey to Work	10	15	16	8	20	18	20	15	22
Employers Business	12	10	5	10	3	5	0	5	10
Own Business	20	15	16	15	10	27	17	20	20
Family and Social	40	39	37	35	35	36	28	43	20
Other	18	21	26	32	32	14	35	17	28
Total	100	100	100	100	100	100	100	100	100

Source: Travel Time Surveys 1999.
Note: A/C =Air Conditioned, C/C= Chair Class, O/C= Ordinary Class.

Table 4.3 Feeder Road - Percentage Sample Distribution by Trip Purpose

Trip Purpose	O/C Bus	Mini Bus	Micro Bus	Car	Auto Rick	Tempo	Motor Cycle
Journey to Work	18	20	15	5	8	20	27
Employers Business	5	0	5	5	15	5	10
Own Business	27	17	20	18	30	25	23
Family and Social	36	28	43	42	22	25	22
Other	14	35	17	30	25	25	18
Total	100	100	100	100	100	100	100

Source: Travel Time Surveys 1999.

Tables 4.4 and 4.5 show the distribution of occupations according to main road and feeder road users respectively.

Table 4.4 Main Road - Percentage Sample Distribution by Occupation

Occupations	A/C Bus	C/C Bus	O/C Bus	Mini Bus	Micro Bus	Car	Auto Rick	Tempo	Motor Cycle
Businessman	33	23	29	33	40	47	20	30	25
Officer	30	25	13	9	30	28	3	8	13
Salesman	0	5	6	15	5	3	17	10	8
Clerical	5	10	16	13	10	10	43	38	22
Farmer	0	2	3	7	0	2	2	7	0
Student	18	13	18	8	2	0	7	7	15
Domestic Staff	0	0	0	0	0	0	0	0	0
Housewife	14	10	5	8	8	0	0	0	0
Unemployed	0	2	0	0	0	0	5	0	10
Other	0	10	10	7	5	10	3	0	7
Total	100	100	100	100	100	100	100	100	100

Source: Travel Time Surveys 1999.
Note: A/C =Air Conditioned, C/C= Chair Class, O/C= Ordinary Class.

Table 4.5 Feeder Road - Percentage Sample Distribution by Occupation

Occupations	O/C Bus	Mini Bus	Micro Bus	Car	Auto Rick	Tempo	Motor Cycle
Businessman	23	25	25	50	40	20	28
Officer	0	7	8	18	10	7	21
Salesman	19	10	10	2	5	15	10
Clerical	0	15	5	10	12	23	10
Farmer	18	13	2	0	12	17	2
Student	9	20	23	8	3	13	17
Domestic Staff	0	0	0	0	3	0	0
Housewife	9	3	17	5	3	0	0
Unemployed	0	5	5	0	2	2	7
Other	22	2	5	7	10	3	5
Total	100	100	100	100	100	100	100

Source: Travel Time Surveys 1999.

Tables 4.6 and 4.7 show the reported monthly household income of the respondents (gross of tax), disaggregated by bus 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 4.6 Main Road -Percentage Sample Distribution by Monthly Income

Income Group (Taka)	A/C Bus	C/C Bus	O/C Bus	Mini Bus	Micro Bus	Car	Tempo	Auto Rick	Motor Cycle
<1000	0	0	2	0	0	0	0	0	0
1001-2000	0	0	0	5	0	0	0	0	0
2001-5000	12	25	13	33	2	10	58	35	7
5001-10000	43	43	42	32	45	15	10	45	45
10001-20000	23	22	27	20	38	32	27	17	38
20001-30000	22	10	16	10	15	25	5	3	10
30000+	0	0	0	0	0	18	0	0	0
Total	100	100	100	100	100	100	100	100	100

Source: Travel Time Surveys 1999.
Note: A/C =Air Conditioned, C/C= Chair Class, O/C= Ordinary Class.

Table 4.7 Feeder Road -Percentage Sample Distribution by Monthly Income

Income Group (Taka)	O/C Bus	Mini Bus	Micro Bus	Car	Tempo	Auto Rick	Motor Cycle
<1000	4	0	0	0	0	0	0
1001-2000	18	0	5	0	7	10	0
2001-5000	50	45	17	0	43	20	7
5001-10000	19	43	55	45	43	30	43
10001-20000	5	12	23	40	7	25	35
20001-30000	4	0	0	15	0	15	15
30000+	0	0	0	0	0	0	0
Total	100	100	100	100	100	100	100

Source: Travel Time Surveys 1999.

4.5 Unit Travel Time Costs

The 1999 TTC are set out in Table 4.8. The bus value is an average of all bus types weighted by annual bus passenger km. The TTC for buses and cars is 11 per cent higher than the 1998/99 value, whilst Tempo's remain unchanged. The values for motorcycles and autorickshaws have increased substantially from last year's values which were only estimates. The new surveys (which included these vehicles for the first time) found high travel time values for these vehicle types.

Table 4.8 Recommended Economic TTC For 1999/2000

Vehicle Category	Occupancy Number	TTC per pass Taka/hr	TTC per vehicle Taka/hr
All Buses	47.1	13.9	654.7
Car/Utility	3.2	31.2	100.0
Tempo	9	8.9	80.1
Auto Rickshaw	2	19.8	39.7
Motor Cycle	1.5	25.3	37.9

As in last years report, the analysis demonstrated several important facts:

- Bus passenger incomes are higher than previously estimated, especially on the de-luxe inter-city air-conditioned and chair class services.
- The large differences between the Feeder Road and Main Road transport markets identified in the previous report were confirmed in the 1999 surveys.

5 ACCIDENT COSTS

5.1 Introduction

5.1.1 General

Accident costs have not generally been included in economic appraisal in Bangladesh. This analysis is intended to be the starting point in the process to incorporate accident costing in the Bangladesh road appraisal system. Given that many of the data sets needed to derive accident costs are of very poor quality the costs presented are indicative only. This analysis is intended to document the data sources, analysis procedures and present the current working estimates. As many assumptions were required, a conservative but realistic approach was used. However, the paper presents a solid framework for the development of costs under subsequent projects.

For the last two decades, road accident costs have been generally assumed to cost a country around one per cent of Gross National Product (GNP.) This figure initially applied to both motorised and motorising countries. But with the shift towards the higher priced Willingness to Pay approach, road accident costs in motorised countries are now estimated at a higher rate. In the Institution of Civil Engineer's publication "A Vision for Road Safety beyond 2000", road accidents were quoted as costing the European Union 2.5 per cent of its GNP, the equivalent of approximately $US 200 billion. (ICE, 1996)

In addition to their overall impact on the national economy, estimates of accident costs are also needed to measure the safety impacts of road schemes. The main objective of most road improvements is to reduce vehicle operating costs and journey times, which is most often achieved by increasing vehicle speeds. Increased speeds may increase the number and severity of accidents. It is, therefore, vital to include the accident of accidents in road appraisals as the failure to do so may result in increased loss of life and economic output.

5.1.2 Accident Costing Methodologies

The two basic accident costing methodologies are the Lost Output (or "human capital") 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 caused by road accidents. The WTP method, on the other hand, considers the value of prevention, i.e. how much people would pay to avoid an accident altogether, and accordingly produces much higher cost estimates than the Lost Output Method. WTP has only been used in motorised countries and the Lost Output method has traditionally been recommended for motorising countries whose primary objective is maximising national economic growth.

Lost Output methods can be further classified into Gross and Net Lost Output. As can be surmised, the Net Lost Output subtracts an estimate of personal consumption from the expected lost earnings of a road traffic accident (RTA) fatality. While Net Lost Output was used for the first few years of accident costing in the UK (1968-71), most countries rely on the Gross Output Method. It should be noted that the current UK WTP approach calculates foregone production using the net lost output method and assumes all foregone pleasure to be represented in the Human Costs Component. For further background reference on the different accident costing methods, please refer to the TRL publication Overseas Road Note 10.

5.1.3 Other Work in Bangladesh

There had been little rigorous research into estimating accident costs in Bangladesh. The most recent estimates we are aware of are in the Road Materials and Standards Study (RMSS-Howard Humphreys et al, 1994). This analysis estimated the average cost of an injury RTA to be approximately Taka 228,000 in 1992 prices (US$6444). This costing analysis was basically a "desk exercise" but hospital surveys were conducted to identify the total number of RTA and related casualties, rather than just those police reported. The two main cost components were identified as lost output (45%) and vehicle related damage (40%), which included both vehicle damage and loss of business.

Dr Jobair Bin Alam of the Bangladesh University of Engineering and Technology (BUET) is also currently researching accident costs. However, despite initial approaches regarding co-operation in July 1998 no liaison was achieved.

5.2 Estimating the Number of Road Traffic Accidents

As most injury RTA include more than one casualty, RTA costing is traditionally divided into casualty related costs (lost output, medical costs, pain, grief and suffering) and event related costs (property damage and administration costs.) RTA casualties are classified in three basic categories:

- **Fatalities** are limited to deaths occurring from and within 30 days of the RTA
- **Serious injuries** include injuries which require hospitalisation, i.e. an overnight stay in a hospital, to those RTA related deaths occurring after the first 30 days.
- **Slight injuries** are those which require medical treatment but not hospitalisation.

The total cost of road accidents should include both reported and unreported road accidents and not be limited to those officially reported, as all accidents incur costs. While widescale under-reporting of simple RTA is accepted by all, many, including the Bangladesh Police, believe that fatal and grievous RTA are well reported. This has not been found to be the case as:

- Hospital records show many more RTA inpatients being treated than reported by police. Assume over 4000 being hospitalised for RTA in DMP alone and while this is equivalent to national figures for grievous injuries, DMP is reported at only accounting for only 24% RTA and 13% of injuries.
- Comparison with those DMP fatal RTA reported in one newspaper during 1996 and 1997 found that approximately 30% of fatal RTA newspaper reported RTA were not in the DMP MAAP database (including one where 9 killed in truck accident in Demra).
- Manual reporting system is prone to inaccuracy as seen by Police Headquarters reporting different RTA and casualty figures than in MAAP. Police Headquarters reported over 30% more injury road accidents but approximately 30% less RTA casualties in Dhaka than did the computerised MAAP system.

Accordingly, it was assumed that only 20% of casualty RTA are included in the official police accident statistics for DMP. Conservative assumptions were made and it is possible that the actual figure is twice as large and only 10% casualty RTA are being officially recorded. It was decided to use the top end of the range as a starting point.

It was also assumed that the level of under-reporting was consistent throughout Bangladesh. While under-reporting tends to be worse in rural areas, the accident data from the Ranges was more consistent than the metropolitan areas and so the same under-reporting ratio has been a applied. The resultant estimate of casualty RTA is set out in Table 5.0.

Table 5.0 Estimated Casualty RTA Nationwide (1997 Figures)

	RTA	Fatalities	Grievous	Simple	Total Casualties
Urban RTA	8795	813	3106	9273	13193
Rural RTA	18770	9385	22524	33786	65695
Total Casualty RTA	27565	10198	25630	43059	78888

Source: Consultants Working Estimates

It should be pointed out that the severity ratio, i.e. the ratio of RTA injuries to fatality is less than 8:1 compared with recent study recommendations in Indonesia of 25:1 and 52:1. (Downing, 1997) The accident costing exercise in Kerala, India found an injury to fatality rate of 21:1 (1992-93) (Chand, 1995) so again, injuries could be much higher than is being estimated here. The severity ratio will greatly depend upon the extent to which accidents are consistently reported as the relative extent of under-reporting by accident severity is unknown. The percentages used in this accident costing are shown in Table 5.1. Fatal accidents are assumed to be the best reported with almost half all reported, while only one out of every 15 simple RTA is believed reported to the police.

Table 5.1 Relative RTA Reporting Percentages Assumed (1997 Figures)

	Police Headquarters			Costing Estimates			Reporting percentage		
Type	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Fatal	422	2264	2686	740	4693	5432	57%	48%	49%
Grievous	748	1092	1840	2958	6570	9528	25%	17%	19%
Simple	521	398	919	5098	7508	12606	10%	5%	7%
Total	1691	3754	5445	8795	18770	27565	19%	20%	20%

Source: Consultants Working Estimates

It has traditionally been assumed that fatal RTA have been the most well reported as this is the case in motorised countries. However, the reality of the situation in Bangladesh is that fatal RTA can be expected to involve the highest compensation and so also the greatest incentive to avoid involving the police where compensation might have to be shared. Further research into the extent of under-reporting is required before an accurate assessment of the accident situation can be made. Property damage only (PDO) accidents have also been estimated as they too incur costs. Conservative figures have been used with four PDO RTA being estimated for every urban casualty RTA, and two PDO RTA for every rural 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 5.2.

Table 5.2 Estimated Nationwide Total RTA (Casualty and PDO)

	RTA	PDO multiplier	Estimated PDO	Total RTA
Urban RTA	8795	4	35180	43975
Rural RTA	18770	2	37540	56310
Total Casualty RTA	27565		72720	100285

Source: Consultants Working Estimates

5.3 Valuing Road Traffic Accident Cost Components

5.3.1 Lost Output

Lost output refers to the loss of productive capacity to the economy. While most accident surveys rely on accident victim surveys or average wage rates to estimate lost output, average incomes for motorised transport users were already determined by the TTC surveys. Only the average income of a pedestrian had to be calculated additionally using an average subsistence wage of Tk 1500 per month. Table 5.3 shows the average incomes estimated for the different road user types and the relative casualty share assumed.

Table 5.3 Average Income and RTA Casualty Share by Road User Type (Taka -1997)

Item	Truck	Bus	Car	Rickshaw	Pedestrian
Average monthly income	5,441	6,083	15,410	4,686	1,500
Average annual income	65,292	73,000	184,920	56,232	18,000
RTA casualty share	5%	25%	5%	15%	50%

Source: Economics Working Paper E7 and Consultants Working Estimates

The net lost output approach was used in the analysis. The net lost output for a RTA fatality was based on the following assumptions:

- average lost working years, 28 (average retirement age, 57 years, - average age of RTA fatality, 29 years)
- discount rate of 12% and average GDP per capita growth rate 3.1%
- estimated average annual RTA income
- 30% personal consumption.

Injuries and Recovery time

The lost output for RTA injuries was the daily wage multiplied by the number of days recovering. 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 will be valued at 100% and the remaining 5 days at 25%, i.e. leisure time. Both days spent recuperating with simple injuries have been assumed to be working days.

Table 5.4 Lost Output Casualty Costs (Taka-1997)

Category	Per casualty Cost	Fatal RTA		Grievous RTA		Simple RTA	
		Number	Cost	Number	Cost	Number	Cost
Fatality	344,085	1.7	584,945	0	0	0	0
Grievous	4,217	1.4	5,904	1.7	7,169	0	0
Simple	321	1.4	450	2.2	707	1.5	482
Total			**591,298**		**7,876**		**482**

Source: Consultants Working Estimates

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, medicine, 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 100 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 12,000/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 400 will be used. Average in-patient length of stay is not known for RTA casualties only and an average in-patient stay of 10 days is assumed. 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 5.5 Medical Costs per RTA Casualty (Taka-1997)

Category	**Per casualty Cost**	**Fatal RTA**		**Grievous RTA**		**Simple RTA**	
		Number	Cost	Number	Cost	Number	Cost
Fatality	100	1.7	170	0	0	0	0
Grievous	4,200	1.4	5,880	1.7	7,140	0	0
Simple	100	1.4	140	2.2	220	1.5	150
Total			**6,190**		**7,360**		**150**

Source: Consultants Working Estimates

5.3.3 Human Costs (Pain, Grief and Suffering)

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. 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% 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 5.6. The term "human costs" is used to refer to this expanded component.

Table 5.6 Human Costs (Taka-1997)

Category	**Per**	**Fatal RTA**	**Grievous RTA**	**Simple RTA**

	casualty Cost						
		Number	Cost	Number	Cost	Number	Cost
Fatality	206,451	1.7	350,967	0	0	0	0
Grievous	2,530	1.4	3,542	1.7	4,301	0	0
Simple	193	1.4	270	2.2	424	1.5	289
Total			**354,779**		**4,726**		**289**

Source: Consultants Working Estimates

5.3.4 Vehicle Damage Costs

In addition to vehicle damage, this component should also include other property damage costs and any lost business due to the vehicle being out of commission. Vehicle damage was known to be a major cost component and data was collected during the November 1998 survey of some one hundred vehicle operators in Dhaka by the Economics Circle. This data is summarised in Table 5.7.

Table 5.7 Average Vehicle Damage Costs From 1998 Operators Survey (Taka per vehicle-1998)

Item	Med Truck	Small Truck	Large Bus	Mini Bus	Utility	Car	Tempo	Baby Taxi	Mean
Damage	20,750	7,167	75,833	69,833	12,000	11,500	4,914	2,917	29,370
Lost earnings	9,000	1,167	33,667	58,889	0	8,200	3,021	1,081	18,224
Total Costs	**29,750**	**8,333**	**109,500**	**128,722**	**12,000**	**19,700**	**7,936**	**3,998**	**47,594**

Source: Economics Circle. 1998 Vehicle Operators Survey

In addition, vehicle claim data was provided by one large private insurance company which found the 1997 average vehicle damage claim cost was Taka 43,500 (265 claims). Given the uncertainty regarding the proportions of vehicles involved in an average accident it was decided to adopt an interim average vehicle damage and loss of earnings cost at this stage. A value of Taka 50,000 per simple accident was therefore adopted which accords with the average values from the operators survey and the insurance company. The average vehicle related cost was weighted so that grievous and fatal accidents cost 1.5 and 2 times more than simple accidents. Table 5.8 sets out the resultant costs.

Table 5.8 Average Vehicle Related Costs per Accident (Taka-1998)

Severity	Unit costs
Fatal	100,000
Grievous	75,000
Simple	50,000
PDO	2,500

Source: Consultants Working Estimates

5.3.5 Administrative Costs

Administrative costs include the “handling costs” incurred by police, insurance companies and courts in investigation 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 (Tk 500) is suggested for general administrative costs. The total administrative costs estimated should represent the following:

- police investigations (5500 RTA with 2700 Fatal, 1800 Grievous and 900 Simple)
- post accident inspections (1300 conducted by BRTA 1997)
- insurance claims (unknown amount)
- court proceedings (unknown number or duration)
- private negotiations (estimated 95,000)

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;
3. travel time delay from accidents, including that from road blockades occasionally set up after accidents;
4. accident scene clear up;
5. leisure time lost in the post working years;
6. life expectancy reduced of RTA casualties.

Moreover, this preliminary accident costing exercise was limited to the three main casualty types, fatal, grievous and simple. It did not factor in those grievously injured who are left disabled and with reduced earning capability.

5.4.2 Average Accident Cost by Severity

The costs of components are a composite of 1997 and 1998 values. For the purpose of these indicative estimates, which are based on 1997 accident numbers all costs are quoted as 1997. Table 5.9 shows the cumulative cost of the various cost components to each RTA severity.

Table 5.9 Total Accident Cost By Severity Type And Cost Component (Taka '000)

Component	Fatal	Grievous	Simple	PDO
Lost output	591.3	7.9	0.5	0.0
Medical costs	6.2	7.4	0.2	0.0
Human costs	354.8	4.7	0.3	0.0
Vehicle damage	100.0	75.0	50.0	2.5
Administration	0.5	0.5	0.5	0.5
Total	**1052.8**	**95.5**	**51.4**	**3.0**

Source: Consultants Working Estimates

According to these estimates, a fatal RTA costs 14 times that of a grievous RTA and 28 times more than a simple RTA. Property damage only accidents have been estimated at only 6% of a simple accident. The cost of a grievous RTA is estimated at twice that of a simple RTA.

5.4.3 National Road Traffic Accident Costs

Table 5.10 sets out the sum of all accident cost components for the total number of estimated accidents in 1997. The total cost of all road accidents, including PDO, has been conservatively estimated at Tk 7,495 million (Tk 750 Crore or US$153 million). The vast majority of the costs are due to casualty accidents with property damage only accidents accounting for less than 2.5 per cent of total costs.

Table 5.10 Annual National RTA Costs For 1997 (Taka)

Item	No. of Accidents	Ave. Cost per accident ('000)	Total Cost (million)
Fatal RTA	5,432	1,053	5,719
Grievous RTA	9,528	95	910
Simple RTA	12,606	51	648
Total casualty RTA	**27,565**		**7,276**
PDO RTA	72,720	3	218
Total RTA	**100,285**		**7,495**
Average RTA			0.27

Source: Consultants Working Estimates

The average RTA is estimated to cost Tk 270,000 (US$ 5,510). The total national accident cost is equal to 0.5 per cent of Gross National Product in 1997 (see Table 5.11.) This is less than the previously assumed global amount of 1 per cent. However, when it is considered that the whole analysis was based on conservative assumptions this amount is almost certainly the minimum cost to society. The true cost is probably much closer to the one per cent estimate and represents a totally unacceptable waste of life and Bangladesh's scarce resources.

Table 5.11 Annual Accident Costs and Gross National Product

Item	Taka Million	US$ Million
Annual Accident Costs	7,495	153
Gross National Product	1,616,309	32,986
Accident Costs%GNP	0.5%	0.5%

Source: Consultants Working Estimates
Note: US$1=49 Taka

5.5 Conclusions And Recommendations

5.5.1 Significance of This Findings

Many assumptions were required with this accident costing and this analysis is intended to promote discussion, which will confirm or correct these assumptions. However, the analysis had proved that accident costs are very significant in Bangladesh and represent a very real drain on its resources. As traffic volumes and the population increases these costs will undoubtedly increase. Immediate action is required to address the accident problem in Bangladesh if the scale of the losses is not to hold back development and result in an unacceptable loss of human life.

5.5.2 Areas for Further Research

A main area of work in this accident costing was the estimation of the actual number of road accidents. Further research is required on this fundamental problem as an accurate assessment of the overall accident situation is not yet possible. More research is also required on all the cost components and in particular 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, driver behaviour and road design. Without this knowledge it will not be possible to apply accident costs 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.

5.5.4 The Way Forward

At the time of publication a major research project by the Transport Research Laboratory of the United Kingdom is under consideration. This would review accident costing methodologies used in less developed countries and conduct case-studies in a few selected countries. At the present time Bangladesh is a candidate for a case study and it is intended that this work will form the basis for the updating of the preliminary work in this report.

APPENDIX A UNIT VEHICLE OPERATING COSTS

ALL COSTS ARE ECONOMIC VALUES IN 1999 PRICES

GLOSSARY

Curv	-	Horizontal Curvature (degrees per km)
Fuel	-	Petrol/Diesel Cost
Lubr	-	Lubricating Oil Cost
Tyre	-	Tyre Cost
Crew	-	Crew Time Cost
M.L.	-	Maintenance Labour
M.P.	-	Maintenance Parts Cost
Depr	-	Depreciation Cost
Inte	-	Interest Cost
Over	-	Overhead

Note: Zero gradient and free flow traffic conditions assumed.

VEHICLE OPERATING COSTS 1999/2000
CAR-HDM CATEGORY 1

CURV deg/ km	IRI m/km	FUEL %	LUBR %	TIRE %	CREW %	M.L. %	M.P. %	DEPR %	INTE %	OVER %	TOTAL VOC Taka/km	SPEED km/ hour
0	2	12.3	1.1	1.2	3.2	1.5	21.1	25	15	19.6	6.36	80
0	3	11.8	1.1	1.3	3	1.6	24.1	23.9	14.4	18.8	6.66	79
0	4	11.3	1.2	1.4	2.9	1.6	27.3	22.8	13.7	17.8	7.01	79
0	5	10.8	1.2	1.4	2.8	1.7	30.9	21.5	12.9	16.8	7.42	78
0	6	10.1	1.2	1.4	2.7	1.8	34.6	20.3	12.2	15.8	7.91	76
0	7	9.4	1.2	1.4	2.5	1.8	38.5	19	11.4	14.7	8.49	74
0	8	8.7	1.1	1.4	2.4	1.8	42.6	17.7	10.6	13.6	9.18	72
0	9	8	1.1	1.4	2.3	1.9	46.7	16.3	9.8	12.5	10.00	69
0	10	7.3	1.1	1.4	2.2	1.9	50.6	15.1	9.1	11.4	10.93	66
0	11	6.7	1	1.3	2.1	1.9	53.9	14	8.4	10.5	11.86	63
0	12	6.2	1	1.3	2.1	1.9	56.8	13.2	7.9	9.8	12.80	60
0	13	5.7	1	1.3	2.1	1.8	59.2	12.4	7.4	9.1	13.74	57
0	14	5.3	1	1.3	2	1.8	61.3	11.8	7.1	8.5	14.69	54
0	15	5	0.9	1.2	2	1.8	63.1	11.2	6.7	8	15.63	51
150	2	12	1.1	1.2	3.3	1.5	21	25.2	15.1	19.6	6.38	75
150	3	11.5	1.1	1.3	3.2	1.6	24	24.1	14.5	18.7	6.68	75
150	4	11.1	1.2	1.3	3.1	1.6	27.3	22.9	13.8	17.8	7.03	74
150	5	10.5	1.2	1.4	2.9	1.7	30.8	21.7	13	16.8	7.44	74
150	6	9.9	1.2	1.4	2.8	1.8	34.5	20.4	12.3	15.8	7.93	73
150	7	9.3	1.2	1.4	2.6	1.8	38.4	19.1	11.5	14.7	8.51	71
150	8	8.6	1.1	1.4	2.5	1.8	42.5	17.8	10.7	13.6	9.20	69
150	9	7.9	1.1	1.4	2.4	1.9	46.6	16.4	9.9	12.5	10.02	67
150	10	7.2	1.1	1.4	2.3	1.9	50.5	15.2	9.1	11.4	10.95	64
150	11	6.6	1	1.3	2.2	1.9	53.9	14.1	8.5	10.5	11.88	61
150	12	6.1	1	1.3	2.1	1.9	56.7	13.2	7.9	9.8	12.81	58
150	13	5.7	1	1.3	2.1	1.8	59.1	12.4	7.5	9.1	13.75	56
150	14	5.3	1	1.3	2.1	1.8	61.2	11.8	7.1	8.5	14.70	53
150	15	5	0.9	1.2	2	1.8	63.1	11.2	6.7	8	15.64	50
300	2	11.5	1.1	1.2	3.6	1.5	20.9	25.5	15.3	19.5	6.43	68
300	3	11.1	1.1	1.3	3.5	1.5	23.9	24.4	14.6	18.6	6.72	68
300	4	10.6	1.2	1.3	3.3	1.6	27.1	23.2	13.9	17.7	7.07	68
300	5	10.1	1.2	1.4	3.2	1.7	30.6	22	13.2	16.7	7.48	67
300	6	9.6	1.2	1.4	3	1.7	34.3	20.7	12.4	15.7	7.97	67
300	7	9	1.2	1.4	2.9	1.8	38.3	19.3	11.6	14.6	8.55	66
300	8	8.3	1.1	1.4	2.7	1.8	42.3	18	10.8	13.5	9.24	64
300	9	7.7	1.1	1.4	2.5	1.9	46.4	16.6	10	12.4	10.06	62
300	10	7.1	1.1	1.4	2.4	1.9	50.4	15.3	9.2	11.4	10.98	61
300	11	6.5	1	1.3	2.3	1.9	53.7	14.2	8.5	10.5	11.91	58
300	12	6	1	1.3	2.2	1.8	56.6	13.3	8	9.7	12.84	56
300	13	5.6	1	1.3	2.2	1.8	59	12.5	7.5	9.1	13.78	54
300	14	5.3	1	1.3	2.1	1.8	61.1	11.9	7.1	8.5	14.72	51
300	15	5	0.9	1.2	2.1	1.8	63	11.3	6.8	8	15.66	49

VEHICLE OPERATING COSTS 1999/2000
UTILITY-HDM CATEGORY 4

CURV deg/ km	IRI m/km	FUEL %	LUBR %	TIRE %	CREW %	M.L. %	M.P. %	DEPR %	INTE %	OVER %	TOTAL VOC Taka/km	SPEED km/ hour
0	2	17.9	0.9	3.2	3.8	0.7	18.3	25.3	19.7	10.2	7.98	69
0	3	17.2	0.9	3.4	3.6	0.7	21.5	24.1	18.8	9.7	8.39	69
0	4	16.6	0.9	3.6	3.5	0.8	24.3	23.1	18	9.2	8.82	68
0	5	16	1	3.7	3.4	0.8	26.8	22.2	17.3	8.8	9.25	67
0	6	15.4	1	3.9	3.3	0.8	29.1	21.4	16.7	8.4	9.70	66
0	7	14.9	1	4	3.2	0.8	31.1	20.8	16.2	8	10.17	64
0	8	14.4	1	4.1	3.2	0.8	32.9	20.2	15.8	7.6	10.65	62
0	9	14	1	4.2	3.1	0.9	34.4	19.8	15.4	7.3	11.16	60
0	10	13.6	1	4.3	3.1	0.9	35.8	19.4	15.1	6.9	11.68	58
0	11	13.2	1	4.3	3.1	0.8	37	19	14.9	6.6	12.23	55
0	12	12.9	1	4.4	3.1	0.8	38	18.8	14.6	6.3	12.79	53
0	13	12.6	1	4.4	3.1	0.8	38.9	18.5	14.5	6.1	13.37	50
0	14	12.4	1	4.4	3.2	0.8	39.7	18.4	14.3	5.8	13.96	48
0	15	12.2	1	4.5	3.2	0.8	40.4	18.2	14.2	5.6	14.56	45
150	2	17.6	0.9	3.1	4	0.7	18	25.7	20.1	9.9	8.15	65
150	3	17	0.9	3.3	3.8	0.7	21.1	24.6	19.2	9.5	8.56	65
150	4	16.4	0.9	3.5	3.6	0.8	23.9	23.5	18.4	9	8.98	64
150	5	15.8	0.9	3.7	3.5	0.8	26.4	22.6	17.7	8.6	9.41	63
150	6	15.3	1	3.8	3.4	0.8	28.6	21.8	17	8.2	9.85	62
150	7	14.8	1	4	3.3	0.8	30.6	21.1	16.5	7.9	10.31	61
150	8	14.3	1	4.1	3.3	0.8	32.4	20.6	16	7.5	10.79	59
150	9	13.9	1	4.1	3.2	0.8	34	20	15.6	7.2	11.29	58
150	10	13.5	1	4.2	3.2	0.8	35.4	19.6	15.3	6.9	11.81	55
150	11	13.2	1	4.3	3.2	0.8	36.6	19.3	15	6.6	12.34	53
150	12	12.9	1	4.3	3.2	0.8	37.7	19	14.8	6.3	12.89	51
150	13	12.6	1	4.4	3.2	0.8	38.6	18.7	14.6	6	13.46	49
150	14	12.4	1	4.4	3.2	0.8	39.4	18.5	14.4	5.8	14.04	47
150	15	12.2	1	4.4	3.2	0.8	40.2	18.3	14.3	5.5	14.63	45
300	2	17.3	0.8	3	4.2	0.7	17.4	26.4	20.6	9.6	8.40	60
300	3	16.7	0.9	3.2	4	0.7	20.5	25.2	19.7	9.2	8.81	59
300	4	16.1	0.9	3.4	3.9	0.7	23.2	24.1	18.8	8.8	9.23	59
300	5	15.6	0.9	3.6	3.7	0.8	25.7	23.2	18.1	8.4	9.65	58
300	6	15.1	0.9	3.7	3.6	0.8	28	22.4	17.5	8	10.09	58
300	7	14.6	0.9	3.9	3.5	0.8	30	21.7	16.9	7.7	10.54	57
300	8	14.2	1	4	3.4	0.8	31.8	21	16.4	7.4	11.01	56
300	9	13.9	1	4.1	3.4	0.8	33.4	20.5	16	7	11.50	54
300	10	13.5	1	4.2	3.3	0.8	34.8	20	15.6	6.8	12.00	52
300	11	13.2	1	4.2	3.3	0.8	36.1	19.6	15.3	6.5	12.52	51
300	12	12.9	1	4.3	3.3	0.8	37.2	19.3	15	6.2	13.06	49
300	13	12.7	1	4.3	3.3	0.8	38.2	19	14.8	6	13.61	47
300	14	12.4	1	4.4	3.3	0.8	39	18.7	14.6	5.7	14.18	45
300	15	12.2	1	4.4	3.3	0.8	39.8	18.5	14.5	5.5	14.76	43

VEHICLE OPERATING COSTS 1999/2000
MICRO BUS-HDM CATEGORY 4

CURV deg/ km	IRI m/km	FUEL %	LUBR %	TIRE %	CREW %	M.L. %	M.P. %	DEPR %	INTE %	OVER %	TOTAL VOC Taka/km	SPEED km/ hour
0	2	32.1	1.7	1.2	5	1.3	10.1	21.4	12.9	14.2	4.08	78
0	3	31.1	1.8	1.3	4.8	1.4	12.6	20.7	12.4	13.7	4.24	78
0	4	30	1.9	1.4	4.7	1.6	15.6	19.9	11.9	13.1	4.44	77
0	5	28.5	1.9	1.5	4.5	1.7	19.1	19	11.4	12.4	4.70	75
0	6	26.9	1.9	1.5	4.3	1.9	23.2	18	10.8	11.6	5.02	73
0	7	25	1.8	1.5	4.1	2	27.8	16.9	10.2	10.7	5.44	71
0	8	23	1.8	1.4	3.9	2.1	32.9	15.8	9.5	9.7	5.97	68
0	9	20.9	1.7	1.4	3.7	2.2	38.3	14.5	8.7	8.7	6.65	65
0	10	18.9	1.6	1.3	3.5	2.2	43.5	13.3	8	7.8	7.46	62
0	11	17.3	1.5	1.3	3.3	2.2	47.6	12.3	7.4	7	8.28	58
0	12	16.1	1.4	1.2	3.2	2.2	51	11.6	6.9	6.4	9.11	55
0	13	15.1	1.4	1.2	3.1	2.2	53.8	11	6.6	5.8	9.94	52
0	14	14.3	1.3	1.1	3	2.1	56.1	10.4	6.3	5.4	10.78	49
0	15	13.6	1.3	1.1	2.9	2.1	58	10	6	5	11.63	47
150	2	31.3	1.7	1.2	5.4	1.3	9.9	22.1	13.2	14	4.15	72
150	3	30.4	1.8	1.3	5.2	1.4	12.4	21.3	12.8	13.4	4.31	71
150	4	29.3	1.8	1.4	5	1.6	15.4	20.4	12.3	12.8	4.51	71
150	5	28	1.8	1.4	4.8	1.7	18.8	19.5	11.7	12.2	4.77	69
150	6	26.5	1.8	1.5	4.6	1.8	22.9	18.5	11.1	11.4	5.10	68
150	7	24.7	1.8	1.5	4.4	2	27.4	17.3	10.4	10.5	5.51	66
150	8	22.8	1.7	1.4	4.1	2.1	32.5	16.1	9.6	9.6	6.04	64
150	9	20.8	1.7	1.4	3.9	2.1	37.9	14.8	8.9	8.6	6.72	62
150	10	18.9	1.6	1.3	3.6	2.2	43.1	13.5	8.1	7.7	7.52	59
150	11	17.4	1.5	1.2	3.4	2.2	47.3	12.5	7.5	7	8.34	56
150	12	16.1	1.4	1.2	3.3	2.2	50.7	11.7	7	6.3	9.16	54
150	13	15.1	1.3	1.2	3.1	2.2	53.5	11.1	6.6	5.8	9.99	51
150	14	14.3	1.3	1.1	3.1	2.1	55.9	10.5	6.3	5.4	10.83	48
150	15	13.6	1.2	1.1	3	2.1	57.8	10.1	6	5	11.67	46
300	2	30.5	1.7	1.2	5.9	1.2	9.6	22.7	13.6	13.6	4.28	64
300	3	29.7	1.7	1.3	5.7	1.4	12	22	13.2	13.1	4.44	64
300	4	28.7	1.8	1.3	5.5	1.5	14.9	21.1	12.7	12.5	4.64	63
300	5	27.5	1.8	1.4	5.2	1.7	18.4	20.1	12.1	11.9	4.89	63
300	6	26.1	1.8	1.4	5	1.8	22.4	19	11.4	11.1	5.22	62
300	7	24.5	1.8	1.4	4.7	1.9	26.9	17.8	10.7	10.3	5.63	60
300	8	22.7	1.7	1.4	4.4	2	31.9	16.5	9.9	9.4	6.15	59
300	9	20.8	1.6	1.3	4.1	2.1	37.3	15.2	9.1	8.5	6.82	57
300	10	18.9	1.5	1.3	3.8	2.2	42.5	13.9	8.3	7.6	7.62	55
300	11	17.4	1.5	1.2	3.6	2.2	46.8	12.8	7.7	6.9	8.43	53
300	12	16.2	1.4	1.2	3.4	2.2	50.2	12	7.2	6.3	9.25	51
300	13	15.2	1.3	1.2	3.3	2.1	53.1	11.3	6.8	5.8	10.07	49
300	14	14.4	1.3	1.1	3.1	2.1	55.5	10.7	6.4	5.3	10.90	47
300	15	13.7	1.2	1.1	3.1	2.1	57.5	10.2	6.1	4.9	11.74	45

VEHICLE OPERATING COSTS 1999/2000
LARGE BUS-HDM CATEGORY 5

CURV deg/ km	IRI m/km	FUEL %	LUBR %	TIRE %	CREW %	M.L. %	M.P. %	DEPR %	INTE %	OVER %	TOTAL VOC Taka/km	SPEED km/ hour
0	2	17.9	1.1	5	6.7	3.3	20.7	16.7	8	20.7	12.05	63
0	3	17.8	1.1	5	6.6	3.6	21.3	16.4	7.9	20.4	12.26	63
0	4	17.6	1.1	5	6.5	3.8	21.9	16.2	7.8	20	12.48	63
0	5	17.4	1.1	5	6.5	4.1	22.5	16	7.7	19.6	12.73	62
0	6	17.1	1.2	5	6.4	4.5	23.1	15.9	7.6	19.2	13.00	61
0	7	16.8	1.2	5	6.4	4.8	23.6	15.7	7.6	18.8	13.30	60
0	8	16.5	1.2	5	6.5	5.1	24.1	15.7	7.5	18.3	13.63	58
0	9	16.2	1.2	4.9	6.5	5.5	24.6	15.7	7.5	17.9	14.00	56
0	10	15.8	1.2	4.9	6.6	5.9	25	15.7	7.5	17.3	14.41	54
0	11	15.5	1.2	4.8	6.7	6.3	25.4	15.7	7.6	16.8	14.87	51
0	12	15.2	1.2	4.7	6.8	6.7	25.8	15.8	7.6	16.3	15.36	49
0	13	14.9	1.2	4.6	6.9	7.1	26.1	15.9	7.6	15.7	15.90	46
0	14	14.6	1.2	4.5	7	7.5	26.4	15.9	7.6	15.2	16.47	44
0	15	14.3	1.2	4.5	7.1	8	26.6	16	7.7	14.6	17.08	42
150	2	17.6	1.1	5.4	6.8	3.2	20.5	16.8	8.1	20.5	12.19	61
150	3	17.5	1.1	5.4	6.7	3.5	21.1	16.6	8	20.2	12.40	61
150	4	17.3	1.1	5.4	6.7	3.8	21.7	16.4	7.9	19.8	12.62	61
150	5	17.1	1.1	5.5	6.6	4.1	22.3	16.2	7.8	19.4	12.87	60
150	6	16.9	1.2	5.5	6.5	4.4	22.8	16	7.7	19	13.14	59
150	7	16.6	1.2	5.5	6.5	4.7	23.4	15.9	7.6	18.6	13.44	58
150	8	16.3	1.2	5.5	6.5	5.1	23.9	15.8	7.6	18.2	13.77	57
150	9	16	1.2	5.4	6.6	5.5	24.4	15.8	7.6	17.7	14.14	55
150	10	15.7	1.2	5.4	6.7	5.8	24.8	15.7	7.6	17.2	14.55	53
150	11	15.4	1.2	5.3	6.7	6.2	25.2	15.8	7.6	16.7	15.01	50
150	12	15	1.2	5.2	6.8	6.6	25.5	15.8	7.6	16.1	15.50	48
150	13	14.8	1.2	5.1	6.9	7.1	25.9	15.9	7.6	15.6	16.03	46
150	14	14.5	1.2	5.1	7	7.5	26.2	15.9	7.6	15.1	16.60	44
150	15	14.2	1.2	5	7.1	7.9	26.4	15.9	7.7	14.5	17.22	42
300	2	17.2	1	5.7	7.1	3.2	20.1	17.2	8.3	20.2	12.41	58
300	3	17	1.1	5.8	7	3.4	20.7	17	8.2	19.8	12.62	58
300	4	16.9	1.1	5.9	6.9	3.7	21.3	16.7	8	19.5	12.85	57
300	5	16.7	1.1	5.9	6.8	4	21.9	16.5	7.9	19.1	13.09	57
300	6	16.5	1.1	5.9	6.8	4.3	22.4	16.3	7.8	18.7	13.36	56
300	7	16.3	1.2	6	6.7	4.7	23	16.2	7.8	18.3	13.66	55
300	8	16	1.2	5.9	6.7	5	23.5	16	7.7	17.9	14.00	54
300	9	15.7	1.2	5.9	6.8	5.4	24	16	7.7	17.4	14.36	53
300	10	15.5	1.2	5.9	6.8	5.7	24.4	15.9	7.6	16.9	14.77	51
300	11	15.2	1.2	5.8	6.8	6.1	24.8	15.9	7.6	16.4	15.21	49
300	12	14.9	1.2	5.8	6.9	6.5	25.2	15.9	7.6	15.9	15.70	47
300	13	14.6	1.2	5.7	7	7	25.5	15.9	7.6	15.4	16.23	45
300	14	14.4	1.2	5.6	7.1	7.4	25.9	15.9	7.7	14.9	16.80	43
300	15	14.1	1.2	5.6	7.2	7.9	26.1	16	7.7	14.4	17.40	41

VEHICLE OPERATING COSTS 1999/2000
MINI BUS-HDM CATEGORY 5

CURV deg/ km	IRI m/km	FUEL %	LUBR %	TIRE %	CREW %	M.L. %	M.P. %	DEPR %	INTE %	OVER %	TOTAL VOC Taka/km	SPEED km/ hour
0	2	26.7	1.9	7.3	7.1	5.2	12.9	13.3	9.6	16.1	6.97	65
0	3	26.4	1.9	7.4	7	5.6	13.3	13.1	9.4	15.8	7.08	65
0	4	26.1	2	7.4	6.9	6.1	13.7	12.9	9.3	15.5	7.20	64
0	5	25.8	2	7.5	6.9	6.6	14.1	12.8	9.2	15.3	7.34	64
0	6	25.4	2	7.4	6.8	7.1	14.4	12.7	9.1	15	7.48	63
0	7	25	2.1	7.4	6.9	7.6	14.8	12.6	9.1	14.7	7.64	61
0	8	24.5	2.1	7.3	6.9	8.2	15.2	12.5	9	14.3	7.82	59
0	9	24	2.1	7.2	7	8.8	15.5	12.5	9	14	8.03	57
0	10	23.4	2.1	7.1	7.1	9.4	15.8	12.5	9	13.6	8.25	55
0	11	22.9	2.1	6.9	7.2	10	16	12.5	9	13.2	8.51	52
0	12	22.5	2.1	6.8	7.4	10.7	16.2	12.5	9	12.7	8.79	49
0	13	22	2.1	6.6	7.5	11.4	16.4	12.5	9	12.3	9.10	47
0	14	21.6	2.1	6.5	7.6	12.1	16.6	12.6	9	11.9	9.43	44
0	15	21.3	2.1	6.3	7.8	12.8	16.7	12.5	9	11.4	9.79	42
150	2	26.2	1.8	7.9	7.2	5.1	12.7	13.4	9.7	15.9	7.05	63
150	3	25.9	1.9	8	7.1	5.6	13.1	13.2	9.5	15.6	7.17	63
150	4	25.7	1.9	8	7.1	6	13.5	13.1	9.4	15.4	7.29	62
150	5	25.3	2	8	7	6.5	13.9	12.9	9.3	15.1	7.43	62
150	6	25	2	8.1	7	7	14.3	12.8	9.2	14.8	7.57	61
150	7	24.6	2	8	7	7.5	14.6	12.7	9.1	14.5	7.74	59
150	8	24.1	2.1	8	7	8.1	15	12.6	9.1	14.1	7.92	58
150	9	23.6	2.1	7.9	7.1	8.7	15.3	12.5	9	13.8	8.12	56
150	10	23.2	2.1	7.8	7.2	9.3	15.6	12.5	9	13.4	8.35	54
150	11	22.7	2.1	7.6	7.3	9.9	15.8	12.5	9	13	8.61	51
150	12	22.3	2.1	7.5	7.4	10.6	16.1	12.5	9	12.6	8.89	49
150	13	21.9	2.1	7.3	7.5	11.2	16.3	12.5	9	12.2	9.19	46
150	14	21.5	2.1	7.2	7.6	11.9	16.4	12.5	9	11.8	9.53	44
150	15	21.1	2.1	7.1	7.7	12.7	16.6	12.5	9	11.3	9.89	42
300	2	25.5	1.8	8.4	7.6	5	12.5	13.7	9.9	15.6	7.18	59
300	3	25.3	1.8	8.5	7.5	5.5	12.9	13.5	9.7	15.4	7.29	59
300	4	25	1.9	8.6	7.4	5.9	13.3	13.3	9.6	15.1	7.42	58
300	5	24.7	1.9	8.6	7.3	6.4	13.7	13.1	9.5	14.8	7.56	58
300	6	24.4	2	8.6	7.2	6.9	14	13	9.3	14.5	7.71	57
300	7	24	2	8.7	7.2	7.4	14.4	12.8	9.2	14.2	7.88	56
300	8	23.7	2	8.6	7.2	8	14.7	12.7	9.2	13.9	8.06	55
300	9	23.3	2	8.6	7.2	8.5	15	12.7	9.1	13.5	8.27	53
300	10	22.8	2.1	8.5	7.3	9.1	15.3	12.6	9.1	13.2	8.49	52
300	11	22.4	2.1	8.4	7.4	9.8	15.6	12.6	9	12.8	8.75	50
300	12	22	2.1	8.3	7.5	10.4	15.8	12.5	9	12.4	9.03	47
300	13	21.6	2.1	8.1	7.6	11.1	16	12.5	9	12	9.33	45
300	14	21.3	2.1	8	7.7	11.8	16.2	12.5	9	11.6	9.66	43
300	15	20.9	2	7.9	7.7	12.5	16.4	12.5	9	11.2	10.02	41

VEHICLE OPERATING COSTS 1999/2000
SMALL TRUCK-HDM CATEGORY 7

CURV deg/ km	IRI m/km	FUEL %	LUBR %	TIRE %	CREW %	M.L. %	M.P. %	DEPR %	INTE %	OVER %	TOTAL VOC Taka/km	SPEED km/ hour
0	2	21.2	1.3	13	3.9	3.3	6	18.6	8.9	23.8	7.14	64
0	3	20.5	1.4	12.8	3.8	3.8	8.2	17.9	8.6	22.9	7.42	64
0	4	19.9	1.4	12.7	3.7	4.2	10.3	17.4	8.4	22.1	7.70	63
0	5	19.3	1.4	12.5	3.7	4.5	12.3	17	8.1	21.3	7.99	62
0	6	18.8	1.4	12.3	3.6	4.7	14	16.6	8	20.5	8.29	60
0	7	18.3	1.4	12.1	3.6	4.9	15.7	16.4	7.9	19.8	8.60	58
0	8	17.9	1.5	11.8	3.6	5	17.2	16.2	7.8	19	8.94	56
0	9	17.6	1.5	11.6	3.6	5.2	18.5	16.1	7.7	18.3	9.29	53
0	10	17.3	1.5	11.3	3.7	5.2	19.7	16	7.7	17.6	9.65	51
0	11	17.1	1.5	11.1	3.7	5.3	20.8	16	7.7	16.9	10.04	48
0	12	16.9	1.5	10.9	3.8	5.3	21.8	15.9	7.7	16.3	10.44	45
0	13	16.7	1.5	10.7	3.9	5.3	22.6	16	7.7	15.7	10.85	43
0	14	16.6	1.5	10.5	3.9	5.3	23.4	16	7.7	15.1	11.28	40
0	15	16.6	1.5	10.3	4	5.3	24.1	16	7.7	14.5	11.71	38
150	2	20.7	1.3	14.1	4	3.2	5.8	18.7	9	23.2	7.33	61
150	3	20.1	1.3	14	3.9	3.7	8	18	8.6	22.3	7.62	61
150	4	19.5	1.4	13.8	3.8	4.1	10.1	17.5	8.4	21.5	7.90	60
150	5	19	1.4	13.7	3.7	4.4	12	17	8.2	20.7	8.19	59
150	6	18.5	1.4	13.5	3.7	4.6	13.7	16.6	8	20	8.50	58
150	7	18.1	1.4	13.3	3.6	4.8	15.3	16.4	7.9	19.3	8.81	56
150	8	17.7	1.4	13.1	3.6	4.9	16.8	16.1	7.7	18.6	9.15	54
150	9	17.4	1.4	12.8	3.7	5	18.1	16	7.7	17.9	9.50	52
150	10	17.1	1.4	12.6	3.7	5.1	19.3	15.9	7.6	17.2	9.87	49
150	11	16.9	1.4	12.4	3.7	5.2	20.4	15.8	7.6	16.6	10.25	47
150	12	16.7	1.4	12.2	3.8	5.2	21.3	15.8	7.6	16	10.65	45
150	13	16.5	1.4	12	3.9	5.2	22.2	15.8	7.6	15.4	11.06	42
150	14	16.4	1.4	11.8	3.9	5.2	23	15.8	7.6	14.8	11.49	40
150	15	16.3	1.4	11.7	4	5.2	23.7	15.8	7.6	14.3	11.93	38
300	2	20.3	1.3	15.3	4.2	3.1	5.6	18.9	9	22.4	7.59	57
300	3	19.7	1.3	15.1	4	3.5	7.7	18.2	8.7	21.6	7.88	56
300	4	19.2	1.3	15	3.9	3.9	9.7	17.6	8.5	20.8	8.17	56
300	5	18.7	1.3	14.9	3.8	4.2	11.6	17.2	8.2	20.1	8.47	55
300	6	18.2	1.4	14.7	3.8	4.5	13.3	16.8	8	19.4	8.77	54
300	7	17.8	1.4	14.6	3.7	4.6	14.8	16.4	7.9	18.7	9.09	53
300	8	17.4	1.4	14.4	3.7	4.8	16.3	16.2	7.8	18	9.43	51
300	9	17.1	1.4	14.2	3.7	4.9	17.6	16	7.7	17.4	9.78	50
300	10	16.9	1.4	14	3.7	5	18.8	15.9	7.6	16.8	10.14	48
300	11	16.6	1.4	13.8	3.8	5	19.8	15.8	7.6	16.2	10.53	45
300	12	16.5	1.4	13.6	3.8	5.1	20.8	15.7	7.5	15.6	10.92	43
300	13	16.3	1.4	13.5	3.8	5.1	21.7	15.7	7.5	15	11.34	41
300	14	16.2	1.4	13.3	3.9	5.1	22.5	15.7	7.5	14.5	11.76	39
300	15	16.1	1.4	13.2	4	5.1	23.2	15.7	7.5	13.9	12.20	37

VEHICLE OPERATING COSTS 1999/2000
MEDIUM TRUCK-HDM CATEGORY 8

CURV deg/ km	IRI m/km	FUEL %	LUBR %	TIRE %	CREW %	M.L. %	M.P. %	DEPR %	INTE %	OVER %	TOTAL VOC Taka/km	SPEED km/ hour
0	2	25.9	1.5	8.1	3.8	3	11.5	11.4	7.5	27.3	8.69	61
0	3	24.6	1.5	7.8	3.6	3.4	15.4	10.8	7.1	25.7	9.21	61
0	4	23.4	1.4	7.6	3.4	3.7	18.9	10.3	6.8	24.4	9.73	60
0	5	22.3	1.4	7.3	3.3	3.9	22.1	9.9	6.6	23.1	10.25	59
0	6	21.3	1.4	7.1	3.3	4.1	24.9	9.7	6.4	22	10.78	57
0	7	20.3	1.4	6.8	3.2	4.2	27.4	9.5	6.2	20.9	11.33	55
0	8	19.5	1.4	6.6	3.2	4.3	29.6	9.3	6.2	19.9	11.88	52
0	9	18.7	1.4	6.4	3.2	4.3	31.7	9.3	6.1	19	12.46	50
0	10	18	1.3	6.2	3.3	4.3	33.4	9.2	6.1	18.2	13.05	47
0	11	17.5	1.3	6	3.3	4.4	35	9.2	6.1	17.3	13.67	44
0	12	17	1.3	5.8	3.3	4.3	36.4	9.2	6.1	16.6	14.30	42
0	13	16.6	1.3	5.6	3.4	4.3	37.6	9.2	6.1	15.9	14.95	40
0	14	16.2	1.3	5.5	3.4	4.3	38.7	9.2	6.1	15.2	15.60	37
0	15	15.9	1.3	5.4	3.5	4.3	39.7	9.3	6.1	14.6	16.28	35
150	2	25.3	1.5	8.7	3.9	3	11.4	11.6	7.7	27	8.79	59
150	3	24	1.4	8.4	3.7	3.4	15.3	11	7.3	25.4	9.32	58
150	4	22.9	1.4	8.2	3.5	3.7	18.7	10.5	6.9	24.1	9.84	57
150	5	21.9	1.4	7.9	3.4	3.9	21.8	10.1	6.7	22.9	10.37	56
150	6	20.9	1.4	7.7	3.3	4	24.6	9.8	6.5	21.7	10.91	55
150	7	20	1.4	7.4	3.3	4.1	27.1	9.6	6.3	20.7	11.45	53
150	8	19.2	1.4	7.2	3.3	4.2	29.3	9.4	6.2	19.7	12.01	51
150	9	18.5	1.3	7	3.3	4.3	31.3	9.3	6.2	18.8	12.59	49
150	10	17.9	1.3	6.8	3.3	4.3	33.1	9.3	6.1	18	13.19	46
150	11	17.3	1.3	6.6	3.3	4.3	34.7	9.2	6.1	17.2	13.80	44
150	12	16.9	1.3	6.4	3.4	4.3	36.1	9.2	6.1	16.4	14.43	41
150	13	16.5	1.3	6.3	3.4	4.3	37.3	9.2	6.1	15.7	15.08	39
150	14	16.1	1.3	6.1	3.4	4.3	38.4	9.2	6.1	15.1	15.74	37
150	15	15.8	1.2	6	3.5	4.2	39.4	9.3	6.1	14.4	16.41	35
300	2	24.5	1.4	9.3	4.1	3	11.2	12	7.9	26.5	8.94	55
300	3	23.4	1.4	9	3.9	3.3	15	11.4	7.5	25	9.47	54
300	4	22.3	1.4	8.8	3.7	3.6	18.4	10.9	7.2	23.7	10.00	54
300	5	21.4	1.4	8.5	3.6	3.8	21.5	10.4	6.9	22.5	10.53	53
300	6	20.5	1.4	8.3	3.5	4	24.2	10.1	6.7	21.4	11.07	52
300	7	19.7	1.4	8.1	3.4	4.1	26.7	9.8	6.5	20.4	11.62	50
300	8	18.9	1.3	7.9	3.4	4.2	28.9	9.6	6.4	19.4	12.19	49
300	9	18.3	1.3	7.7	3.4	4.2	30.9	9.5	6.3	18.6	12.77	47
300	10	17.7	1.3	7.5	3.4	4.2	32.6	9.4	6.2	17.7	13.37	45
300	11	17.2	1.3	7.3	3.4	4.3	34.2	9.3	6.2	16.9	13.98	42
300	12	16.7	1.3	7.1	3.4	4.3	35.6	9.3	6.1	16.2	14.61	40
300	13	16.4	1.3	7	3.4	4.2	36.9	9.3	6.1	15.5	15.26	38
300	14	16	1.2	6.8	3.5	4.2	38	9.3	6.1	14.9	15.92	36
300	15	15.7	1.2	6.7	3.5	4.2	39	9.3	6.1	14.3	16.59	35