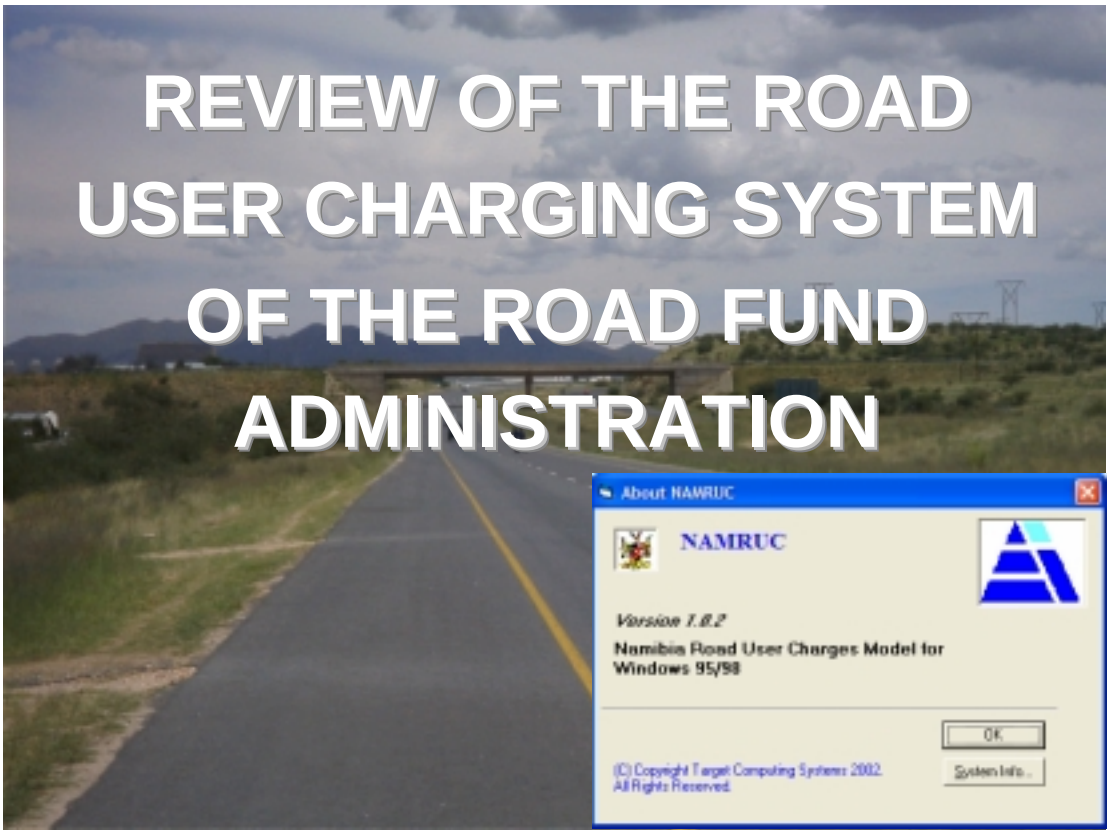
REVIEW OF THE ROAD USER CHARGING SYSTEM OF THE ROAD FUND ADMINISTRATION



PART B: STUDY ON MACRO-ECONOMIC IMPACTS OF ECONOMIC EFFICIENCY IN THE ROAD SECTOR

PHASE 2: REVIEW OF IMPACTS OF SPECIFIC INSTRUMENTS ON THE ECONOMY

AND

PART C: REVIEW OF ROAD USER CHARGES

PHASE 1: RUC POLICY DOCUMENT, REVISED NAMRUC MODEL & RUC STRATEGY

FINAL REPORT

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EXECUTIVE SUMMARY

Background

The Namibia Road User Charges (RUC) System was developed with the aim of economically recovering the full cost of roads expenditure from road users in an equitable manner. The system determines the amount and manner of funds to be raised from road users in accordance with the "user pay" principle, and consequently determines the road user charges to be imposed.

The implementation of a basic structure for a RUC System in April 2000 was based on the findings and recommendations of the ICTE as per the *Proposed Policy on Road User Charging* document. The RUC System was designed to achieve the following objectives:

- Ensure that revenue needed to provide and maintain roads is raised from road users (including foreign road users) rather than the general taxpayer;
- Price the use of roads so as to improve economic efficiency in road transport by removing price distortions and charging road users according to the "consumption" of roads;
- Promote equity between different categories of road users
- Establish a link between supply and demand for transport infrastructure;
- Increase transparency in the road funding process; and
- Provide for equal competition between road and rail transport by letting road transport operators pay for their use of infrastructure.

Purpose of the project

During June 2003 Africon Namibia was appointed to conduct a review study of the current RUC System, with the main purpose of investigating and determining whether current revenue levels are sufficient and adequate and also whether the current RUC System adheres to the principles of equity and efficiency.

Current cost recovery instruments are the fuel levy, license fees, cross-border charges as well as abnormal vehicle fees. Although these RUC instruments have been implemented since the development of a basic structure for road user charging structure in April 2000, Mass Distance Charges (MDCs) have not yet been implemented yet due to various constraints experienced in the implementation thereof. Legal provisions also need to be developed for the implementation of MDCs. This is one of the reasons that necessitated the review of the RUC System, of which this document forms part.

The purpose of this report is therefore to provide the findings of the review of the current road user charges (RUC) and the updating of the NAMRUC Model, and to provide the RFA with options or scenarios to recover costs from road users by investigating a number of options in terms of efficiency and equity. Other considerations such as comparison of fuel prices with countries in the region, impacts on VOCs as well as broader macro-economic impacts were also investigated.

The NAMRUC Model was developed for the calculation of the level of RUCs in Namibia according to the principles of the RUC System in order to recover all road costs from road users during a specific year. The NAMRUC Model includes all the respective RUC instruments and

calculates the level of the different RUCs. The calculation of these levels forms the basis for defining the future stable, real, annual expenditure level of road user charges.

Approach and methodology

The first part of this study consisted of a short review of the current RUCs. This was followed by an update of the NAMRUC Model with the most recent information available, and consisted of the updating and amendment of the following modules:

- NaTIS Information;
- Module 1: Vehicle Population;
- Module 3: Annual Fuel Sales, Vehicle Travel Estimates and Current Fees;
- Module 5: Road Fund Expenditure Budget; and
- Module 10: Scenario Analyser.

A total of N$ 926.3 million per annum needs to be recovered from road users for sustainable, long-term funding of the Namibian road network. This amount is based on the RFA Business Plan as well as the Medium to Long Term Roads Master Plan. Currently only N$ 506.5 million is recovered from road users. Therefore there is an under-recovery of N$ 419.8 million.

Once the NAMRUC Model was updated, the implications of the respective RUC instruments were assessed through analysis of several scenarios to recover road costs from road users. The scenarios analysed were the following:

- **Scenario 1: Maintain current instruments**
    - Scenario 1.1: Maintain current instruments with **fuel levies** as adjustment fee;
    - Scenario 1.2: Maintain current instruments with **licence fees** as adjustment fee;
- **Scenario 2: Introduction of MDCs**
    - Scenario 2.A.1: Introduction of MDCs for diesel vehicles (diesel levy **lowered**) and adjustment of under-recovery through **fuel levies** for petrol vehicles;
    - Scenario 2.A.2: Introduction of MDCs for diesel vehicles (diesel levy **lowered**) and adjustment of under-recovery through **licence fees** for petrol vehicles;
    - Scenario 2.B.1: Introduction of MDCs for diesel vehicles (diesel levy **abolished**) and adjustment of under-recovery through **fuel levies** for petrol vehicles;
    - Scenario 2.B.2: Introduction of MDCs for diesel vehicles (diesel levy **abolished**) and adjustment of under-recovery through **licence fees** for petrol vehicles;
- **Scenario 3: Fuel levies only;**
- **Scenario 4: Licence fees only; and**
- **Scenario 5: MDCs only.**

Each of the above scenarios were analysed in terms of the following costs:

- Equity loss due to the fuel levy;
- Equity loss due to licence fees;

- VAT Refunds (as a negative cost when applicable);
- Collection costs of fuel levies;
- Collection costs of licence fees;
- Collection costs of MDCs;
- Evasion loss; and
- Cost of the Fuel Levy Refund System.

The above costs were categorised again into "perceived" equity costs and actual system costs ("efficiency" costs) for each of the scenarios that were analysed.

Once these costs were determined and analysed, other aspects that affect the preferred suite of cost recovery instruments and their levels were also identified, considered and analysed. This was followed by conclusions and recommendations.

Results from analysis

The results of the scenario analysis are presented in the following table:

Item	Cost per Scenario per Annum (N$ million)								
	1.1	**1.2**	**2.A.1**	**2.A.2**	**2.B.1**	**2.B.2**	**3**	**4**	**5**
Equity Costs	61.90	56.65	43.59	43.68	47.24	47.44	36.01	68.33	49.39
Equity Loss (Fuel levies)	54.51	16.10	21.17	15.78	21.03	15.57	36.01	0.00	0.00
Equity Loss (Licence fees)	7.39	40.55	7.39	12.07	7.39	12.24	0.00	68.33	0.00
Evasion Loss	0.00	0.00	15.03	15.83	18.82	19.63	0.00	0.00	49.39
System Costs	-105.44	-50.39	-53.26	-18.68	-41.24	-5.86	-119.91	6.98	56.37
System Costs (excl. VAT Refunds)	8.95	8.95	23.98	24.78	26.10	26.91	8.95	6.98	56.37
VAT Refunds	-114.39	-59.34	-77.24	-43.46	-67.34	-32.77	-128.86	0.00	0.00
Collection Costs (Fuel levies)	0.74	0.74	0.74	0.74	0.30	0.30	0.74	0.00	0.00
Collection Costs (Licence fees)*	6.98	6.98	6.98	6.98	6.98	6.98	6.98	6.98	6.98
Collection Costs (MDCs)	0.00	0.00	15.03	15.83	18.82	19.63	0.00	0.00	49.39
Fuel Levy Refund System	1.23	1.23	1.23	1.23	0.00	0.00	1.23	0.00	0.00
TOTAL	-43.54	6.26	-9.67	25.00	6.00	41.58	-83.90	75.31	105.76
TOTAL (excl. VAT Refunds)	70.85	65.60	67.57	68.46	73.34	74.35	44.96	75.31	105.76

Note: Negative costs represent benefits.

* Although licence fees are not used as RUC instrument for each scenario, the licence fee collection cost refers to a nominal contribution of the RFA to the licensing system under the MWTC even if the RFA should decide to implement its own (i.e. not under MWTC) vehicle licensing system.

From the above table, the following is evident:

- If VAT Refunds are **included** (i.e. considered to be applicable to funding from fuel levies, as is the case at present), the three lowest cost scenarios are as follows:
    - Scenario 3 – Fuel Levies Only
    - Scenario 1.1 – Current Instruments with Fuel Levies as Adjustment Fee; and
    - Scenario 2.A.1 – Introduction of MDCs (Diesel Levy lowered) and Fuel Levies as Adjustment Fee for Petrol Vehicles.

- If VAT Refunds are **excluded**, the ranking is as follows:
    - Scenario 3 – Fuel Levies Only
    - Scenario 1.2 - Current Instruments with Licence Fees as Adjustment Fee; and

- Scenario 2.A.1 – Introduction of MDCs (Diesel Levy lowered) and Fuel Levies as Adjustment Fee for Petrol Vehicles.

The selection of Scenario 3, where the fuel levy is the only RUC instrument, will however have several negative impacts. One of the most important is that fuel levies need to increase drastically, which may not be an optimal approach at this stage.

A set of other factors that also affect the optimal selection of a strategy for RUC instruments and their levels was also identified, as follows:

- Fuel price differential i.e. the difference in the fuel price of Namibia and its neighbouring countries, that can result in fuel smuggling or loss of revenues.
- Elasticity of fuel sales, namely the probable impact of fuel price increases on the quantity of fuel sold.
- The impact on vehicle operating costs (VOCs).
- The impact on the road asset value.
- A possible modal shift that can occur once instrument levels are changed.
- Macro-economic considerations namely:
  - A shift in consumption patterns
  - Societal equity
  - Inflationary effects
- Practical considerations such as the potential risk of concentrating on one RUC instrument only.

A qualitative evaluation of the scenarios in terms of the above-mentioned other factors is shown in the following table, with equal weightings attached to all factors:

Evaluation of scenarios in terms of other considerations

	Scenario								
Item	**1.1**	**1.2**	**2.A.1**	**2.A.2**	**2.B.1**	**2.B.2**	**3**	**4**	**5**
Fuel smuggling							X		
Future loss of fuel levy revenue			X	X	X	X		X	X
Modal shift		X	X	X	X	X		X	X
Societal equity		X	X	X	X	X		X	X
Inflationary impact	X	X	X	X	X	X	X	X	X
Dependence on single RUC instrument							X	X	X
Limited scope for fuel levy increase	X		X		X		X		
Contribution of heavy transport to economy		X	X	X	X	X		X	X
TOTAL	**2**	**4**	**6**	**5**	**6**	**5**	**4**	**6**	**6**

Note: X represents a **disadvantage** in terms of the evaluation criteria per scenario.

The results from the table indicate the following:

- Fuel smuggling: Scenario 3, where the fuel price will be significantly higher than neighbouring countries, can result in fuel smuggling from neighbouring countries.
- Future loss of fuel levy as a RUC instrument: The implementation of scenarios 2.A.1, 2.A.2, 2.B.1 and 2.B.2 (lowering/abolishment of diesel levy only) as well as scenarios 4 and 5 (abolishment of petrol and diesel levies)) could imply that the fuel levy (on diesel and/or petrol) as a revenue source for the RFA would be lost forever.

- Modal shift: The possibility of a modal shift between vehicle types as well as distortive effects on the vehicle market is lower for scenarios where there is a uniform increase in VOCs between vehicle classes (i.e. scenarios 1.1 and 3)
- Societal equity: The possible negative impacts on societal equity are highest for the scenarios where heavy vehicles face the highest increase in VOCs due to the imposition of additional RUCs.
- Inflationary impact: All scenarios will have an inflationary impact as additional revenue needs to be recovered but the scenarios where heavy vehicles face the highest increase in VOCs due to the imposition of additional RUCs will have a higher inflationary impact, as heavy vehicles are used for the transportation of goods (e.g. especially scenarios 2.B.1, 2.B.2, 4 and 5).
- Dependence on single RUC instrument: Scenarios 3, 4 and 5 imply that only one single RUC instrument is used which provides a greater risk to the RFA.
- Limited scope for fuel levy increases: Scenarios 1.1 (petrol and diesel levy increase), 2.A.1 (petrol levy increase only), 2.B.1 (petrol levy increase only) and 3 (petrol and diesel levy years.
- Contribution of heavy transport to the economy: Heavy vehicles make a significant contribution to the economy, and the scenarios where heavy vehicles face the highest increase in VOCs due to the imposition of additional RUCs can have a negative total economic impact.
- The last row gives a summation of all disadvantages, and it will be noted that Scenario 1.1 followed by scenarios 1.2 and 3 in second position are the most beneficial, as they have the lowest number of disadvantages.

Conclusions and recommendations

This part of the project was aimed at determining the optimal strategy for road user charging in Namibia, after the first few years of operation of the system.

The key findings of the analysis of various RUC scenarios lead to the following conclusions:

- Although the use of the fuel levy as the only RUC instrument (Scenario 3) is attractive in terms of low cost of collection, low revenue risk and simplicity, there are various disadvantages. Such an approach would require high increases (more than 80c/l) in the fuel price and the inequity in cost recovery between vehicle classes will increase. These disadvantages render this option impractical
- The current suite of RUC instruments (Scenarios 1.1 and 1.2) emerged as the next scenarios with lowest cost. Inequities in terms of cost recovery however still exist between and within vehicle classes
- These inequities can be addressed through the introduction of MDCs (Scenarios 2.A.1 and 2.A.2) in addition to current RUC instruments, although such a system would have a cost implication in terms of development, implementation and operation
- Implementation of MDCs while abolishing the diesel fuel levy (Scenarios 2.B.1 and 2.B.2) is not considered to be desirable, due to high system costs, negative impacts associated with the lower fuel price, and loss of the fuel levy as an effective instrument
- Implementation of only licence fees or only MDCs (Scenarios 4 and 5) are also not considered to be feasible, given high total costs as well as dependence on only one instrument.

Based on these findings the following RUC instrument strategy is recommended:

- The current RUC instruments should be maintained, namely the fuel levy, license fees and the cross-border charges system
- The parallel systems should be refined by taking steps identified in Phases 2 and 4 of this project, that reviewed the Fuel Levy Refunding System and the Cross Border Charges System respectively
- The MDC system should be implemented to address issues of inequity between and within vehicle classes, in line with the findings of Phase 3 of this project. Initially, a simplified flat fee base system should be implemented. This can be accompanied by a parallel pilot system to investigate the feasibility of a technology-based system.
- The levels of the various instruments should be increased based on the findings of this part of the project, and can be phased in over time to increase revenues up to the optimal long term level required for sustainable funding

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1. INTRODUCTION

1.1 BACKGROUND

A Road User Charging (RUC) System in general is defined as a system to raise revenue from road users to cover and pay for the costs of providing and maintaining public roads.

During October 1990 the Ministry of Works, Transport and Communication (MWTC) appointed consultants to carry out a study on an appropriate road taxation system for Namibia. During April 1992 Cabinet approved of the *Draft White Paper on Transport Policy (DWP)*. The initiative for a RUC System was based on the recommendations of the *Draft White Paper.* In March 1993 the Cabinet approved in principle the recommendations of a document entitled *Proposed Policy on Road User Charging,* and at the same time approved that an Interministerial Committee of Technical Experts (ICTE) be appointed to formulate final policy recommendations concerning the administrative, technical, legal and institutional issues related to the implementation of a RUC System for Namibia. Subsequently, a RUC System was implemented for Namibia in 2000.

During June 2003 Africon Namibia was appointed to conduct a review study of the current RUC System, with the main purpose of investigating and determining whether current revenue levels are sufficient and adequate and also whether the current RUC System adheres to the principles of equity and efficiency.

1.2 DEVELOPMENT OF THE NAMIBIA RUC SYSTEM

The Road Fund Administration (RFA) Act of 1999 defines the RUC System as being an independent system to regulate road funding to be based on the principles of economic efficiency and full cost recovery.

The Namibia RUC System was developed with the aim of economically recovering the full cost of roads expenditure from road users in an equitable manner. The system determines the amount and manner of funds to be raised from road users in accordance with the "user pay" principle, and consequently determines the road user charges to be imposed.

The implementation of a basic structure for a RUC System in April 2000 was based on the findings and recommendations of the ICTE as per the *Proposed Policy on Road User Charging* document. The RUC System was designed to achieve the following objectives:

- Ensure that revenue needed to provide and maintain roads is raised from road users (including foreign road users) rather than the general taxpayer;
- Price the use of roads so as to improve economic efficiency in road transport by removing price distortions and charging road users according to the "consumption" of roads;

- Promote equity between different categories of road users
- Establish a link between supply and demand for transport infrastructure;
- Increase transparency in the road funding process; and
- Provide for equal competition between road and rail transport by letting road transport operators pay for their use of infrastructure.

Current cost recovery instruments are the fuel levy, license fees, cross-border charges as well as abnormal vehicle fees. Although these RUC instruments have been implemented since the development of a basic structure for road user charging structure in April 2000, Mass Distance Charges (MDCs) have not yet been implemented yet due to various constraints experienced in the implementation thereof. Legal provisions also need to be developed for the implementation of MDCs. This is one of the reasons that necessitated the review of the RUC System, of which this document forms part.

The purpose of this report is therefore to provide the findings of the review of the current road user charges (RUC) and the updating of the NAMRUC Model, and to provide the RFA with options or scenarios to recover costs from road users by investigating a number of options in terms of efficiency and equity. Other considerations such as comparison of fuel prices with countries in the region, impacts on VOCs as well as broader macro-economic impacts were also investigated.

The study is conducted in the following parts:

- Part B: Macro-Economic Impacts of Economic Efficiency in the Road Sector (MIEERS) Study
  - Phase 1: Review of Road Sector
  - Phase 2: Review of Impact of Specific Instruments on the Economy
  - Phase 3: Review of Fuel Taxation Policy
  - Phase 4: Review of Economic Warrants of Loans for Development Projects
- Part C: RUC Review
  - Phase 1: Road User Charges
  - Phase 2: Fuel Levy Refund
  - Phase 3: Mass Distance Charges (MDC)
  - Phase 4: Cross Border Charges (CBC)

This document forms part of Part B – Phase 2: Review of Impact of Specific Instruments on the Economy and Part C – Phase 1: Road User Charges.

1.3 OUTLINE OF DOCUMENT

The remainder of this document is structured as follows:

- Section 2 describes the approach followed for the review and updating of the NAMRUC Model;
- Section 3 provides a review of the current RUC instruments and proposes several options that are available to recover costs from road users;
- Section 4 concludes this document.

2. REVIEW OF THE NAMRUC MODEL

2.1 INTRODUCTION

The Namibian Road User Charges (NAMRUC) Model was developed for the calculation of the level of RUCs in Namibia according to the principles of the RUC System. The NAMRUC Model includes all the respective RUC instruments and calculates the level of the different RUCs. This forms the basis for defining the future stable, real, annual expenditure level of road user charges.

The system furthermore comprises, in sequential order, the determination of (i) the amount of funding, (ii) the manner of allocation of funds, and (iii) the rates of road user charges.

The model currently consists of 11 modules, divided into two separate main components, which contains respectively input and output modules. The model is structured as follows:

The ***Input Model Component*** consists of the following modules:

- NaTIS Info
- Module 1: Vehicle population
- Module 2: Vehicle characteristics
- Module 3: Annual fuel sales, vehicle travel estimates and current fees
- Module 5: Road Fund expenditure budget

The ***Output Model Component*** consists of the following modules:

- Module 4: Total, urban and rural axle-km, E80-km and PCE-km
- Module 6: Cost distribution and summary
- Module 7: Cost responsibility
- Module 8: Instrument recovery levels
- Module 9: Revenue and expenditure
- Module 10: Scenario analyser
- Module 11: 5-year planning

The Structure of the NAMRUC Model is depicted in Figure 2-1.

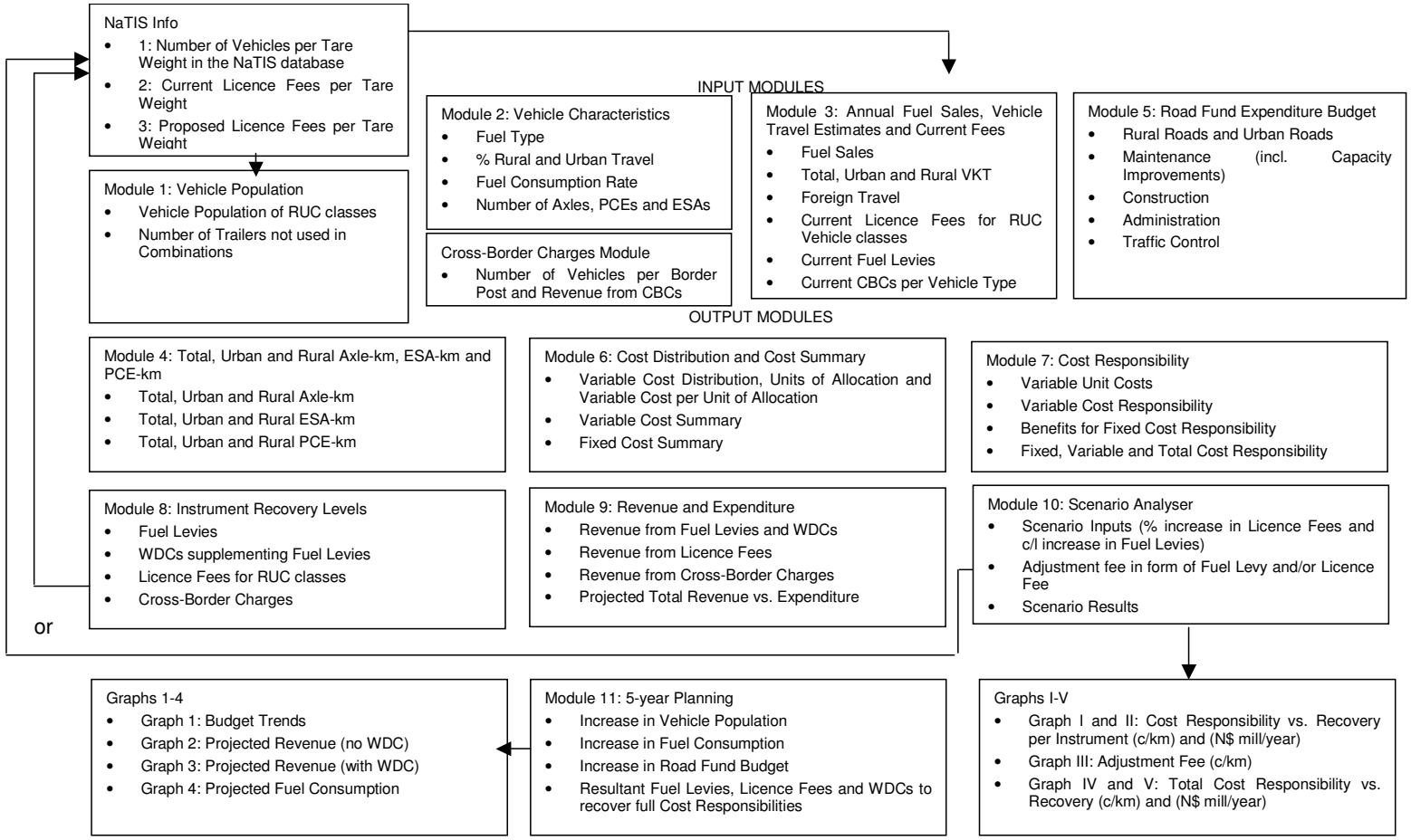

Figure 2-1: NAMRUC Model Structure

2.2 REVIEW OF NAMRUC MODEL: APPROACH AND METHODOLOGY

This section sets out the approach and methodology followed for the review and updating of the NAMRUC Model.

For the purposes of updating the model, the following information were obtained and used as inputs to update the NAMRUC Model:

2.2.1 NaTIS Information

The following information were requested and obtained from NaTIS:

- Licensing income;
- Cost breakdown of the NaTIS system;
- Cost breakdown for operating NaTIS at the respective NaTIS centres in Namibia.

2.2.2 Module 1: Vehicle Population

The vehicle population statistics, as obtained from the RFA, were updated in the NAMRUC Model.

2.2.3 Module 3: Annual Fuel Sales, Vehicle Travel Estimates and Current Fees

2.2.3.1 Annual Fuel Sales

Information with regard to the latest annual fuel sales available were obtained from the following sources:

- Ministry of Mines and Energy (MME);
- Caltex Oil (SA) (Pty) Ltd.

2.2.3.2 Foreign Vehicle Travel Estimates

Distances traveled between the respective border posts and the main central towns of Namibia were calculated. To do this, the average distance traveled per vehicle type was taken into consideration. The following methodology was followed to arrive at the average distance traveled per vehicle type:

- The number of vehicles per vehicle type (type 1-17) entering Namibia at the various border posts was determined.
- Centroid towns[1] were identified in each of the respective regions of Namibia.
- Distances were measured between each of the centroid towns and the respective border posts (refer to Table 2-1).

[1] A centroid town can be defined as a town that is situated in the centre of a respective region.

- Each distance was then multiplied with the number of vehicles per vehicle type.
- The product of each origin-destination (OD) pair for each vehicle type was then summed, and divided by the total number of vehicles per vehicle type in order to arrive at an average annual distance per vehicle type (refer to Table 2-2).

Table 2-1: Border Post – Central Town Travel Distances

Border Post	NAMIBIA REGION AND CENTRAL TOWN PER REGION												
	Caprivi	Erongo	Hardap	Karas	Khomas	Kunene	Ohangwena	Okavango	Omaheke	Omusati	Oshana	Oshikoto	Otjozodjupa
	Katima Mulilo	Usakos	Mariental	Keetmanshoop	Windhoek	Sesfontein	Eenhana	Rundu	Gobabis	Okahao	Oshakati	Tsumeb	Okakarara
Ariamsvlei	2009	1011	537	333	798	1494	1568	1498	1003	1543	1476	1224	1093
Ariamsvlei	2009	1011	537	333	798	1494	1568	1498	1003	1543	1476	1224	1093
Aroab	1870	867	451	163	652	1321	1418	1231	857	1416	1356	1072	927
Buitepos	1533	531	381	802	320	1016	1090	1020	115	775	708	746	618
Buitepos1	1533	531	381	802	320	1016	1090	1020	115	775	708	746	618
Hohlweg	1933	930	514	226	715	1384	1481	1294	920	1479	1419	1135	990
Katima Mulilo	0	1192	1472	1693	1211	1389	893	511	1418	1061	989	819	1060
Mahenene	1220	744	1107	1328	846	551	268	731	1109	82	119	420	695
Mohembo	330	916	1196	1417	935	1113	594	235	1140	897	825	543	784
Ngoma	67	1259	1539	1760	1278	1456	959	578	1485	1128	1056	886	1127
Noordoewer	1997	999	525	304	786	1482	1556	1486	991	1566	1494	1241	1082
Noordoewer1	1997	999	525	304	786	1482	1556	1486	991	1566	1494	1241	1082
Oshikango	949	714	994	1215	733	517	60	615	938	167	95	307	582
Ruacana	1253	716	1121	1342	860	323	284	742	1065	224	152	434	709
Veloorsdrift	1997	999	525	304	786	1482	1556	1486	484	1556	1494	1212	1082
Wenella	0	1192	1472	1693	1211	1389	893	511	1418	1061	989	819	1060
Windhoek	1211	211	261	482	0	696	770	700	205	780	708	426	296

Table 2-2: Estimated Average Annual Distances Travelled Per Vehicle Type

Vehicle Type	Description*	Average Distance traveled per vehicle type (km/annum)**
Type 1	Motor cycles, motor tricycle and motor quadrucycle Caravans and light trailers drawn by type 2 vehicles)	1283
Type 2	All passenger cars, station wagons, S/C and D/C bakkies, 2x4 and 4x4 bakkies, Kombis, Microbus and minibus. (up to 16 seaters)	1043
Type 3	Light goods vehicle/delivery vehicles/buses > 16 to 25 seaters (GVM < 3500kg)	780
HEAVY VEHICLES: (single units)		
Type 4	Bus with 2 axles. (carrying capacity of 25 or more passengers)	1465
Type 5	Bus: with 3 axles. (carrying capacity of 25 or more passengers)	1552
Type 6	Single unit Truck with 2 axles	1032
Type 7	Single unit Truck with 3 axles	795
HEAVY VEHICLES: (Traction unit as part of a combination vehicle)		
Type 8	Truck tractor: with 2 axles	909
Type 9	Truck tractor: with 3 axles	1418
Type 10	Truck tractor: with 4 or more axles	822
HEAVY TRAILERS (as part of a combination vehicle)		
Type 11	Trailer: with 1 axle (GVM > 1500 kg/ < 3500 kg)	1346
Type 12	Trailer: with 2 axles or (GVM > 3500 kg)	1469
Type 13	Trailer: with 3 axles	1373
Type 14	Trailer: with 4 axles	975
Type 15	Trailer: with 5 or more axles	2202
CONSTRUCTION VEHICLES		
Type 16	Tyre dozer, grader motor, front-end loaders, excavators, self-propelled vibratory rollers.	905
Type 17	Any other vehicle not listed.	985

Note: * The vehicle descriptions are based on the descriptions as per notice under section 18(1)(c) of the Road Fund Administration Act, 1999 (Act No. 18 of 1999)
** An assumption was made that a vehicle would enter and exit at the same border post.

2.2.3.3 Current Fees

Current vehicle licence fees were obtained from NaTIS and updated in the NAMRUC Model.

2.2.4 Module 5: Road Fund Expenditure Budget

The RFA budget was updated with figures from the preferred scenario (Scenario 2 – Minimised Total Transport Costs) of the *Medium to Long Term Roads Master Plan (MLTRMP)* as well as figures from the RFA Five-Year Business Plan April 2003 to March 2008.

2.2.5 Module 10: Scenario Analyser

For purposes of estimating the equity loss of the licence fees and fuel levies (refer to section 3.3), Module 10 was adjusted.

3. REVIEW OF RUC INSTRUMENTS AND OPTIONS FOR RECOVERING COSTS FROM ROAD USERS

3.1 INTRODUCTION

In order to recover road costs from road users, various instruments are available. These are as follows:

- Fuel Levies;
- Licence Fees;
- Mass Distance Charges (MDCs); and
- Cross Border Charges.

Each of these instruments[2] (except for the cross border charges which is aimed at recovering road costs from foreign vehicles only) can be used in isolation to recover costs from road users.

The following section provides a short overview of the road user charging instruments currently in place in Namibia, and will be followed by a review of a combination of various options available to recover costs from road users, as possible alternatives to the current collection of revenues (i.e. fuel levies, licence fees and cross-border charges).

3.2 REVIEW OF RUC INSTRUMENTS

3.2.1 Fuel Levies

In terms of Section 18(1)(d), and subject to sub-section (4)(f) of the RFA Act, 1999 (Act No 18 of 1999), the RFA may impose *"… a levy on every litre of petrol and every litre of diesel sold by any undertaking at any point in Namibia and which is to be included in any determination of the selling price of petrol or diesel, as the case may be, under any law relating to petroleum products".*

The main study objectives with regard to fuel levies are the following:

- To prepare and implement a transparent and generally accepted strategy with regard to the future increases in the rates of road user fuel levies;
- To obtain support from road users, the Ministry of Mines & Energy and other relevant stakeholders;
- To review the road user fuel levy refunding system.

The purpose of fuel levies is to recover variable costs from road users.

[2] It should be noted that overloading fines are also commonly referred to as road user charges. These were however excluded from this analysis as a revenue-generating instrument, as they should rather be considered as a deterrent.

3.2.2 License Fees

The license fee collection system was implemented with the Gazetting of Government Notice Nr 94 dated 1 April 2000. In terms of the system, registering authorities, appointed by the Ministry of Works, Transport and Communication, collect licence fees and pay these into the RFA's bank account.

Revenue from vehicle licence fees are raised in accordance with the principle that fixed fees should preferably be used for the recovery of fixed costs.

3.2.3 Mass-Distance Charges System (MDCS)

MDCs are not currently employed by the RFA as a RUC instrument, but are being considered as an additional RUC instrument. Section 18(1)(a) of the RFA Act empowers the RFA to levy a charge on any motor vehicle in respect of the travelling distance in the course of on-road use, which may be based on the mass and dimensions of the vehicle. This charge is commonly referred to as mass-distance charges, which are aimed at recovering the excess variable cost responsibility for heavy vehicles that cannot be recovered using fuel levies only.

A diesel levy on its own does not sufficiently recover the costs of marginal damage inflicted on roads by heavy vehicles, the reason being that road damage increases more sharply with increases in vehicle weight than does with fuel consumption. The rationale for MDCs is illustrated by means of Figure 3-1.

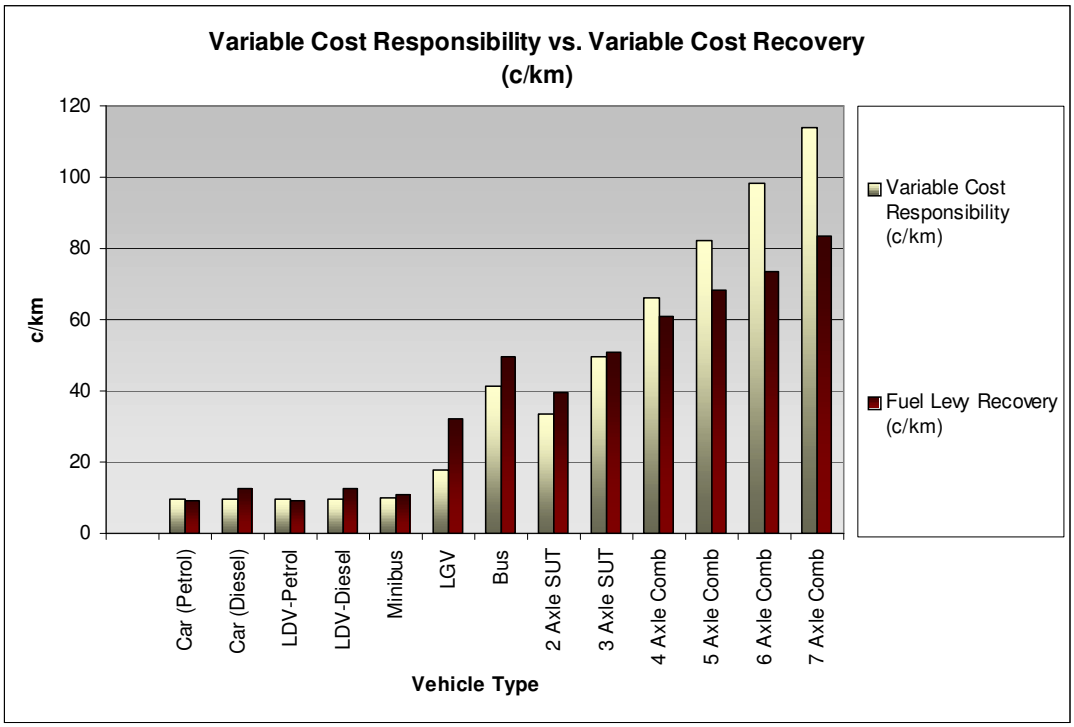

Figure 3-1: Rationale for MDCs

It will be noted from Figure 3-1 (which is based on actual data from the NAMRUC Model) that heavy vehicles (from 4 Axle Combination Vehicles upwards) are cross-subsidised by their lighter counterparts, and that the difference between variable cost responsibility and cost recovery increases as the weight or mass of vehicles increases.

MDCs should therefore only be considered for the heaviest vehicle types. This will imply that the most significant inequity will be addressed, and that MDC collection and administration costs will be minimised.

Mass-distance charges are expressed in terms of a rate/charge per distance and rates increase with the weight of a vehicle. The levying of such charges require the measurement of distances travelled by individual vehicles as well as additional administrative arrangements for their collection.

This report takes into consideration the option of implementing MDCs as RUC instrument, in addition to the current RUC instruments, as well as the option of implementing MDCs as the only RUC instrument. This is addressed in more detail at a later stage in this report.

3.2.4 Cross-Border Charges System (CBCS)

The current Cross-Border Charges (CBC) system was developed during October and November 2000 and implemented at four border posts on 1 December 2000, namely Noordoewer, Ariamsvlei, Buitepos and Oshikango.

The CBC System has now been in operation for over 2 years. A further 6 border collection points have in the meantime been set up for collecting cross-border charges. These collection points are Ruacana, Mahenene, Wenella, Ngoma, Klein Manasse and Holweg.

The current cross-border charge is the road user charge referred to in terms of Section 18(1)('c) of the RFA Act, namely an "entry fee" in respect of a motor vehicle not registered in Namibia that temporarily enters Namibia. The total charge on any foreign vehicle should be such as to have the same net effect as road charges paid by Namibian road users in Namibia, in order to comply with the principle of non-discrimination in terms of Section 18(3)(d) of the RFA Act.

The cross-border charges are collected by an agent on behalf of the RFA and deposited onto the RFA account on a weekly basis.

Currently a flat fee per vehicle type is charged. The ultimate aim is to eventually charge cross-border traffic on the basis of distance travelled and vehicle weight through the implementation of a mass-distance charging system. The aim is that a cross-border charge will eventually consist of both an "entry fee" as well as a "mass-distance charge" or a "distance-related fee".

3.3 METHODOLOGY FOR REVIEWING OF OPTIONS TO RECOVER COSTS FROM ROAD USERS

The purpose of this section is to assess the implications of each instrument by reviewing a number of options that are available to recover costs from road users. The review will focus on the following options:

- Scenario 1.1: Maintain current instruments with **fuel levies** as adjustment fee;
- Scenario 1.2: Maintain current instruments with **licence fees** as adjustment fee;
- Scenario 2.A.1: Introduction of MDCs for diesel vehicles (diesel levy **lowered**) and adjustment of under-recovery through **fuel levies** for petrol vehicles;
- Scenario 2.A.1: Introduction of MDCs for diesel vehicles (diesel levy **lowered**) and adjustment of under-recovery through **licence fees** for petrol vehicles;
- Scenario 2.B.1: Introduction of MDCs for diesel vehicles (diesel levy **abolished**) and adjustment of under-recovery through **fuel levies** for petrol vehicles;
- Scenario 2.B.2: Introduction of MDCs for diesel vehicles (diesel levy **abolished**) and adjustment of under-recovery through **licence fees** for petrol vehicles;
- Scenario 3: Fuel levies only;
- Scenario 4: Licence fees only; and
- Scenario 5: MDCs only.

Each option was reviewed in terms of the following:

- Equity (i.e. does cross-subsidisation between vehicle classes and within vehicle classes occur and what is the extent of cross-subsidisation?)
- Efficiency (i.e. is the revenue collection by means of a instrument efficient in terms of costs of collection and is evasion minimised?)

Furthermore, the issue of Value Added Tax (VAT) was also incorporated into the analysis for purposes of comparing the various options.

Subsequently, the various options were analysed in terms of the following costs:

- Equity loss due to the fuel levy;
- Equity loss due to licence fees;
- VAT Refunds (as a negative cost when applicable);
- Collection costs of fuel levies;
- Collection costs of licence fees;
- Collection costs of MDCs;
- Evasion loss; and
- Cost of the Fuel Levy Refund System.

Each of the above items was quantified, in order to arrive at a “total cost” per option. Once these costs were determined and analysed, other aspects that affect the preferred suite of cost recovery instruments and their levels were also identified, considered and analysed. This was followed by conclusions and recommendations. The methodology that was followed for the quantification of each of the above items is discussed in more detail below.

3.3.1 Equity Loss (Fuel Levies)

Significant cross-subsidisation can occur between small and large heavy vehicles if fuel levies are used to recover variable costs. If the fuel levy is set to accurately charge the smaller heavy vehicles, then the larger heavy vehicles will be undercharged. If the fuel levy is set to more accurately charge the larger heavy vehicles, then the smaller vehicles are overcharged. This problem is the main motivation for the use of a mass distance charge, which can be accurately set for each type of vehicle.

In order to determine the equity loss attributable to fuel levies, the cost responsibility was compared with the cost recovery of each vehicle type after introduction of the adjustment fee in the form of fuel levies, and the equity loss was determined as the total under-recovery **or** over-recovery[3].

3.3.2 Equity Loss (Licence Fees)

It should be noted that the use of licence fees to address the current under recovery would ideally[4] result in no cross-subsidisation **between** vehicle classes, but cross-subsidisation **within** vehicle classes would occur due to the current licence fee structure.

Regarding the approach that was used to quantify equity loss for vehicle licence fees, the following should be noted:

- The current licensing fee structure is based on tare weights which do not always result in equitable licence fees for various classes of vehicles, as there is currently a significant overlap for various vehicle classes within a specific tare weight band (e.g. within a tare weight band of 2001-3000kg there are various vehicle classes[5], namely “Car”, “LDV”, “Minibus”, “LGV”, “Bus”, “2-Axle Truck Tractors” (used for the combination vehicles) and “Other”.
- Due to the tare weight overlap, cross-subsidisation is inevitable due to the following phenomena:
    - “lower cost responsibility vehicle classes” (e.g. “Cars”) fall within the same tare weight band as “higher cost responsibility vehicle classes” (e.g. “LGVs”)
    - there is a “tare weight spread” within specific vehicle classes (e.g. the vehicle class “Car” has a “tare weight spread” of 8 tare weight bands ranging from 0-750kg up to 6001-7000kg.
- In order to estimate the equity loss, the “optimal” licence fee of each **vehicle class** was compared to the “optimal” licence fee for each **tare weight category**

[3] The over-recovery should equal the under-recovery for both petrol and diesel vehicles, as there are cross-subsidisation between vehicle classes. Using both the under- and over-recovery to determine the equity loss would result in double-counting.

[4] The current licence fee structure in Namibia causes cross-subsidisation between vehicle classes, as it is based on tare weight and there is a significant overlap in terms of tare weight between vehicle classes.

[5] In order to arrive at the vehicle population of Namibia, the NaTIS database was used and vehicle descriptions within tare weight bands were extracted to arrive at the number of vehicles within a specific class.

(i.e. the weighted average licence fee of various vehicle classes within a specific tare weight band).

In order to address the situation of an inequitable licensing structure, the following can be recommended:

- Licence fees should be based on Gross Vehicle Mass (GVM), although there may still be an overlap between vehicle classes.
- In order to avoid the overlap, it is suggested that the licensing structure should be refined as to accommodate various GVM or tare weight bands within a specific vehicle class. In other words, the licensing fee of say vehicle class "Car" should be different than that of vehicle class "LDV" even though they are in the same tare or GVM band. This especially pertains to the vehicle class "Other"[6] (e.g. construction vehicles, graders etc.), as these vehicles use the road network to a very small extend but currently have exorbitantly high licence fees due to their high tare weights.

3.3.3 VAT Refunds

The fuel levy, as a road user charge, has the advantage that the RFA can claim back input VAT on projects paid for out of revenue collected from fuel levies, which does not apply to expenses paid out of revenue from any other road user charge.

Fuel is zero-rated for VAT, and the RFA can claim input VAT on expenses incurred out of revenue from fuel levies, but pays zero output VAT to the Ministry of Finance (MoF). In other words the RFA is refunded the input VAT paid on project expenses paid out of revenue from fuel levies.

The item "VAT refunds" is therefore not a cost but a benefit, and was calculated for each option by applying a 15% rate to the revenue generated from fuel levies. It should be noted that the amount of VAT refunded is only applicable for those options where fuel levies are in fact used (either entirely or only in part) to recover costs from road users, and it differs for each option depending on the amount of revenue generated from fuel levies.

During discussions with a representative of the Ministry of Finance (MoF): Inland Revenue (IR), it was mentioned that the rationale behind the zero rating of fuel is that fuel is used as an input for the production of various services and goods. The following three Acts apply to VAT:

- Value Added Tax Act, 2000 (Act 10 of 2000);
- Value Added Tax Amendment Act, 2000 (Act 34 of 2000); and
- Value Added Tax Amendment Act, 2002 (Act 6 of 2002).

In terms of schedule III, paragraph 2, subsection r) of the Value Added Tax Act, 2000 (Act 10 of 2000), ("the Principal Act") the *supply of*

[6] The vehicle licensing structure in the South African Province of Gauteng makes provision for different licence fees for *inter alia* breakdown vehicles, truck tractors and agricultural tractors.

(i) petrol, leaded; or
(ii) petrol, unleaded; or
(iii) distillate fuels (e.g. gas oil and diesel oil); or
(iv) mixtures of illuminating or heating kerosene with lubricity agents,

*being goods subject to the fuel levy as defined in section 1 of the Customs and Excise Act …*are zero-rated.

According to the representative of the MoF:IR, there is no intention to alter the status of fuel regarding the above provisions. It is also not the intention to zero rate licence-style fees (e.g. licence fees or MDCs). In this regard, the Value Added Tax Amendment Act, 2000 (Act 34 of 2000) states that a taxable activity (an activity subject to VAT) does not include

any activity conducted by the State (e.g. the issuing of licences).

The question now arises whether VAT is applicable, should the vehicle licensing function be conducted by a private organisation. In this regard, section 4, subsection (1) b (iv) states that a taxable activity does not include

the registration of, or issuing of a licence in relation to, any goods or activities by a registering authority.

Based on the above, it seems that VAT Refunds will only remain applicable to fuel levies and not any other road user charge as such. This approach was adopted in the analysis in this report.

3.3.4 Collection Costs (Fuel Levies)

During discussions with the Ministry of Mines and Energy (MME), it was mentioned that the collection costs of fuel levies in Namibia amounts to 0.1 cents per litre. In order to arrive at the collection costs of fuel levies for each option, the amount of 0.1 cents per litre was subsequently multiplied with the fuel quantity sold in Namibia. It should be noted that the fuel levy collection costs is the same for each option except in the following cases:

- Where no fuel levies are used to recover costs from road users (i.e. the collection costs are zero); and
- Where the diesel levy is abolished due to the introduction of MDCs (i.e. the collection cost of 0.1 cents per litre **only** applies to the quantity of **petrol** sold).

3.3.5 Collection Costs (Licence Fees)

Vehicle registration and licence fees are payable in terms of the Road Traffic and Transport (RTT) Act, while licence fees, as a road user charge, are also payable in terms of the RFA Act.

Currently licence fees (the RTT portion as well as the road user charges portion) are collected by NaTIS on behalf of the Ministry of Works, Transport and Communication

(MoWTC) and the RFA, and are paid into the account of the RFA. On the other hand, the RFA is responsible for the funding of NaTIS except for capital expenditure which is funded from allocations from central government.

The annual costs for the operation of NaTIS amounts on average to N$ 36.64 million per annum (RFA, 5 Year Business Plan). This amount makes provision for the following sub-functions of NaTIS:

- Vehicle registration;
- Vehicle licensing;
- Vehicle testing; and
- Driver licensing.

In order to determine the collection costs of licence fees, two broad options exist:

- It could be argued that the vehicle licensing function is dependent on the other functions and should therefore be seen as inseparable from the other functions.
- The costs of issuing vehicle licenses should be separated from the overall costs of operating NaTIS. In other words only the costs that are strictly attributable to the issuing of licences should be considered as licence fee collection costs.

The current vehicle population in Namibia amounts to 187 243 (NaTIS, 2003). If the first option is considered, the licence fee collection cost per vehicle amounts to N$ 196 per vehicle.

Ideally each vehicle should cover its own collection costs, however this is currently not the case, as for instance the licence fee of motorcycles amounts to only N$ 96 per annum.

For the second option, the costs for collecting licence fees are estimated at N$ 6.98 million per annum. This estimate was made by means of the following approach.

The total cost of operating NaTIS functions for the 2003 year, was N$31,006,850. This amount was made up of the following three items:

- VRL cost (Vehicle registration and licensing) N$22,239,698
- DL cost (Driver's license) N$ 7,462,546
- VTS cost (Vehicle testing) N$ 1,304,606

The number of NaTIS transactions during the last three financial years, is summarised in Table 3-1.

Table 3-1: NaTIS transactions for the last three financial years

Year	VRL	DL	VTS	**Total**
2001-2002	373 689	0	1 533	**375 222**
2002-2003	632 432	230 933	869	**864 234**
2003-2004	716 687	266 082	118	**982 887**
Total	**1 722 808**	**497 015**	**2 520**	**2 222 343**

During the 2001-2002 financial year, no driver's licenses were processed. However, when considering the following two financial years (2002-2003 and 2003-2004), the average number of transactions processed per financial year is 923 561.

The average cost per NaTIS transaction can therefore be calculated as N$33.57 per transaction.

The transaction types during the last financial year (2003-2004) were scrutinised in order to obtain the number of transactions concerning licensing activities. The following transactions were identified as such:

- Licensing S 3;
- Licensing S 2.5;
- Licensing S 2.10;
- Licensing S 2.8;
- Licensing S 2.9;
- Licensing S 2.7;
- Licensing S 2.1;
- Licensing S 2.4;
- Licensing S 2.2;
- Spec license no;
- Other license no;
- Retain own lic no;
- Other lic no transfer;
- MV license arrears;
- MV license penalties.

These transactions totalled a number of 207 870 NaTIS transactions during the 2003-2004 financial year. When applying the average cost of a NaTIS transaction (N$33.57) to this number, the total cost of NaTIS licensing transactions for the financial year 2003-2004 can be calculated as N$6.98 million.

For purposes of quantifying the annual licence fee collection costs, the amount of N$6.98 million was therefore applied.

It should be noted that there are currently 32 regional NaTIS registering authorities in Namibia. Figure 3-2 shows the average transaction costs per vehicle per registering authority, and it will be noted that Otjinene (more than N$ 450 per vehicle compared to the average for the whole of Namibia of just below N$ 50) has by far the highest transaction cost per vehicle followed by Bethanie and Okakarara. Windhoek has the lowest transaction cost (N$ 24) followed by Ondangwa. Only about 30% of the NaTIS operating cost could be allocated to a specific registering authority. The rest were categorised as overheads.

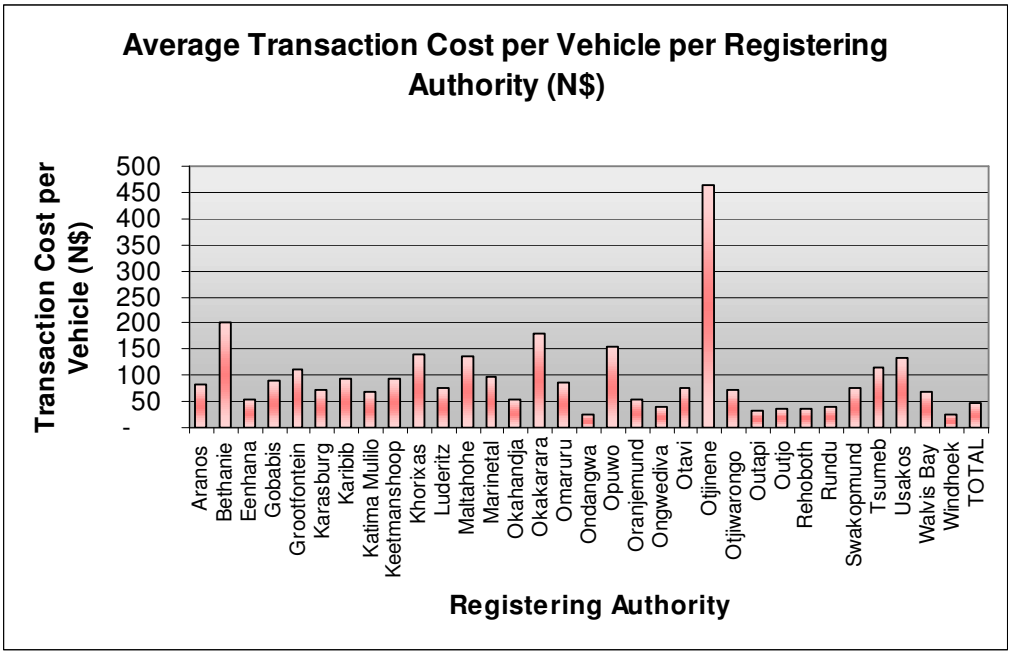

Figure 3-2: Average Transaction Cost per Vehicle per Registering Authority

It can be argued that some of these registering authorities are not viable and are being cross-subsidised by the bigger registering authorities (e.g. Windhoek). Therefore, it can be argued that it is not necessary to have that many registering authorities. However, in order to ensure adequate accessibility for the population of Namibia to a registering authority, it can be argued that it is necessary to have 23 registering authorities.

3.3.6 Collection Costs (MDCs)

The preliminary estimate of collection costs of MDCs were taken as 5% of revenue generated from MDCs (based on Heggie (1995).

At the time of preparing this report, the investigation of the MDC system was not yet finalised, and consequently a more detailed cost estimate of the system was not available.

3.3.7 Evasion Loss

The evasion loss pertaining to MDCs was estimated as 5% of revenue generated from MDCs (based on Heggie (1995) and the New Zealand Weight-Distance Charges Compliance Survey). In the absence of other information, this figure was used in the analysis.

In order to ensure full cost recovery given the evasion loss, law-abiding vehicle operators need to pay higher MDCs in order to maintain full cost recovery. Therefore,

the evasion loss can be viewed as an inequity in the sense that law-abiding vehicle operators "cross-subsidise" the less responsible vehicle operators.

3.3.8 Fuel Levy Refund System

The cost of operating the current fuel levy refund system, and to possibly extend the current system was estimated. For this purpose, the following cost components were taken into consideration:

Table 3-2: Cost Estimate of the Fuel Levy Refund System

Cost Item	N$ per annum
Remuneration (Data processors)	368 146
Remuneration (Accountant)*	328 840
Stationery	138 180
Telephone	12 000
Rent of Building	25 586
Electricity	2 880
Hardware / System Implementation Costs**	200 000
Extension of current system***	150 000
TOTAL	**1 225 632**

Note: * Assuming 60% of the accountant's time is spent on the fuel levy refund system.
** Estimated at a total cost of N$ 1 million to be depreciated over a period of 5 years.
*** Includes feasibility study for extension of the current system of N$ 330 000 and development of the extended system of N$ 420 000 to be depreciated over a period of 5 years.

From Table 3-2, it is evident that the cost of the fuel levy refund system amounts to approximately N$ 1.23 million per annum.

3.4 RESULTS OF THE ANALYSIS

Once the NAMRUC Model was updated, the implications of the respective RUC instruments were assessed through analysis of several scenarios to recover road costs from road users.

The purpose of this section is to present the results of the analysis in terms of the implications of each instrument by reviewing the various options that are available to recover costs from road users.

Based on information from the RFA Five-Year Business Plan and the Medium to Long Term Roads Master Plan (MLTRMP), the updating of Module 5 revealed that a total of N$ 926 million per annum should be recovered from road users for sustainable long-term funding of the Namibian road network (refer to Table 3-3).

Table 3-3: Updated Module 5 (Budget)

Activity	Budget N$ mill.
RURAL ROADS	
All Unsurfaced Roads Maintenance	329.140
Blading+Regravelling	282.390
Routine	12.910
Miscellaneous	33.840
Surfaced Roads Maintenance	343.610
Pavement Reseal+Fogspray	45.010
Pavement Rehabilitation+Bridge Rehabilitation	216.570
Bitumen Maintenance (Routine)	67.230
Miscellaneous	11.280
Capacity Improvements	3.520
Total Maintenance	**672.750**
Loan Repayments	**141.540**
Labour-based projects+Development RAR (RFA)	48.230
Development projects+Planning	93.310
Administration (RA)	**127.297**
(Includes NaTIS Operation+Planning)	
Traffic Control (Nampol)	**-**
TOTAL RURAL	**941.587**
URBAN ROADS	
All Roads Maintenance	36.631
Administration (RFA)	**21.815**
Traffic Control (Municipalities) (Testing +Enforcement)	**26.325**
TOTAL URBAN	**84.771**
RESERVE FUND	**8.684**
TOTAL EXPENDITURES	**1,035.042**
REVENUE ITEMS	**108.707**
Cross-border Charges*	23.772
Abnormal Load Fees	1.378
VAT Refunds	59.335
Interest	24.222
TOTAL EXPENDITURES MINUS REVENUE	**926.34**

Note: Revenue from Cross-Border Charges determined from current cross border charge levels (effective from 1 April 2004) and number of foreign vehicles entering border posts for the period 1 April 2002 until 30 March 2003. The same applies to VAT refunds which are based on the revenue from fuel levies at 15%.

The above costs to be recovered from road users can be divided into variable and fixed costs as per NAMRUC Cost Allocation methodology. Variable costs are in turn divided again into different categories per unit of allocation (e.g. VKT, Axle-km, PCE –km or ESA-km). The breakdown of costs into variable and fixed costs is shown in Table 3-4.

Table 3-4: Breakdown of Costs into Variable and Fixed Costs

Cost Category	Amount N$ million
Variable Costs	**573.02**
Maintenance (incl. Capacity Improvements)	541.69
VKT related	254.93
Axle-km related	54.58
PCE-km related	3.15
ESA-km related	229.03
Traffic Control (PCE-km related)	23.56
Reserve Fund (VKT related)	7.77
Fixed Costs	**353.31**
Maintenance	93.19
Construction	126.67
Administration	133.45
TOTAL (VARIABLE + FIXED)	**926.34**

Note: VKT = Vehicle kilometres travelled
PCE = Passenger Car Equivalent
ESA = Equivalent Standard Axle

Ideally all fixed costs should be recovered from road users in the form of licence fees and all variable costs in the form of variable instruments (i.e. fuel levies and/or MDCs).

The respective levels of licence fees and fuel levies as well as fuel levies and MDCs that are required to recover the fixed and variable costs from road users are shown in Table 3-5.

Table 3-5: Theoretical optimum levels of Licence Fees and Fuel Levies

Vehicle Type	Required Licence Fee (N$/year)	Required Fuel Levy **without** MDC (c/l)	Required Fuel Levy **with** MDC (c/l)	MDC (N$/100km)
Motor Cycle	344			
Car – Petrol	1,376			
LDV-Petrol	1,429			
Minibus – Petrol	1,661			
LGV – Petrol	-			
Bus – Petrol	-			
2 Axle SUT - Petrol	-			
3 Axle SUT - Petrol	-			
Caravan	185			
Light Trailer	282			
All Petrol Vehicles		**89.69**	**89.69**	
Car – Diesel	1,403			6.15
LDV-Diesel	1,494			6.15
Minibus – Diesel	-			5.85
LGV – Diesel	1,473			9.25
Bus – Diesel	3,328			26.86
2 Axle SUT - Diesel	5,374			22.20
3 Axle SUT - Diesel	10,620			34.44
4 Axle Comb	29,065			47.47
5 Axle Comb	30,008			60.79
6 Axle Comb	30,051			74.69
7 Axle Comb	30,051			87.22
Other	10			-
All Diesel Vehicles		**123.87**	**29.28**	

The current recovery from domestic road users based on current charge levels amounts to N$ 506.5 million (refer to Table 3-6) compared to N$ 926.3 million, which should be recovered from domestic road users. There is thus an under-recovery of N$ 419.8 million.

Table 3-6: Current Charge Levels and Revenue from Current Charges

Vehicle Type	Current Charges		Revenue from Current Charges (N$ million)		
	Licence Fee (N$/yr)	Fuel Levy (c/l)	Licence Fees	Fuel Levies	Total
Motor Cycle	96		0.33	0.64	0.97
Car – Petrol	221		18.77	121.23	140.00
LDV-Petrol	252		14.03	79.64	93.67
Minibus - Petrol	309		3.05	16.98	20.03
LGV – Petrol	-		-	-	-
Bus – Petrol	-		-	-	-
2 Axle SUT - Petrol	-		-	-	-
3 Axle SUT - Petrol	-		-	-	-
Caravan	120		0.20	-	0.20
Light Trailer	96		1.00	-	1.00
All Petrol Vehicles		**73.00**	**37.40**	**218.49**	**255.88**
Car – Diesel	339		0.59	2.53	3.12
LDV-Diesel	278		2.14	11.22	13.36
Minibus - Diesel	-		-	-	-
LGV – Diesel	732		2.47	11.75	14.22
Bus – Diesel	7,011		5.88	14.67	20.56
2 Axle SUT - Diesel	4,026		4.40	4.69	9.08
3 Axle SUT - Diesel	10,753		14.09	14.48	28.57
4 Axle Comb	4,190		6.11	48.11	54.22
5 Axle Comb	9,484		8.28	32.33	40.61
6 Axle Comb	15,789		6.85	17.24	24.10
7 Axle Comb	15,950		6.91	19.54	26.44
Other	7,810		15.81	0.52	16.32
All Diesel Vehicles		**73.00**	**73.51**	**177.08**	**250.60**
TOTAL			**110.91**	**395.57**	**506.48**

Based on the cost responsibilities as well as the current level of charges, the over (under) recovery per vehicle type is indicated in Table 3-7.

Table 3-7: Current Over and (Under) Recovery per Vehicle per Year

Vehicle Type	Over (Under) Recovery N$/year
Motor Cycle	(223)
Car – Petrol	(1,502)
LDV-Petrol	(1,525)
Minibus – Petrol	(1,472)
LGV – Petrol	-
Bus – Petrol	-
2 Axle SUT - Petrol	-
3 Axle SUT - Petrol	-
Caravan	(269)
Light Trailer	(473)
Car – Diesel	(1,418)
LDV-Diesel	(1,571)
Minibus – Diesel	-
LGV – Diesel	(353)
Bus – Diesel	(1,931)
2 Axle SUT - Diesel	(2,857)
3 Axle SUT - Diesel	(5,967)
4 Axle Comb	(48,901)
5 Axle Comb	(54,418)
6 Axle Comb	(59,370)
7 Axle Comb	(67,540)
Other	7,953

From Table 3-7, it is evident that there is a significant under recovery for all vehicle types except for other vehicles (e.g. graders, construction vehicles etc.) where there is an over recovery per vehicle of N$ 7 953 per year.

During a workshop in 2000 on mass distance charges, three possible ways were discussed to address the under recovery, namely:

- Mass distance charges;
- Licence fees; or
- Fuel levies.

The attendees at the workshop agreed that mass distance charges would be the most preferred option, as there would be no cross-subsidisation between and within vehicle classes. However, for the interim period (i.e. before the implementation of MDCs) it was agreed that fuel levies should be used as adjustment fee in order to address the under recovery. However, for purposes of comprehensiveness the use of licence fees as adjustment fee was also investigated.

The current under-recovery must be addressed through the use of some or other instrument or a so-called adjustment fee (which can be in the form of fuel levies, licence fees or MDCs or a combination). In the quantification of the scenarios (especially in the equity loss), the assessment of each refers to the situation once the adjustment fee was introduced and full total cost recovery was achieved.

The various options that are available to address the under-recovery are presented below.

3.4.1 Scenario 1.1: Maintain current instruments with fuel levies as adjustment fee

The use of fuel levies to address the under recovery would result in the fuel levy rates and resultant over- or under recovery as depicted in Table 3-8.

Table 3-8: Scenario1.1 - Fuel Levies Necessary to Address Under-Recovery and Resultant Over (Under)-Recovery

Vehicle Type	Adjustment Fee in Fuel Levy (c/l)	Over-(Under)-Recovery per vehicle after Adjustment Fee(N$/yr)
Motor Cycle		(20)
Car – Petrol		20
LDV-Petrol		0
Minibus – Petrol		339
LGV – Petrol		-
Bus – Petrol		-
2 Axle SUT - Petrol		-
3 Axle SUT - Petrol		-
Caravan		-
Light Trailer		-
All Petrol Vehicles	**68.69**	-
Car – Diesel		91
LDV-Diesel		(56)
Minibus - Diesel		-
LGV – Diesel		3,083
Bus – Diesel		15,504
2 Axle SUT - Diesel		1,684
3 Axle SUT - Diesel		5,676
4 Axle Comb		(13,973)
5 Axle Comb		(14,971)
6 Axle Comb		(16,682)
7 Axle Comb		(19,169)
Other		8,192
All Diesel Vehicles	**66.56**	-

From Table 3-8, the following is evident:

- The existing road user charges component of the fuel levy needs to be increased with nearly 100%, implying a fuel levy of 141.69 cents per litre and 139.56 cents per litre for petrol and diesel, respectively.
- There is still significant cross-subsidisation between vehicle classes, as especially the heavier vehicles (4 Axle – 7 Axle Combination vehicles) experience significant under recovery at the expense of their lighter counterparts.

The costs of this option are as follows:

Table 3-9: Costs of Scenario 1.1

Item	Costs (N$ million)*
Equity Loss (Fuel levies)	54.51
Equity Loss (Licence fees)	7.39
VAT Refunds	(114.39)
Collection Costs (Fuel levies)	0.74
Collection Costs (Licence fees)	6.98
Collection Costs (MDCs)	0.00
Evasion Loss	0.00
Fuel Levy Refund System	1.23
TOTAL	(43.54)
TOTAL (excl. VAT Refunds)	70.85

Note: * Negative costs represent benefits.

If the under recovery is addressed in form of a fuel levy, the loss in equity which is purely attributable to fuel levies amounts to N$ 54.51 million. Similarly the equity loss attributable to licence fees is N$ 7.39 million. From Table 3-9, it is evident that the biggest cost is the equity loss due to the cross-subsidisation caused by fuel levies. This cost is however off-set by the benefit “VAT refunds”.

3.4.2 Scenario 1.2: Maintain current instruments with licence fees as adjustment fee

The licence fee levels which are necessary to address the current under recovery as well as the resultant percentage increase in current licence fee levels are depicted in Table 3-10.

Table 3-10: Scenario 1.2 - Licence Fees Necessary to Address Under-Recovery

Vehicle Type	Adjustment Fee in form of Licence Fee (N$/yr)	Over-(Under)-Recovery per vehicle after Adjustment Fee (N$/yr)	Resultant % Increase in Current Licence Fee Levels (%)
Motor Cycle	207	-	216%
Car-Petrol	1,405	-	635%
LDV-Petrol	1,426	-	566%
Minibus-Petrol	1,364	-	442%
LGV-Petrol	-	-	N/A
Bus-Petrol	-	-	N/A
2AxleSUT-Petrol	-	-	N/A
3AxleSUT-Petrol	-	-	N/A
Caravan	257	-	214%
Light Trailer	455	-	474%
Car-Diesel	1,319	-	389%
LDV-Diesel	1,469	-	529%
Minibus-Diesel	-	-	N/A
LGV-Diesel	212	-	29%
Bus-Diesel	1,116	-	16%
2AxleSUT-Diesel	2,513	-	62%
3AxleSUT-Diesel	5,111	-	48%
4AxleComb	46,246	-	1104%
5AxleComb	51,306	-	541%
6AxleComb	55,827	-	354%
7AxleComb	63,575	-	399%
Other	-	7,956	0%

Note: N/A = not applicable.

From Table 3-10, the following can be derived:

- Only the “other vehicles” category experiences an over recovery due to the current licence fee level which is higher than the cost responsibility of that category.
- Using licence fees in order to address the current under recovery would result in some cases in significant increases in the licence fee levels ranging from 16% for Diesel Buses and 1104% for 4 –Axle Combination Vehicles. From an acceptability point of view, the 100% increase in fuel levies would be more acceptable to road users than the increases in licence fee levels.

The costs of this option are detailed in Table 3-11.

Table 3-11: Costs of Scenario 1.2

Item	Costs (N$ million)*
Equity Loss (Fuel levies)	16.10
Equity Loss (Licence fees)	40.55
VAT Refunds	(59.34)
Collection Costs (Fuel levies)	0.74
Collection Costs (Licence fees)	6.98
Collection Costs (MDCs)	0.00
Evasion Loss	0.00
Fuel Levy Refund System	1.23
TOTAL	6.26
TOTAL (excl. VAT Refunds)	65.60

3.4.3 Scenario 2.A.1: Introduction of MDCs for all Diesel vehicles (Diesel Levy lowered) and adjustment of under-recovery through fuel levies for petrol vehicles

This option entails that MDCs are implemented for all diesel-powered vehicles, and that the RUC component of the diesel fuel levy is lowered to 29.38c/l (i.e. representing the lowest variable cost responsibility of a specific class of vehicles). The resulting MDC in N$ per 100km levels recovering the total cost responsibility of diesel vehicles are depicted in Table 3-12.

Table 3-12: Scenario 2.A.1: MDC Levels for all Diesel Vehicles

Vehicle Type	Diesel Levy (c/l)	MDC (N$/100km)
Car – Diesel	29.38	11.21
LDV – Diesel	29.38	11.96
Mini Bus (Diesel)	29.38	-
LGV	29.38	12.86
Bus	29.38	19.96
2 Axle SUT	29.38	28.53
3 Axle SUT	29.38	32.83
4 Axle Comb	29.38	72.88
5 Axle Comb	29.38	81.22
6 Axle Comb	29.38	88.09
7 Axle Comb	29.38	100.20
Other	29.38	-

From Table 3-12, it is evident that the MDC levels gradually increase as the vehicle classes get heavier especially from the 2 Axle Single Unit Trucks up to the 7 Axle Combination Vehicles with the highest MDC level for the 7 Axle Combination Vehicles of N$ 100.20 per 100 km.

From Table 3-12 it is also evident that “other vehicles” do not have to pay MDCs, as their total cost responsibility is lower than what is currently recovered from this class.

For the petrol vehicles, the current under recovery is addressed through fuel levies. In this case, a petrol levy of 75.24c/l (additional to the existing level of 73c/l) is needed.

Table 3-13 indicates the over-(under) recovery per vehicle after implementation of Scenario 2.A.1.

Table 3-13: Scenario 2.A.1 - Over-(Under)-Recovery per vehicle after Adjustment Fee

Vehicle Type	Over-(Under)-Recovery per vehicle after Adjustment Fee (N$/yr)
Motor Cycle	(25)
Car-Petrol	23
LDV-Petrol	-
Minibus-Petrol	359
LGV-Petrol	-
Bus-Petrol	-
2AxleSUT-Petrol	-
3AxleSUT-Petrol	-
Caravan	-
Light Trailer	-
Car-Diesel	-
LDV-Diesel	-
Minibus-Diesel	-
LGV-Diesel	-
Bus-Diesel	-
2AxleSUT-Diesel	-
3AxleSUT-Diesel	-
4AxleComb	-
5AxleComb	-
6AxleComb	-
7AxleComb	-
Other	7,800

The following table indicates the costs of this scenario.

Table 3-14: Costs of Scenario 2.A.1

Item	Costs (N$ million)*
Equity Loss (Fuel levies)	21.17
Equity Loss (Licence fees)	7.39
VAT Refunds	(77.24)
Collection Costs (Fuel levies)	0.74
Collection Costs (Licence fees)	6.98
Collection Costs (MDCs)	15.03
Evasion Loss	15.03
Fuel Levy Refund System	1.23
TOTAL	-9.67
TOTAL (excl. VAT Refunds)	67.57

3.4.4 Scenario 2.A.2: Introduction of MDCs for all Diesel vehicles (Diesel Levy lowered) and adjustment of under-recovery through licence fees for petrol vehicles

This scenario is the same as scenario 2.A.1 except that licence fees (additional to the current levels) are used for petrol vehicles to address the current under recovery.

Table 3-15: Scenario 2.A.2: Licence Fees Necessary to Address the Current Under-Recovery

Vehicle Type	Adjustment Fee in Licence Fee (N$/yr)
Motor Cycle	233
Car – Petrol	1,567
LDV-Petrol	1,590
Minibus – Petrol	1,543
LGV – Petrol	-
Bus – Petrol	-
2 Axle SUT – Petrol	-
3 Axle SUT – Petrol	-
Caravan	277
Light Trailer	485

Table 3-16 indicates the over - (under) recovery per vehicle after implementation of Scenario 2.A.2.

Table 3-16: Scenario 2.A.2 - Over-(Under)-Recovery per vehicle after Adjustment Fee

Vehicle Type	Over-(Under)-Recovery per vehicle after Adjustment Fee (N$/yr)
Motor Cycle	-
Car-Petrol	-
LDV-Petrol	-
Minibus-Petrol	-
LGV-Petrol	-
Bus-Petrol	-
2AxleSUT-Petrol	-
3AxleSUT-Petrol	-
Caravan	-
Light Trailer	-
Car-Diesel	-
LDV-Diesel	-
Minibus-Diesel	-
LGV-Diesel	-
Bus-Diesel	-
2AxleSUT-Diesel	-
3AxleSUT-Diesel	-
4AxleComb	-
5AxleComb	-
6AxleComb	-
7AxleComb	-
Other	7,800

The costs of this scenario are as follows:

Table 3-17: Costs of Scenario 2.A.2

Item	Costs (N$ million)*
Equity Loss (Fuel levies)	15.78
Equity Loss (Licence fees)	12.07
VAT Refunds	(43.46)
Collection Costs (Fuel levies)	0.74
Collection Costs (Licence fees)	6.98
Collection Costs (MDCs)	15.83
Evasion Loss	15.83
Fuel Levy Refund System	1.23
TOTAL	25.00
TOTAL (excl. VAT Refunds)	68.46

3.4.5 Scenario 2.B.1: Introduction of MDCs for diesel vehicles (diesel levy abolished) and adjustment of under-recovery through fuel levies for petrol vehicles

This option entails that the RUC component of the fuel levy on diesel is abolished and variable costs are recovered only in the form of MDCs from diesel vehicles, and that the current under recovery of petrol vehicles is addressed through the use of fuel levies.

The difference between Scenario 2.A and Scenario 2.B is as follows:

- Scenario 2.A whereby MDCs are implemented and the RUC component of the fuel levy on diesel would mean that a fuel levy refunding system still needs to be maintained, although the fuel levy refunds paid to the sectors would decrease due to the introduction of MDCs.
- Regarding Scenario 2.B, there is no need for a fuel levy refund system, as the RUC component of the fuel levy on diesel will be completely replaced by a MDC system for purposes of recovering variable costs from diesel vehicles.

The resulting MDC levels in N$ per 100km are depicted in Table 3-18.

Table 3-18: Scenario 2.B.1 - MDC levels for all Diesel Vehicles

Vehicle Type	Diesel Levy (c/l)	MDC (N$/100km)
Car – Diesel	0.00	14.32
LDV – Diesel	0.00	15.08
Mini Bus (Diesel)	0.00	-
LGV	0.00	20.77
Bus	0.00	32.18
2 Axle SUT	0.00	38.58
3 Axle SUT	0.00	45.68
4 Axle Comb	0.00	88.27
5 Axle Comb	0.00	98.55
6 Axle Comb	0.00	106.75
7 Axle Comb	0.00	121.37
Other	0.00	-

Due to the current under recovery of petrol vehicles, it is necessary to address this under recovery by means of an increase in fuel levies, in which case a petrol levy of 76.99c/l is needed additional to the existing level of 73c/l (i.e. a petrol levy of 149.99c/l).

It should be noted that the over - (under) recovery per vehicle after the implementation of Scenario 2.B.1 is the same as for Scenario 2.A.1.

Table 3-19: Costs of Scenario 2.B.1

Item	Costs (N$ million)*
Equity Loss (Fuel levies)	21.03
Equity Loss (Licence fees)	7.39
VAT Refunds	(67.34)
Collection Costs (Fuel Levies)	0.30
Collection Costs (Licence Fees)	6.98
Collection Costs (MDCs)	18.82

Item	Costs (N$ million)*
Evasion Loss	18.82
Fuel Levy Refund System	0.00
TOTAL	6.00
TOTAL (excl. VAT Refunds)	73.34

3.4.6 Scenario 2.B.2: Introduction of MDCs for diesel vehicles (diesel levy abolished) and adjustment of under-recovery through licence fees for petrol vehicles

The resultant increase in licence fee levels necessary to address the under recovery is shown in

Table 3-20.

Table 3-20: Scenario 2.B.2 - Licence Fees Necessary to Address the Current Under-Recovery

Vehicle Type	Adjustment Fee in Licence Fee (N$/yr)
Motor Cycle	239
Car – Petrol	1,603
LDV-Petrol	1,627
Minibus - Petrol	1,583
LGV – Petrol	-
Bus – Petrol	-
2 Axle SUT - Petrol	-
3 Axle SUT - Petrol	-
Caravan	282
Light Trailer	491

It should be noted that the over - (under) recovery per vehicle after the implementation of Scenario 2.B.2 is the same as for Scenario 2.A.2.

Table 3-21: Costs of Scenario 2.B.2

Item	Costs (N$ million)*
Equity Loss (Fuel levies)	15.57
Equity Loss (Licence fees)	12.24
VAT Refunds	(32.77)

Item	Costs (N$ million)*
Collection Costs (Fuel levies)	0.30
Collection Costs (Licence fees)	6.98
Collection Costs (MDCs)	19.63
Evasion Loss	19.63
Fuel Levy Refund System	0.00
TOTAL	41.58
TOTAL (excl. VAT Refunds)	74.35

3.4.7 Scenario 3: Fuel Levies only

This option entails that only fuel levies are used to recover the fixed and variable cost components of road users. In other words, the current licence fees will be abolished and not only the variable costs but also the fixed costs will be recovered from road users in the form of fuel levies. This would entail that the fuel levies have to be increased to 151.63c/l and 167.06c/l (compared to the current level of 73c/l) for petrol and diesel, respectively. With this option there will be significant cross-subsidisation between vehicle classes, as shown in Table 3-22.

Table 3-22: Scenario 3 - Over – or Under-Recovery Per Vehicle Type

Vehicle Type	Over-(Under)-Recovery per vehicle after Adjustment Fee(N$/yr)
Motor Cycle	(82)
Car – Petrol	43
LDV-Petrol	(7)
Minibus – Petrol	319
LGV – Petrol	-
Bus – Petrol	-
2 Axle SUT – Petrol	-
3 Axle SUT – Petrol	-
Caravan	-
Light Trailer	-
Car – Diesel	352
LDV-Diesel	267
Minibus – Diesel	-
LGV – Diesel	3,736
Bus – Diesel	15,493
2 Axle SUT – Diesel	(551)
3 Axle SUT – Diesel	(480)
4 Axle Comb	(4,391)
5 Axle Comb	(8,929)
6 Axle Comb	(15,714)
7 Axle Comb	(16,118)
Other	480

The costs of this option are as follows:

Table 3-23: Costs of Scenario 3

Item	Costs (N$ million)*
Equity Loss (Fuel levies)	36.01

Item	Costs (N$ million)*
Equity Loss (Licence fees)	0.00
VAT Refunds	(128.86)
Collection Costs (Fuel levies)	0.74
Collection Costs (Licence fees)	6.98
Collection Costs (MDCs)	0.00
Evasion Loss	0.00
Fuel Levy Refund System	1.23
TOTAL	-83.90
TOTAL (excl. VAT Refunds)	44.96

3.4.8 Scenario 4: Licence Fees Only

This option entails that only licence fees are used to recover the fixed and variable cost components of road users. In other words, the current fuel levies will be abolished. The required licence fee levels are shown in Table 3-24. It should be noted that these are the **total** required licence fee levels (i.e. **not additional** to the current levels).

Table 3-24: Scenario 4 – Required Levels of Licence Fees

Vehicle Type	Required Licence Fees (N$/yr)	Resultant % Increase in Current Licence Fee Levels (%)
Motor Cycle	539	461%
Car-Petrol	3,366	1420%
LDV-Petrol	3,423	1259%
Minibus-Petrol	3,731	1109%
LGV-Petrol	-	N/A
Bus-Petrol	-	N/A
2AxleSUT-Petrol	-	N/A
3AxleSUT-Petrol	-	N/A
Caravan	415	246%
Light Trailer	607	533%
Car-Diesel	3,431	913%
LDV-Diesel	3,529	1171%
Minibus-Diesel	-	N/A
LGV-Diesel	4,879	566%
Bus-Diesel	28,210	302%
2AxleSUT-Diesel	11,926	196%
3AxleSUT-Diesel	29,644	176%
4AxleComb	91,876	2093%
5AxleComb	107,727	1036%
6AxleComb	122,616	677%
7AxleComb	137,257	761%
Other	120	-98%

The costs of this option are as follows:

Table 3-25: Cost of Scenario 5

Item	Costs (N$ million)*
Equity Loss (Fuel levies)	0.00
Equity Loss (Licence fees)	68.33
VAT Refunds	0.00
Collection Costs (Fuel levies)	0.00
Collection Costs (Licence fees)	6.98
Collection Costs (MDCs)	0.00
Evasion Loss	0.00
Fuel Levy Refund System	0.00
TOTAL	75.31
TOTAL (excl. VAT Refunds)	75.31

3.4.9 Scenario 5: MDCs Only

This option entails that only MDCs are used to recover the fixed and variable cost components of road users. In other words, the current fuel levies as well as the current licence fees will be abolished.

Table 3-26: Required Levels of MDCs for Scenario 5

Vehicle Type	Required MDC levels (N$/100km)
Motor Cycle	10.58
Car-Petrol	17.18
LDV-Petrol	17.47
Minibus-Petrol	19.05
LGV-Petrol	-
Bus-Petrol	-
2AxleSUT-Petrol	-
3AxleSUT-Petrol	-
Caravan	15.88
Light Trailer	16.57
Car-Diesel	17.18
LDV-Diesel	17.67
Minibus-Diesel	-
LGV-Diesel	26.56
Bus-Diesel	47.10
2AxleSUT-Diesel	64.92
3AxleSUT-Diesel	80.25
4AxleComb	99.60
5AxleComb	116.78
6AxleComb	132.93
7AxleComb	148.80
Other	11.98

The costs of this option are as follows:

Table 3-27: Cost of Scenario 5

Item	Costs (N$ million)*
Equity Loss (Fuel levies)	0.00
Equity Loss (Licence fees)	0.00
VAT Refunds	0.00
Collection Costs (Fuel levies)	0.00
Collection Costs (Licence fees)	6.98
Collection Costs (MDCs)	49.39
Evasion Loss	49.39
Fuel Levy Refund System	0.00
TOTAL	105.76
TOTAL (excl. VAT Refunds)	105.76

3.5 SUMMARY AND OTHER CONSTRAINTS

The purpose of this section is to provide a summary of the findings in terms of equity and efficiency of the options that were analysed. The cost items that were analysed per scenario are summarised in Table 3-28.

Table 3-28: Summary of Scenarios (N$ million)

	Cost per Scenario per Annum (N$ million)								
Item	**1.1**	**1.2**	**2.A.1**	**2.A.2**	**2.B.1**	**2.B.2**	**3**	**4**	**5**
Equity Costs	61.90	56.65	43.59	43.68	47.24	47.44	36.01	68.33	49.39
Equity Loss (Fuel levies)	54.51	16.10	21.17	15.78	21.03	15.57	36.01	0.00	0.00
Equity Loss (Licence fees)	7.39	40.55	7.39	12.07	7.39	12.24	0.00	68.33	0.00
Evasion Loss	0.00	0.00	15.03	15.83	18.82	19.63	0.00	0.00	49.39
System Costs	-105.44	-50.39	-53.26	-18.68	-41.24	-5.86	-119.91	6.98	56.37
System Costs (excl. VAT Refunds)	8.95	8.95	23.98	24.78	26.10	26.91	8.95	6.98	56.37
VAT Refunds	-114.39	-59.34	-77.24	-43.46	-67.34	-32.77	-128.86	0.00	0.00
Collection Costs (Fuel levies)	0.74	0.74	0.74	0.74	0.30	0.30	0.74	0.00	0.00
Collection Costs (Licence fees)*	6.98	6.98	6.98	6.98	6.98	6.98	6.98	6.98	6.98
Collection Costs (MDCs)	0.00	0.00	15.03	15.83	18.82	19.63	0.00	0.00	49.39
Fuel Levy Refund System	1.23	1.23	1.23	1.23	0.00	0.00	1.23	0.00	0.00
TOTAL	-43.54	6.26	-9.67	25.00	6.00	41.58	-83.90	75.31	105.76
TOTAL (excl. VAT Refunds)	70.85	65.60	67.57	68.46	73.34	74.35	44.96	75.31	105.76

Note: Negative costs represent benefits.

* Although licence fees are not used as RUC instrument for each scenario, the licence fee collection cost refers to a nominal contribution of the RFA to the licensing system under the MWTC even if the RFA should decide to implement its own (i.e. not under MWTC) vehicle licensing system.

From Table 3-28, the following is evident:

- If VAT Refunds are **included** (i.e. considered to be applicable to funding from fuel levies, as is the case at present), the three lowest cost scenarios are as follows:
    - Scenario 3 – Fuel Levies Only;
    - Scenario 1.1 – Current Instruments with Fuel Levies as Adjustment Fee and ;
    - Scenario 2.A.1 – Introduction of MDCs (Diesel Levy lowered) and Fuel Levies as Adjustment Fee for Petrol Vehicles.

- If VAT Refunds are **excluded**, the ranking is as follows:
    - Scenario 3 – Fuel Levies Only;
    - Scenario 1.2 - Current Instruments with Licence Fees as Adjustment Fee; and
    - Scenario 2.A.1 – Introduction of MDCs (Diesel Levy lowered) and Fuel Levies as Adjustment Fee for Petrol Vehicles.

The selection of Scenario 3, where the fuel levy is the only RUC instrument, will however have several negative impacts. One of the most important is that fuel levies need to increase drastically, which may not be an optimal approach at this stage.

A set of other factors that also affect the optimal selection of a strategy for RUC instruments and their levels was also identified, as follows:

- Fuel price differential i.e. the difference in the fuel price of Namibia and its neighbouring countries, that can result in fuel smuggling or loss of revenues.
- Elasticity of fuel sales, namely the probable impact of fuel price increases on the quantity of fuel sold.
- The impact on vehicle operating costs (VOCs).
- The impact on the road asset value.
- A possible modal shift that can occur once instrument levels are changed.
- Macro-economic considerations namely:
    - A shift in consumption patterns;
    - Societal equity;
    - Inflationary effects.
- Practical considerations such as the potential risk of concentrating on one RUC instrument only.

These are discussed in more detail below.

3.5.1 Fuel Price Differential

Table 3-29 and Figure 3-3 give a comparison of fuel prices with other countries in the region.

Table 3-29: Comparison of Fuel Prices with other Countries

Country	Petrol Price (N$/l)	Diesel Price (N$/l)
Uganda	6.08	5.21
Namibia	3.70	3.60
Namibia (Scenario 3)	4.49	4.54
Lesotho	3.78	3.55
South Africa	3.84	3.50
Tanzania	6.80	6.40
Kenya	5.03	4.59
Angola	1.41	0.94
Mozambique	3.74	3.74
Zambia	5.44	6.10
Malawi	5.38	4.75
Botswana	3.48	3.25

Country	Petrol Price (N$/l)	Diesel Price (N$/l)
Swaziland	3.60	3.45

Note: Based on the following exchange rates as at 29 October 2003:

- Uganda Shillings/N$ 286.13
- Tanzania Shillings/N$ 150.87
- Kenya Shillings/N$ 11.33
- Mozambique Metical/N$ 3 331.80
- Zambia Kwacha/N$ 678.16
- Malawi Kwacha/N$ 15.14
- Botswana Pula/N$ 0.67
- Angola New Kwanza/N$ 8.50
- Lesotho Maloti, South Africa Rand, Swaziland Emalangeni/N$ 1.00

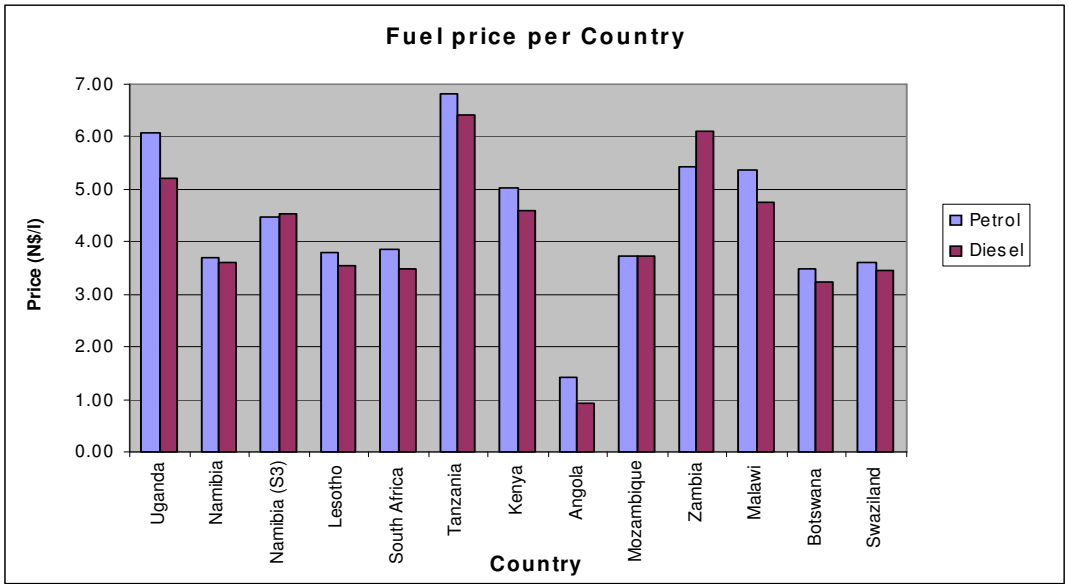

Figure 3-3: Comparison of Fuel Prices with other Countries

From Table 1.1 and Figure 3-3, it is evident that the current fuel prices in Namibia are in the same range as other countries except for Uganda, Kenya, Zambia and Malawi where fuel prices are significantly higher. Should Scenario 3 be implemented, the fuel price will increase with 21.3% and 26.1% from the current level for Petrol and Diesel, respectively.

It could be argued that the scenarios where the fuel levies are lowered from the current level (i.e. scenarios 2.A.1, 2.A.2, 2.B.1 and 2.B.2 (lowering/abolishment of diesel levy only) as well as scenarios 4 and 5 (abolishment of petrol and diesel levies)) could have the following implications:

- potential fuel smuggling **from** Namibia to other countries, as the fuel price will be lower compared to other countries due to the reduction/abolishment of the fuel levies in Namibia; and

- possible distortive effects on the vehicle market due to differences in the price between petrol and diesel (only applicable for the scenarios where **only** the diesel levy is lowered).

It is however believed that once the fuel levy as a revenue source for the RFA is lowered or abolished, a great possibility exists that another government institution will "claim" the fuel levy in order to raise additional revenue. This would possibly imply that the fuel levy as a revenue source for the RFA would be lost forever.

It will be noted that the fuel prices in Angola are significantly lower than those in the other countries which could raise the concern for the potential of fuel smuggling between Namibia and Angola. During discussions with the Ministry of Mines and Energy (MME) as well as a representative from the Namibian Petroleum Association, it was mentioned that there is some fuel smuggling between Angola and Namibia. This however mainly pertains to Diesel and has also reduced due to continuing talks between the Namibian Petroleum Association and the Angolan counterpart (SONANGOL). The reason for the low fuel prices in Angola is the fact that fuel from Angola is of inferior quality and in fact of lower standard than the standard prescribed by SADC, and causes complaints from consumers. The MME also educated consumers in the northern parts in Namibia to avoid fuel from Angola, for this reason. It seems that some fuel retailers in the northern parts of Namibia are still involved to a limited degree with the practice of blending Angolan fuel into Namibian fuel in order to sell the fuel at lower prices and to increase their profit margin. It is however understood that the MME with support from the Police are trying to stop this illegal practice by all means possible.

The percentage taxes, levies and duties (e.g. import levies, excise duties, road user charges etc.) on fuel are shown in Table 3-30 and Figure 3-4.

Table 3-30: Comparison of Taxes, Levies and Duties on Fuel

Country	Taxes, Levies and Duties on Petrol (%)	Taxes, Levies and Duties on Diesel (%)
Uganda	47.15	38.54
Namibia	28.65	29.44
Namibia (Scenario 3)	41.20	44.10
Lesotho	27.06	28.47
South Africa	29.22	25.71
Tanzania	54.83	55.29
Kenya	38.00	28.00
Swaziland	31.30	30.60
Botswana	18.93	15.99

Source:

1. Uganda Road Management Agency, 2000, Uganda Road Management and Financing - prepared by BKS
2. Ministry of Mines and Energy - Namibia, 2003
3. Road Fund (Ministry of Finance), 2003, Review of the projected Road Maintenance Needs and the Generation of Road Fund Revenue - prepared by Africon
4. The Road Fund Board, 2001, Study to review Road User Charges and Rates for Sustainable Road Financing - prepared by Africon & TISCO
5. Ministry of Public Works & Transport, 2001, Institutional Study on Road Management and Financing - prepared by Africon & ED Simelane & Associates
6. Roads Ministry of Works, Transport and Communication, 1999, Study to Develop a Domestic RUC System for Botswana. Prepared by Africon.

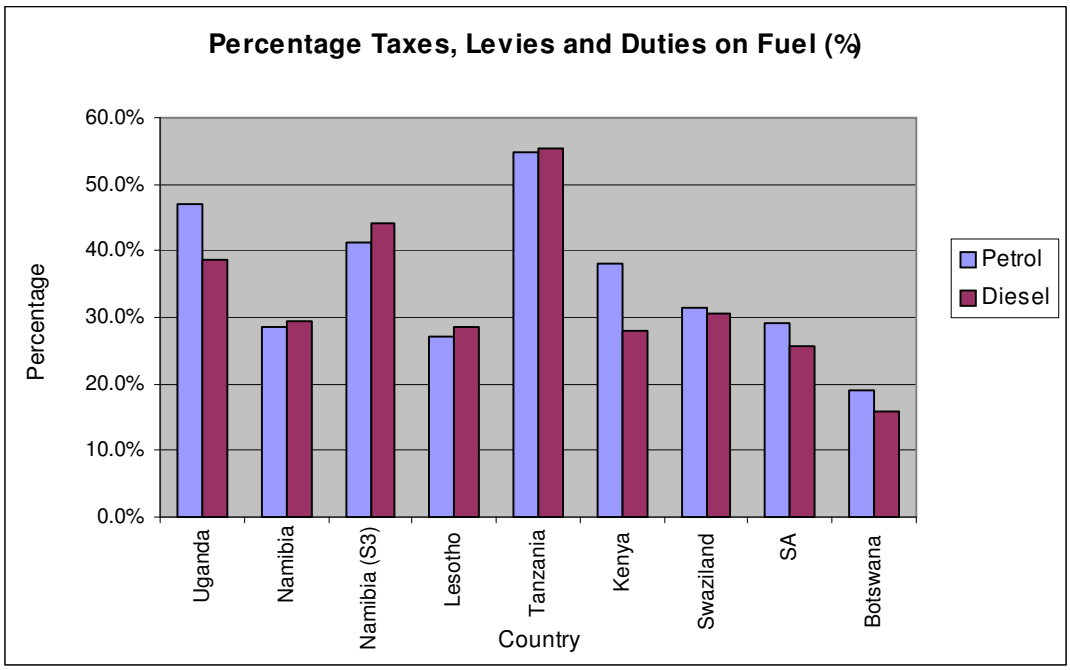

Figure 3-4: Percentage Taxes, Levies and Duties on Fuel

From Table 3-30 and Figure 3-4, it is evident that the proportion of taxes, levies and duties are by far the highest in Tanzania followed by Uganda and Kenya. Botswana has by far the lowest proportion of taxes, levies and duties on fuel.

The proportion of taxes, levies and duties on the current fuel price in Namibia is approximately 29%, and compares favourably with the proportion of taxes, levies and duties on fuel in South, Africa, Lesotho and Swaziland. Should Scenario 3 be implemented, the proportion of taxes, duties and levies on fuel increases to approximately 41% and 44% on petrol and diesel, respectively. A relative high proportion of taxes, duties and levies on fuel, provides a greater incentive to smuggle fuel and to evade taxes on fuel (also refer to Table 3-31: Tanzania Case Study).

Table 3-31: Tanzania Case Study

Once fuel is imported into Tanzania by the various fuel importers, it is stored in bonded warehouses. From there all fuel intended for the domestic market is distributed to local fuel dealers which have to pay over the taxes, levies and duties on fuel to the Tanzania Revenue Authority (TRA) in intervals of 10 days. Fuel intended for use by landlocked neighbouring countries (such as Uganda, Burundi, Rwanda etc) is exported again 'net of taxes'.

Due to the relative high level of taxes on fuel in Tanzania (+/- 55% - refer to Table 3-30), some of the transit fuel which is in fact intended for sale to neighbouring countries is sold on the domestic market at half the price than the fuel intended for the domestic market, as no taxes, duties and levies are levied on transit fuel. It is however understood that the practice of evasion of taxes on transit fuel has however decreased due to the introduction of bio-coding (marking of fuel intended for the domestic market).

It is however believed that the extent of fuel smuggling in Namibia will be negligible and not be comparable to the situation in Tanzania (even if Scenario 3 should be implemented), as appropriate systems are in pace in Namibia to control and curb the practice of fuel smuggling.

It should however be remembered that foreign vehicles travelling in Namibia will try to avoid purchasing fuel in Namibia, as the differential between the fuel price in their country of registration and Namibia is too high, should Scenario 3 be implemented. Possible ways to circumvent this constraint are as follows:

- With the current Cross-Border Charges (CBC) System, it was assumed that foreign vehicles would contribute to their variable cost responsibility by paying the fuel levies in Namibia. The future CBC system could make provision for the fact that foreign vehicles travelling in Namibia will try to avoid purchasing fuel in Namibia by incorporating a fixed and a variable cost component into the future CBC tariffs (this aspect will however be addressed in more detail on the report on CBCs).
- Should the variable cost component not to be incorporated into the CBC tariff, provision could be made for an "on-board fuel levy" whereby the volume of fuel brought in by foreign vehicles be measured at the border (possibly under the current CBC system), and based on the volume of fuel foreign vehicle operators "import" into Namibia, an amount equal to the revenue that could have been generated from the fuel levy of the foreign vehicle has to be paid up-front at the border post. Refunds will be paid to foreign vehicle operators for any fuel that was not used in Namibia when leaving Namibia again.

3.5.2 Possible Impact of Fuel Price Increases on the Quantity of Fuel sold

An important economic characteristic of any product is the price elasticity of the demand for that product, i.e. the percentage change in the amount of the product demanded in reaction to a one percent change in the price of the product. In analysing the impact of a fuel price increase, the price elasticity[7] of the demand for fuel is obviously important.

The majority of international studies found fuel sales to be relatively price inelastic. Various price elasticity estimates are given in Table 3-32.

[7] An elasticity measures the response of the sales volume of a product to a change in the price of the product or to a change in some other factor (such as consumers' income). More precisely, the numerical value of a particular elasticity indicates the percentage change in the sales volume in reaction to a one percent (1%) increase in the price (or income). An elasticity is generally designated as "elastic" or "inelastic" depending on whether its absolute value exceeds 1.0 or not.

Table 3-32: Various Estimates of the Price Elasticity of the Demand for Fuel

Source	Country	Short term price elasticity	Long term price elasticity
U.S. Department of Energy (1981)	USA	–0.1 to –0.4	–0.3 to –0.9
Sterner et al. (1992)	Summary of inter-national research	–0.10 to –0.24	–0.54 to –0.96
D.J. Graham & S. Glaister (2002)	Summary of inter-national research	–0.2 to –0.3	–0.6 to –0.8
S.A. Cloete & E. v.d.M. Smit (1988)	South Africa	–0.25	–0.37
S.D. Ngumeni (1994)	South Africa	–0.1 to –0.2	
Bureau for Economic Policy Analysis (1989)	South Africa	–0.31	
Bureau for Economic Research (2003) – Petrol	South Africa	–0.21	–0.51
– Diesel		–0.18	–0.06

Most of the international studies examined the price elasticity of the demand for fuel in the USA and Europe. The higher price elasticity of the demand for fuel in these countries can probably be attributed to the availability of close substitute forms of transport in the USA and Europe.

For purposes of this study, the estimates of the Bureau for Economic Research were applied in order to estimate the impact of a fuel price increase on the volume of fuel sold. The estimates of the Bureau for Economic Research are based on modern co-integration techniques which are superior compared to the standard techniques such as Ordinary Least Squares (OLS), as they provide an answer to the so-called spurious correlation problem and provides for specification of both the long run theory-based relationships between the variables as well as the short-run dynamic relationships. Unfortunately, no Namibia specific estimates exist, and it is therefore recommended that this needs to be rectified[8]. However, it is believed that the South African estimates represent a fair reflection of the situation in Namibia.

Table 3-33 depicts *inter alia* the short term and long term price elasticities of petrol and diesel as well as the possible impact on the quantity of fuel sold due to the implementation of Scenario 3 on the quantity of fuel sold.

Table 3-33: Estimation of possible impact of Fuel Price Increase on Quantity

[8] During the course of the study, it was not possible to estimate Namibia specific elasticities, as not sufficient historic information was available pertaining to fuel prices and quantity of fuel sold.

ITEM		PETROL	DIESEL
Price Elasticity:	Short Term	-0.21	-0.18
	Long Term	-0.51	-0.06
Current Fuel Price (c/l)		370.00	360.00
Current Levy (c/l)		73	73
Scenario 3 Levy (c/l)		152	167
Resultant increase in Fuel Price (%)		21.35	26.11
% Decrease in Fuel Consumption:	Short Term	-4.48%	-4.70%
	Long Term	-10.89%	-1.57%

Regarding Table 3-33, the following should be noted:

- As mentioned previously, the fuel price elasticity estimates of the Bureau of Economic Research in South Africa were used which appear in the first row.
- The current fuel prices in Namibia (Walvis Bay) appear in the second row.
- The RUC component of the fuel levy appears in the third row.
- The fuel levies as per the preferred scenario (Scenario 3 – Fuel Levies only) as well as the resultant increase in the fuel price due to the implementation of that scenario appear in the fourth row. It will be noted that the implementation of Scenario 3, will mean that the fuel levy needs to be increased from its current level of 73 cents per litre to 152 cents per litre and 167 cents per litre for petrol and diesel, respectively. This would mean that the fuel price (i.e. the pump price payable of which the RUC component of the fuel levy is only one component) would increase with 21.35% and 26.11% for petrol and diesel, respectively.
- The resultant percentage decrease in fuel consumption is shown in the fifth row, and the quantity of fuel consumed will decrease with approximately 4.5% and 4.7% over the short-term for petrol and diesel, respectively. Over the long term the quantity of fuel consumed will decrease with approximately 10.9% and 1.6% for petrol and diesel respectively. It should be noted that the estimated percentage decrease in the quantity of fuel sold is less than the increase in the fuel price due to increasing the RUC levy, and is significantly lower than the increase in the RUC levy itself (108% and 129% increase on the levy on petrol and diesel respectively). This is due to the fact that fuel is relatively **inelastic**, and implies that the RFA will be able to increase its revenue by approaching the MME to increase the fuel levy. If fuel would be **elastic**, it would imply that the RFA would in fact lose revenue if the fuel levy would be increased.
- Elasticities can however not measure directly the political acceptance of increases at the level considered.

3.5.3 Impact on Vehicle Operating Costs

An estimate was made of the impact of the various scenarios that were analysed on vehicle operating costs (VOCs).

Vehicle operating costs (VOCs) refer to costs incurred by vehicles and drivers associated with their travelling on a road. It is possible to differentiate between fixed and variable VOCs. Variable VOCs are use-related, while fixed VOCs are costs

incurred irrespective of the usage of a vehicle. Variable and fixed VOCs include the following:

- Variable VOCs:
  - Fuel costs;
  - Consumption of oil and lubricants;
  - Tyre wear; and
  - Parts and maintenance.

- Fixed VOCs:
  - Depreciation;
  - Insurance;
  - Salary of Driver;
  - Financing costs;
  - Overheads; and
  - Licence fees.

For purposes of estimating VOCs, data was collected from various sources including the South African Road Freight Association, 2003 for all vehicles except cars, minibuses and buses. For cars and minibuses, manufacturers were contacted, and the representative type of vehicle used for car-petrol is a Polo 1 600, for car-diesel is a Polo 1 900 TDI and for minibus is a Toyota Hi-Ace 2 200. For buses, data from a South African Bus Service (KZN Bus Transport) was extracted.

Table 3-34 summarises the percentage increase in vehicle operating costs from the current level, for the respective scenarios.

Table 3-34: Increase in VOCs for the various Scenarios

		Percentage Increase in Vehicle Operating Costs per Scenario								
Vehicle Class	Current VOC (N$/km)	1.1	1.2	2.A.1	2.A.2	2.B.1	2.B.2	3	4	5
Car-Petrol	2.11	2.61%	3.33%	2.86%	3.72%	2.92%	3.80%	2.46%	4.69%	4.86%
Car-Diesel	2.48	2.15%	2.66%	3.11%	3.11%	3.42%	3.42%	2.35%	3.88%	3.89%
LDV-Petrol	2.64	2.08%	1.13%	2.28%	1.26%	2.34%	1.29%	2.19%	0.29%	4.21%
LDV-Diesel	2.74	2.68%	1.12%	2.62%	2.62%	2.58%	2.58%	3.57%	-0.46%	3.31%
Minibus	2.10	2.62%	1.35%	2.87%	1.53%	2.93%	1.57%	2.69%	0.61%	5.99%
LGV	4.72	2.11%	0.09%	1.34%	1.34%	2.08%	2.08%	2.66%	-0.49%	2.98%
Bus	6.03	3.86%	0.21%	0.78%	0.78%	1.10%	1.10%	4.17%	-0.33%	2.28%
2-Axle SUT	5.47	2.68%	0.96%	3.46%	3.46%	4.12%	4.12%	2.25%	0.07%	7.40%
3-Axle SUT	10.35	2.64%	1.03%	1.44%	1.44%	1.52%	1.52%	1.56%	0.91%	2.70%
4-Axle Comb	10.56	2.96%	9.12%	4.96%	4.96%	5.11%	5.11%	3.36%	14.05%	5.35%
5-Axle Comb	7.57	4.66%	6.16%	7.68%	7.68%	7.91%	7.91%	5.45%	6.69%	9.18%
6-Axle Comb	8.05	4.55%	6.30%	7.96%	7.96%	8.27%	8.27%	4.64%	7.08%	9.74%
7-Axle Comb	7.98	4.75%	5.69%	9.44%	9.44%	9.99%	9.99%	5.29%	5.64%	12.00%

From Table 3-34, the following is evident:

- There is an increase in VOC (maximum 14.05%) for all scenarios and vehicle classes except for Scenario 4 where there is a slight decrease in current VOCs for the vehicle classes "LDV-Diesel", "LGV" and "Bus" of between 0.33% and 0.49%.
- For the scenarios where MDCs are used (namely, scenarios 2.A.1, 2.A.2, 2.B.1, 2.B.2 and Scenario 5), the heavy vehicles (most notably from the 5-Axle Combination vehicles upwards) face the highest increases. It is however often quoted that heavy vehicles make a significant contribution to the overall economy and that the lower income groups are highly dependent on heavy vehicle transport. This issue will however be discussed in more detail in section 3.5.6.
- For Scenario 3, the VOC increases are between 1.56% and 5.45%, and although there is significant cross-subsidisation, it can be argued that heavy vehicles make a significant contribution to the economy.

It is evident from Table 3-34, that vehicle operators face a short-term increase in vehicle operating costs. This implies that the transport cost component of goods will increase by these percentages, if it is assumed that cost increases are passed directly onto the consumer. The ability of a producer to pass the increases directly over to a consumer depends on the price elasticity of demand of the product in question. The total increase in prices of goods is dependant on the percentage transport component of the total price of the products, seeing that transport costs is only one of many components, actual increases are estimated to be less than these figures. This issue will be discussed in more detail in section 3.5.6.

Although vehicle operators will face a short-term increase in vehicle operating costs due to RUCs, in the longer term the RUC System should result in a reduction of operating costs of vehicles due to better maintenance of the roads. The reasons for this are as follows:

- The economic benefits of road maintenance have been proved to far exceed the costs of such maintenance, as long as cost-effective maintenance is done at optimal intervals or timing.
- The RUC System ensures that funds are available to maintain the road network in an optimal condition.
- Vehicle operating costs are dependent of the condition of the road network.

The initial increase in road transport operating costs will therefore result in long-term benefits which should filter down through the economy after a few years.

For purposes of ascertaining the benefits in terms of VOCs due to the imposition of RUCs, VOCs were extracted from some of the scenarios that were modelled in the Medium to Long Term Roads Master Plan (MLTRMP). This entails the comparison of the Do Nothing Scenario (Scenario 0), the Do Minimum Scenario (Scenario 1)[9] with the optimum scenario (Scenario 2 – Minimised Total Transport Costs (TTC)).

[9] The MLTRMP Do Minimum Scenario (Scenario 1) was included in the analysis to show the impact on VOCs in terms of the current recovery levels from road users.

When compared to the VOCs of Scenario 2 (Minimised TTC), Scenario 0 (Do Nothing) will result in increased VOCs of 17% and 25% for light and heavy vehicles, respectively, and Scenario 1 (Do Minimum) will result in increased VOCs of 8% and 11% for light and heavy vehicles, respectively.

It will be noted that the VOC increases of 17% and 25% (Scenario 0 (Do Nothing)) and 8% and 11% (Scenario 1 (Do Minimum)) are considerably higher than the VOC increases due to the imposition of additional RUCs (refer to Table 3-34) of 2.47% and 4.96% on average for light and heavy vehicles, respectively (or maximum of 5.99% and 14.05% for light and heavy vehicles, respectively). For the optimal scenario (Scenario 3 – Fuel Levies only) the VOC increases as per Table 3-34 are on average 2.65% and 3.82% for light and heavy vehicles, respectively (or maximum of 3.57% and 5.45% for light and heavy vehicles, respectively).

There will however not only be benefits in terms of VOC due to the imposition of additional RUCs for the pursuance of the MLTRMP Scenario 2 (Minimised TTC) but also benefits in terms of the conservation of the road asset value. This will be discussed in section 3.5.4.

3.5.4 Road Asset Value

The effects of RUCs on the road asset value for the paved road network only, are as follows:

- The road asset value of the MLTRMP Scenario 2 is N$ 10.33 billion over 10 years.
- The road asset value of the MLTRMP Scenario 0 and Scenario 1 over 10 years is N$ 6.33 billion and N$9.10 billion, respectively.
- The loss in asset value therefore represents N$ 4 billion and N$ 1.23 billion over 10 years, respectively or N$ 400 million per annum or N$ 123 million per annum, respectively.

The road asset value of the three MLTRMP scenarios is depicted in Figure 3-5.

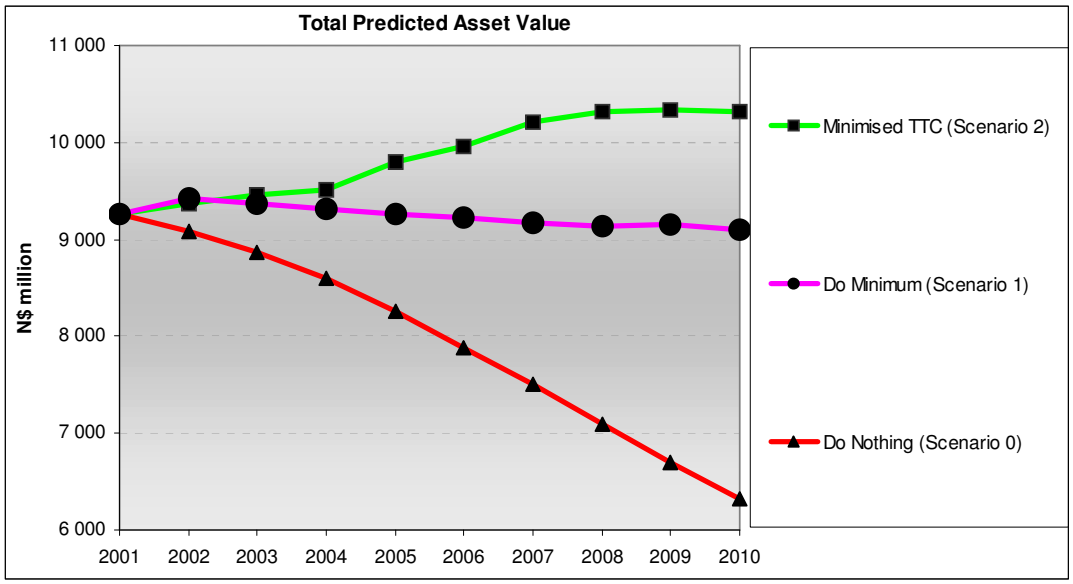

Figure 3-5: Road Asset Value

3.5.5 Modal Shift

The implementation of the proposed increase in road user charges could possibly imply a modal shift from minibus to bus where both are available.

A study in South Africa and more specifically the Cape Metropolitan Area has shown that minibus and bus transport are substitute products, meaning that there is competition between those two modes. This study reported a cross-price elasticity of demand between bus and minibus transport of 1.06% (Neubrech, 1997), meaning that the demand for bus transport will increase by 1.06% in response to a 1% increase in the price of minibus transport. Furthermore, the study indicated that the short-term own-price elasticity of demand for bus transport is 1.90%. In terms of Scenario 3, the short-term effect of a 4.17% VOC increase in bus and a 2.69% VOC increase in minibus transport is that the demand for bus transport will decrease by 0.079% due to a price increase in bus transport (if it is assumed that the VOC increase is passed directly onto the passenger) and the demand for bus transport will increase with 0.029% due to an increase in the price of minibus transport. The overall short-term effect is that the demand for bus transport will increase by 0.051%.

Although the own-price elasticity of minibus transport is not known, a short-run elasticity of 1,90% (as in the case of bus transport) is very likely, as minibus and bus transport are almost perfect substitutes in the short term. This implies that the 4.17% VOC increase of bus and the 2.69% VOC increase of minibus transport causes an decrease of 0.007% in the demand for minibus transport (-0.051% due to a price increase and +0.044% due to the substitution effect).

It is thus anticipated that no significant modal shift between bus and minibus transport will take place, should the elasticities hold true for Namibia.

The same analysis could also be applied in order to determine the effect on the modal split between rail and heavy vehicle freight transport. This, however, would only be possible if elasticities of demand were known, and which could be applied to the Namibian economy.

It should be noted that the possibility of a modal shift between different vehicle types will be limited, if a scenario is implemented where the increase in VOCs is more or less uniform between different vehicle types. This is the case for scenarios 1.1 and 3 (refer to Table 3-34). On the other hand, the probability of a modal shift between different vehicle types as well as the possibility of a distortive effect on the vehicle market will be higher if the other scenarios but especially Scenario 4 should be implemented.

Furthermore, there will also be macro-economic benefits which are discussed in more detail in section 3.5.6.

3.5.6 Macro-economic considerations

A RUC System aims to recover, as accurately as possible, the cost incurred in providing the road system. Ideally, a RUC System would recover those costs without any distortive effects on the economy. This is, however, not possible, as other sectors of the economy would respond to changes taking place in the roads sector. The possible responses that could occur include the following:

- increased costs for transport operators
- modal shift (i.e. if consumers decide to make use of other transport modes eg. rail)
- inflationary effects
- a shift in consumption patterns (as certain goods get more expensive relative to other goods)
- decreasing competitiveness in terms of exports
- societal equity (e.g. RUCs may have a bigger impact on low-income groups than on high-income groups).

These impacts and their extent are all dependant on how the different sectors of the Namibian economy are linked together, and how responsive the markets and consumers are.

Some of the above responses are discussed in more detail below, while some (e.g. increased costs for transport operators) have already been discussed elsewhere in this document.

3.5.6.1 Shift in Consumption Patterns

It can be expected that the increase in road user charges will cause some short term increase in input costs for road transport users. This in turn could cause a shift in consumption patterns (as certain goods get more expensive relative to other goods). This depends on the transport component of each product. The price of low-value

products, like bricks, contains a much higher percentage transport costs than high value products, like diamonds.

Conventional consumer theory states that consumers are faced with decisions as to what combination of goods to purchase, in order to maximise their utility under an income or budget constraint. The choice is extensive as any combination of goods or services may be chosen, including food, clothing, transport, entertainment, etc. Figure 3-6 explains the consumer theory in a simplified way.

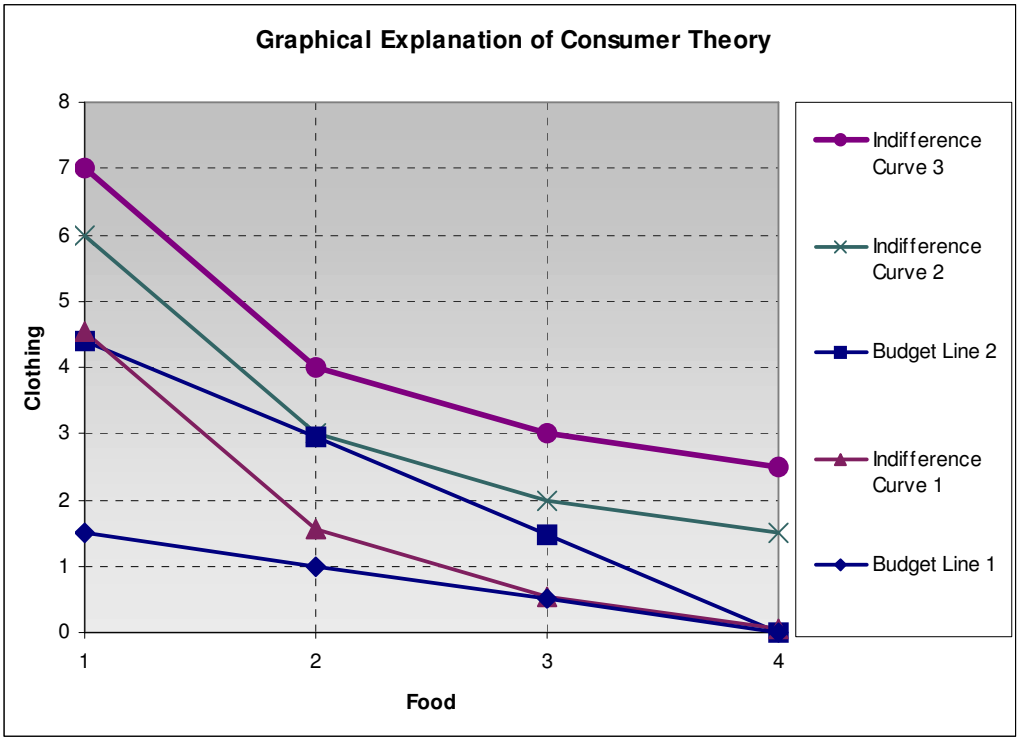

Figure 3-6: Graphical Explanation of Consumer Theory

Suppose consumers only have to choose between two products, namely food and clothing. The straight lines represent the consumer's budget, while all food-clothing combinations which yield equal satisfaction are plotted on one indifference curve[10]. Consumers have to decide what combination of food and clothing to purchase with their available income. Although indifference curve 3 has the highest utility for consumers, it is beyond reach as it is above the budget line 2. The consumer's most preferred and feasible solution is where budget line 2 forms a tangency with indifference curve 2 (i.e. 3 units of clothing and 2 units of food).

Suppose that clothing has a higher transport component than food, then an increase in transport costs causes clothing prices to increase relatively more than food. This causes the budget line of consumers to change its slope. Budget line 1 is then the new

[10] Note that each consumer faces a infinite number of indifference curves which can be on, above or below his budget line. The highest indifference curve is preferred by the consumer. To simplify matters, only three indifference curves are shown.

budget line. The consumer's new most preferred and feasible solution is where budget line 1 forms a tangency with indifference curve 1 (i.e. 3 units of food and 0.5 units of clothing).

The changes in consumption patterns will be dependent upon the relative change in price of the commodities as a result of the change in road transport costs. For purposes of estimating the transport component of the purchase price of the various goods, the sector dependency as determined by means of the Social Accounting Matrix (SAM) for Namibia was used as a proxy. Furthermore, Etosha Transport and FP du Toit Transport provided broad ranges of the transport cost components of furniture (range provided 7%-2%5;to be used as a proxy for the broader sector "housing") and food and clothing, respectively.

The percentage consumption expenditure on various goods per income group is depicted in Table 3-35.

Table 3-35: Consumption Expenditure per Income Group

Income Group	Average Household Consumption Expenditure (N$/year)	Population %	% Expenditure per Category of Goods			
			Food	Housing	Clothing	Other
Low Income Group	2 811	33.3	56.0	29.5	3.0	11.5
Upper Low Income Group	5 273	27.5	59.9	20.1	5.9	14.1
Lower Middle Income Group	8 952	22.3	52.7	19.1	7.8	20.4
Middle Income Group	19 226	11.5	32.2	26.3	7.9	33.6
Upper Middle Income Group	37 939	2.9	19.9	31.7	4.2	44.2
Lower High Income Group	61 595	2,0	15.0	29.8	3.7	51.5
High Income Group	129 335	0.5	9.5	19.6	1.8	69.1
Namibia Total	12 783	100.0	32.5	25.4	5.4	36.7

Source: National Planning Commission – Central Bureau of Statistics

For purposes of estimating the change in consumption expenditure per income group, the following three situations were analysed:

- Current;
- RUCs (Scenario 3) Average Increase in Total Transport Costs 3.28%;
- Minimum RUCs (MLTRMP – Scenario 1 (Do Minimum)) Average Increase in Total Transport Costs 8.30%; and
- No RUCs (MLTRMP – Scenario 0 (Do Nothing)) Average Increase in Total Transport Costs 17.80%[11].

In order to assess the changes in consumption expenditure, the transport cost components of the purchase price of the various goods as depicted in Table 3-36 were used.

[11] Based on a 17% and 25% increase in VOCs for light and heavy vehicles, respectively (as per MLTRMP Do Nothing Scenario) and using a 10% heavy vehicle traffic distribution.

Table 3-36: Transport Cost Components of Goods per Income Group

Income Group	Food	Housing	Clothing	Other
Low Income	30.0%	25.0%	14.0%	12.8%
Upper Low Income	26.0%	22.0%	13.3%	12.8%
Lower Middle Income	22.0%	19.0%	12.6%	12.8%
Middle Income	18.0%	16.0%	11.9%	12.8%
Upper Middle Income	14.0%	13.0%	11.2%	12.8%
Lower High Income	10.0%	10.0%	10.5%	12.8%
High Income	6.0%	7.0%	10.0%	12.8%
Namibia Total	**18.9%**	**16.7%**	**12.1%**	**12.8%**
SAM	**10.3%**	**12.9%**	**11.6%**	**12.8%**

Source: 1) SAM for Namibia.
2) Etosha Transport.
3) FP du Toit Transport.

Regarding Table 3-36, the following should be noted:

- The figures as shown in the last row of Table 3-36 were taken from the SAM. The figures in the second last row show the weighted average transport cost component (weighted by total income contribution per income group, i.e. population within an income group multiplied with average household income of the specific income group). Ideally, the last and second last row should correspond to each other but for purposes of this analysis the figures as shown in the second last row were used to analyse the impact of a rise in road transport costs on the average Namibian citizen.
- The rationale for applying different transport cost components of one good for the various income groups[12] can be explained by the fact that lower income groups are more inclined to use lower value goods than the higher income groups, and as mentioned earlier the transport cost component decreases as the value of a good increases.

Figure 3-7, Figure 3-8 and **Figure 3-9** show the effect in terms of a shift in consumption expenditure for the low and high income groups as well as for the total of Namibia.

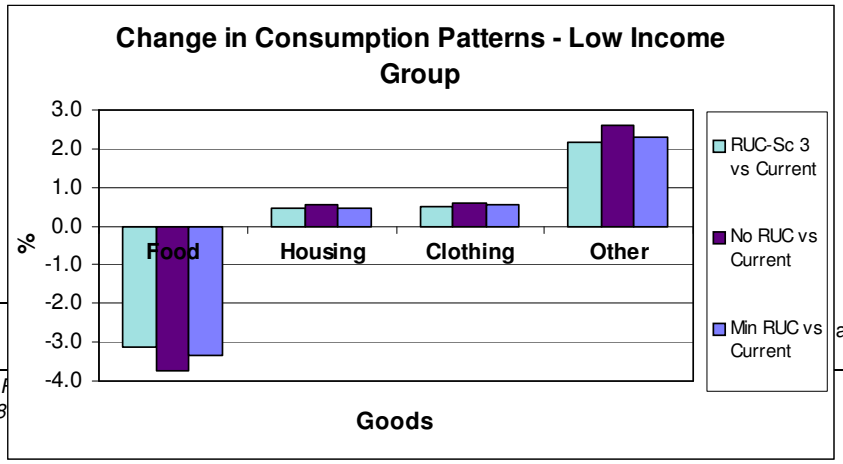

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Figure 3-7: Change in Consumption Expenditure – Low Income Group

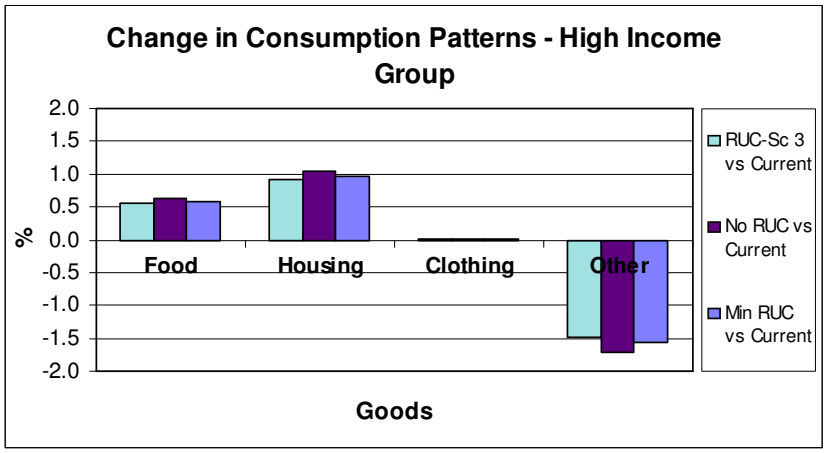

Figure 3-8: Change in Consumption Expenditure – High Income Group

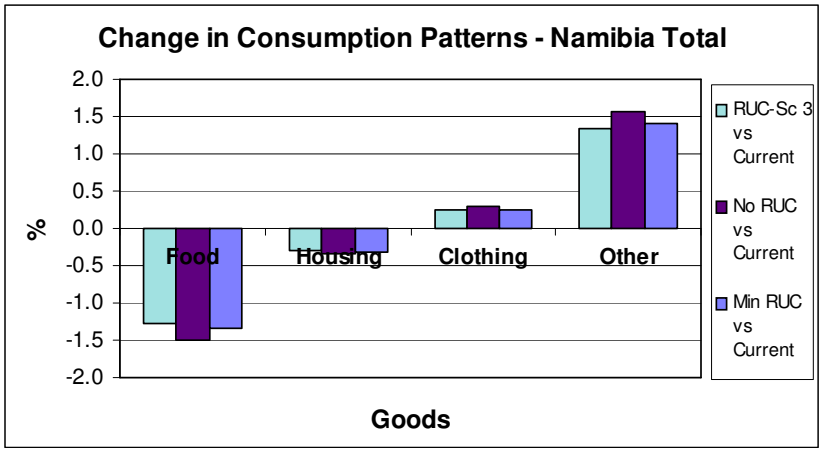

Figure 3-9: Change in Consumption Expenditure – Namibia Total

From Figure 3-7, Figure 3-8 and **Figure 3-9**, the following is evident:

- As can be expected, the situation where no RUCs are used (MLTRMP – Scenario 0 (Do Nothing)) has the largest effect in terms of a change in consumption expenditure.
- The low-income group experience an increase in the expenditure on housing, clothing and other goods on the account of food.
- The high-income group face an increase in food and housing and to a lesser degree in clothing on the account of other goods.
- The average Namibian citizen experiences an increase in the expenditure on other goods and to a lesser extend on clothing and is faced with a decrease in expenditure on food and housing.
- The impact of increasing road transport costs has only a very limited impact on the consumption patterns of the Namibian consumer, depending on the extent of the increase in road transport costs.

It should be noted that the above analysis is based on the assumption that producers are able to shift the cost increases directly onto consumers. This is however not always possible. A firm faced with a change in the cost of an input has several options. If the input cost increases, the firm can:

(1) absorb the higher costs by keeping its prices steady and accepting a lower profit level;
(2) pass on at least some of the higher costs by raising the price of products; or
(3) adjust its production process and employ fewer units of the higher cost input by substituting one or more other inputs.

Several key factors influence how an input cost increase might affect the prices of goods under conditions of competition among numerous firms. For a given increase in an input's cost, the larger will be an increase in the product's price when:

- The share of the input in the total cost of producing the good is larger.
- The input has fewer good substitutes in the production process—that is, few other inputs or processes could be used to produce the product.
- Consumers have few good substitutes for the product, in which case consumers do not decrease purchases substantially when the price is higher.
- A short period of time is considered, as consumers more readily find and use substitute products as more time passes, which would tend to make the price increase of a particular good larger in the short run than in the long run.

3.5.6.2 Societal Equity

Rise in road transport costs can have an effect on societal equity, in the sense that a certain group of consumers (e.g. low-income group) are forced to use relatively more of a good with a higher transport cost component than other consumer groups. This will then affect the overall income available, and can possibly cause a shift in societal equity. The effects on societal equity are analysed by means of the Lorenz Curve and the Gini-coefficient[13], and are presented for the scenarios as per section 3.5.6.1.

Furthermore, the income distribution as in 1993/1994 is also presented.

The Lorenz curve is shown in Figure 3-10 and the Gini-coefficients are presented in Table 3-37.

[13] The Lorenz curve is a graphical tool used to illustrate the extent of inequity regarding income distribution. The Gini-coefficient is a summarising measurement of the extent of inequity regarding income distribution, and was developed by the Italian economist Corrodo Gini. The Gini-coefficient has a maximum value of one indicating absolute inequity and a minimum value of zero indicating absolute equity.

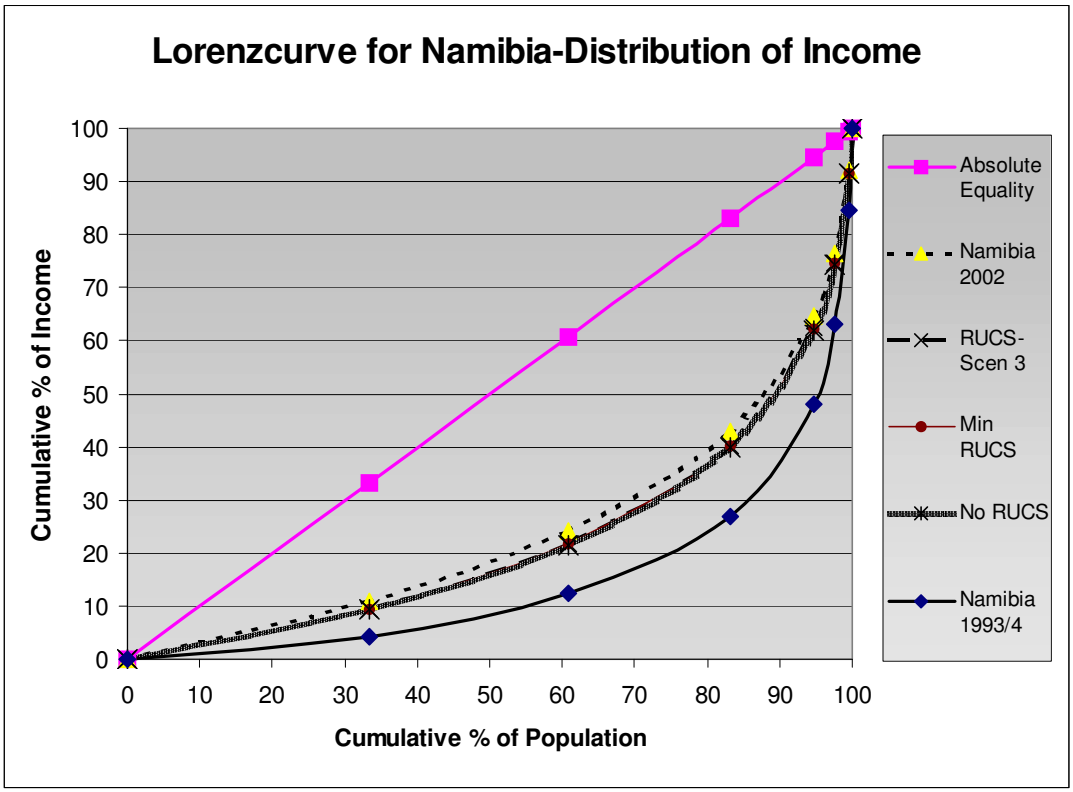

Figure 3-10: Lorenz Curve

Table 3-37: Gini Coefficients

Situation	Gini-coefficient
1993/1994	0.684
No RUCs	0.538
Minimum RUCs	0.534
RUCs-Scenario 3	0.532
2002	0.501

From Figure 3-10 and Table 3-37, the following can be derived:

- When comparing the situation in 1993/1994 and 2002, it is interesting to note that there was a significant improvement in terms of the income distribution in Namibia. In 1993/1994, 5% of the more advantaged population had access to 52% of the total income in Namibia, compared to 2002 where the share of that part of the population decreased to 35%. The Gini-coefficient improved with approximately 0.18 points from 0.684 to 0.501.
- The effect on societal equity due to a rise in road transport costs is minimal, as the Gini-coefficient only deteriorates with 0.031, 0.033 and 0.037 for the situation with increased RUCs (Scenario 3), minimum RUCs and no RUCs, respectively. It is therefore evident that the lower income groups are more affected by an increase in road transport costs than the higher income groups

but an increase in road transport costs only has a limited effect on societal equity.

3.5.6.3 Inflationary Impact

In order to estimate the inflationary impact of a rise in road transport costs, the previous scenarios were applied again (e.g. RUCs (Scenario 3) and No RUCs (MLTRMP Scenario 0 – Do Nothing), and the inflationary impact in terms of the following was investigated by means of the SAM:

- Sector Inflation;
- Consumer Inflation; and
- Government Inflation.

The impact of road transport cost increases on inflation was investigated by applying the assumption that businesses will try to keep profit intact and pass on external cost pressures to consumers.

Table 3-38: Increase in Inflation due to increased Road Transport Costs

	% Increase in Inflation per Scenario		
Inflation	RUCS-Scenario 3	MLTRMP Scenario 1 (Do Minimum)	MLTRMP Scenario 0 (Do Nothing)
Sector Inflation	0.37	0.94	2.03
Consumer Inflation	0.49	1.24	2.67
Government Inflation	0.59	1.49	3.20

It will be noted from Table 3-38 that the increase in RUCs (Scenario 3) has a very limited inflationary impact, while the inflationary impact for the Minimum RUCs (MLTRMP Scenario 1 (Do Minimum) and the No RUCs (MLTRMP Scenario 0 (Do Nothing) is much more pronounced.

It is often stated that an increase in the fuel price (due to the increase of the fuel levy or the landed cost of fuel) has a more pronounced inflationary effect on the economy than the increase in road transport costs due to the increase in other vehicle operating cost components (e.g. licence fee etc.). The reason for this could be as follows: Road transport is used as an input to produce many goods and services. If the fuel price increases, the costs of producers also increase, and those cost increases are shifted largely onto the consumer. The consumers could actually face higher price increases than the initial increase in the price of fuel. This is due to the fact that many producers work with a mark-up on costs. For instance, if the fuel price increases from N$ 1.00 to N$ 1,20 (i.e. a 20 cent cost increase), and the mark-up of a producer is 20%, then the consumer is faced with a 24 cent price increase which is more than the initial 20 cent cost increase. This “multiplier effect” will result in price inflation to a greater or lesser extent, depending on the increases in the fuel price.

Even if the fuel price decreases, producers and retailers are often reluctant to decrease prices of goods, and will often increase the price of goods again once they are faced

with additional fuel price increases, therefore increasing their profit. It was mentioned by the MME that the Botswana counterpart of the MME follows a more pragmatic approach which is more ideal to combat the inflationary impact of fuel price increases by not lowering the fuel price if the IBLC component of the fuel price decreases due to exchange rate considerations or other reasons.

The fuel price is also more visible than other VOC components (e.g. licence fees), and therefore drastic fuel price increases (due to increases in the fuel levy) are less popular than drastic increases in any other RUC instrument (e.g. licence fees), although the effect on total road transport costs is the same. This requires that the public needs to be educated and desensitised in order to make fuel price increases (due to an increase in the fuel levy) more acceptable.

3.5.6.4 The Contribution of Heavy Vehicle Transport on the Economy

In 2002, the transport and storage sector directly contributed N$ 1 119 million or approximately 4% to the Gross Domestic Product (GDP) in Namibia (Quarterly Bulletin of the Bank of Namibia, 2002).

Low-income groups are significantly more dependent on heavy vehicle transport than high income groups (29.1% compared to 4%).

Although heavy vehicle transport cause considerable more damage to the road network, it can be argued that heavy vehicles make a significant contribution to the Namibian economy, and against this background there is some rationale for the cross-subsidisation of heavy vehicles by their lighter counterparts especially also against the backdrop that low-income groups are more dependent on heavy vehicle transport.

3.5.7 Practical Considerations

Although Scenario 3 (Fuel Levies only) is by far the preferred scenario in terms of the overall quantification of efficiency and equity, it should be remembered that a “basket” of different RUCs is preferable to only one single RUC instrument such as the fuel levy. The reasons for this include the following:

- Economic reasons (e.g. ideally all fixed costs should be recovered through fixed cost recovery instruments such as licence fees while variable costs should be recovered through variable instruments such as the fuel levy or MDCs). This is however not always possible due to constraints in terms of acceptability.
- Dependence on one single RUC instrument provides a greater risk to the RFA, as due to unforeseen developments the only source of revenue could dry up or reduce.

3.5.8 Summary of other considerations

The purpose of this sub-section is to provide a summary of the other considerations (other than equity and efficiency) for the evaluation of the various scenarios to recover costs from road users. This is performed in Table 3-39, and it should be noted that not

all other considerations were included in Table 3-39, as some other considerations (e.g. road asset value, impact on VOCs etc.) are for obvious reasons not suitable to be used to evaluate the various scenarios.

A qualitative evaluation of the scenarios in terms of other factors as identified in Section 3.5 is shown in the following table, with equal weightings attached to all factors:

Table 3-39: Evaluation of scenarios in terms of other considerations

	Scenario								
Item	1.1	1.2	2.A.1	2.A.2	2.B.1	2.B.2	3	4	5
Fuel smuggling							X		
Future loss of fuel levy revenue			X	X	X	X		X	X
Modal shift		X	X	X	X	X		X	X
Societal equity		X	X	X	X	X		X	X
Inflationary impact	X	X	X	X	X	X	X	X	X
Dependence on single RUC instrument							X	X	X
Limited scope for fuel levy increase	X		X		X		X		
Contribution of heavy transport to economy		X	X	X	X	X		X	X
TOTAL	2	4	6	5	6	5	4	6	6

Note: X represents a **disadvantage** in terms of the evaluation criteria per scenario

The results from the table indicate the following:

- Fuel smuggling: Scenario 3, where the fuel price will be significantly higher than neighbouring countries, can result in fuel smuggling from neighbouring countries.
- Future loss of fuel levy as a RUC instrument: The implementation of scenarios 2.A.1, 2.A.2, 2.B.1 and 2.B.2 (lowering/abolishment of diesel levy only) as well as scenarios 4 and 5 (abolishment of petrol and diesel levies)) could imply that the fuel levy (on diesel and/or petrol) as a revenue source for the RFA would be lost forever.
- Modal shift: The possibility of a modal shift between vehicle types as well as distortive effects on the vehicle market is lower for scenarios where there is a uniform increase in VOCs between vehicle classes (i.e. scenarios 1.1 and 3) (refer to Table 3-34).
- Societal equity: The possible negative impacts on societal equity are highest for the scenarios where heavy vehicles face the highest increase in VOCs due to the imposition of additional RUCs.
- Inflationary impact: All scenarios will have an inflationary impact as additional revenue needs to be recovered but the scenarios where heavy vehicles face the highest increase in VOCs due to the imposition of additional RUCs will have a higher inflationary impact, as heavy vehicles are used for the transportation of goods.
- Dependence on single RUC instrument: Scenarios 3, 4 and 5 imply that only one single RUC instrument is used which provides a greater risk to the RFA.
- Limited scope for fuel levy increases: Scenarios 1.1 (petrol and diesel levy increase), 2.A.1 (petrol levy increase only), 2.B.1 (petrol levy increase only) and 3 (petrol and diesel levy increase) require significant increases in the diesel and/or petrol levy which may not be possible in the current climate.
- Contribution of heavy transport to the economy: Heavy vehicles make a significant contribution to the economy, and the scenarios where heavy vehicles face the

highest increase in VOCs due to the imposition of additional RUCs can have a negative total economic impact.

- The last row gives a summation of all disadvantages, and it will be noted that Scenario 1.1 followed by scenarios 1.2 and 3 in second position are the most beneficial, as they have the lowest number of disadvantages.

4. CONCLUSIONS AND RECOMMENDATIONS

The purpose of this report was to provide the findings of the review of the current road user charges (RUC) and the updating of the NAMRUC Model, and to provide the RFA with options or scenarios to recover costs from road users by investigating a number of options in terms of efficiency and equity. Other considerations such as comparison of fuel prices with countries in the region, impacts on VOCs as well as broader macro-economic impacts were also investigated.

The options or scenarios to recover costs from road users that were investigated are as follows:

- **Scenario 1: Maintain current instruments**

  - Scenario 1.1: Maintain current instruments with **fuel levies** as adjustment fee;
  - Scenario 1.2: Maintain current instruments with **licence fees** as adjustment fee;
- **Scenario 2: Introduction of MDCs**
  - Scenario 2.A.1: Introduction of MDCs for diesel vehicles (diesel levy **lowered**) and adjustment of under-recovery through **fuel levies** for petrol vehicles;
  - Scenario 2.A.1: Introduction of MDCs for diesel vehicles (diesel levy **lowered**) and adjustment of under-recovery through **licence fees** for petrol vehicles;
  - Scenario 2.B.1: Introduction of MDCs for diesel vehicles (diesel levy **abolished**) and adjustment of under-recovery through **fuel levies** for petrol vehicles;
  - Scenario 2.B.2: Introduction of MDCs for diesel vehicles (diesel levy **abolished**) and adjustment of under-recovery through **licence fees** for petrol vehicles;
- **Scenario 3: Fuel levies only;**
- **Scenario 4: Licence fees only; and**
- **Scenario 5: MDCs only.**

Each of the above scenarios were analysed in terms of the following costs:

- Equity loss (fuel levies);
- Equity loss (licence fees);
- VAT Refunds;
- Collection costs (fuel levies);
- Collection costs (licence fees);
- Collection costs (MDCs);
- Evasion loss;
- Cost of Fuel Levy Refund System.

The results of the analysis showed the following:

- If VAT Refunds are **included**, the three most beneficial scenarios are as follows:
  - Scenario 3 – Fuel Levies Only
  - Scenario 1.1 – Current Instruments with Fuel Levies as Adjustment Fee; and
  - Scenario 2.A.1 – Introduction of MDCs (Diesel Levy lowered) and Fuel Levies as Adjustment Fee for Petrol Vehicles.
- If VAT Refunds are **excluded**, the ranking is as follows:
  - Scenario 3 – Fuel Levies Only
  - Scenario 1.2 - Current Instruments with Licence Fees as Adjustment Fee; and
  - Scenario 2.A.1 – Introduction of MDCs (Diesel Levy lowered) and Fuel Levies as Adjustment Fee for Petrol Vehicles.

The implication is that fuel levies need to increase drastically, which may not be possible in the current climate. Other factors that were also considered are as follows:

- Fuel price differential.

- Possible impact of fuel price increases on the quantity of fuel sold.
- Impact on vehicle operating costs (VOCs).
- Impact on the road asset value.
- Possible modal shift.
- Macro-economic considerations.
  - Shift in consumption patterns
  - Societal equity
  - Inflationary effects
- Practical considerations (e.g. the potential risk of concentrating on one RUC instrument only).

The evaluation of the scenarios in terms of the above-mentioned other factors revealed that Scenario 1.1 followed by scenarios 1.2 and 3 in second position are the most beneficial.

The key findings of the analysis of various RUC scenarios lead to the following conclusions:

- Although the use of the fuel levy as the only RUC instrument (Scenario 3) is attractive in terms of low cost of collection, low revenue risk and simplicity, there are various disadvantages. Such an approach would require high increases (more than 80c/l) in the fuel price and the inequity in cost recovery between vehicle classes will increase. These disadvantages render this option impractical
- The current suite of RUC instruments (Scenarios 1.1 and 1.2) emerged as the next scenarios with lowest cost. Inequities in terms of cost recovery however still exist between and within vehicle classes
- These inequities can be addressed through the introduction of MDCs (Scenarios 2.A.1 and 2.A.2) in addition to current RUC instruments, although such a system would have a cost implication in terms of development, implementation and operation
- Implementation of MDCs while abolishing the diesel fuel levy (Scenarios 2.B.1 and 2.B.2) is not considered to be desirable, due to high system costs, negative impacts associated with the lower fuel price, and loss of the fuel levy as an effective instrument
- Implementation of only licence fees or only MDCs (Scenarios 4 and 5) are also not considered to be feasible, given high total costs as well as dependence on only one instrument.

Based on these findings the following RUC instrument strategy is recommended:

- The current RUC instruments should be maintained, namely the fuel levy, license fees and the cross-border charges system
- The parallel systems should be refined by taking steps identified in Phases 2 and 4 of this project, that reviewed the Fuel Levy Refunding System and the Cross Border Charges System respectively
- The MDC system should be implemented to address issues of inequity between and within vehicle classes, in line with the findings of Phase 3 of this project. Initially, a simplified flat fee base system should be implemented.

This can be accompanied by a parallel pilot system to investigate the feasibility of a technology-based system.

- The levels of the various instruments should be increased based on the findings of this part of the project, and can be phased in over time to increase revenues up to the optimal long term level required for sustainable funding

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ANNEXURE A

AN ECONOMIC PERSPECTIVE ON ROAD TRANSPORT IN NAMIBIA

NAMIBIA – ROAD USER CHARGING

AN ECONOMIC PERSPECTIVE ON ROAD TRANSPORT IN NAMIBIA

CONNINGARTH ECONOMISTS

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12 March 2004

1 INTRODUCTION

1.1 Background

For an economy to perform efficiently, an effective transport infrastructure is essential as transport serves as the "main artery" of the economy. In view of the fact that Namibia is characterised by vast distances and a sparse, widely spread population, it is essential that the Namibian road transport infrastructure is well maintained and continuously upgraded so as to support an expanding economy.

In order to maintain and upgrade road infrastructure, the necessary funds must be available on a continuous basis. Road User Charges (RUCs) are viewed as the most appropriate way of financing road infrastructure. This is specifically as a result of RUCs allocative properties, i.e. costs are brought to bear where they logically belong – the so-called "user pays" principle. Several RUC instruments are available, i.e. fuel levies, mass-distance charges, etc. In comparing these different instruments, both their transaction costs and their economic and socio-economic effects are significantly different.

Following considerable discussion regarding the merits of RUC, this strategy was introduced in Namibia three years ago with the objective of increasing the efficiency of the road transport sector. This study elaborates further on the application of RUCs in Namibia.

1.2 Objective of Study

The objective of this study is to conceptually consider, and practically measure the macro-economic impacts of RUC instruments. This will be achieved by using the Social Accounting Matrix (SAM) for Namibia and applying it to three different types of RUC instruments in order to demonstrate the macro-economic impact of RUC instruments.

1.3 Structure of Report

This study starts off with a generic discussion of RUC instruments and their possible effects in an economy.

A framework for assessing RUC instruments is introduced which includes a discussion of the allocative efficiency of user charge instruments as a transfer mechanism of road transport costs, and the micro and macro-economic issues related to RUCs. A number of different RUC instruments are discussed in relation to this framework.

The Social Accounting Matrix (SAM) for Namibia forms the basis of the methodology used to determine the dependency, inter-relationships and economic impact of the road transport sector in Namibia.

This conceptual discussion is followed by a macro-economic impact analysis of three specific RUC scenarios applied to the Namibian economy and making use of the SAM. The three scenarios include a general fuel levy, a mass-distance charge and a general increase in road transport costs.

In concluding the report, a brief overview of the macro-economic impact of RUCs as investigated in this study, will be given.

2 GENERIC DISCUSSION OF ROAD USER CHARGE INSTRUMENTS

2.1 Introduction

Road User Charge (RUC) was introduced in Namibia three years ago to increase the efficiency and finance of the road transport sector. Considerable discussion of the merits of RUC took place prior to this study, and these discussions are reviewed here with some additional comments on RUC's impact on the macro-economy – as contrasted with road funding out of tax revenues.

It is anticipated that the short-term effect of a RUC system will increase the cost of vehicle operations. In the longer term the system should, however, result in a reduction of operating costs of vehicles due to better maintenance of the roads.

The reasons for this are as follows:

- The economic benefits of road maintenance have been proved to far exceed the costs of such maintenance.
- The RUC system ensures that funds are available to maintain the road network in an optimal condition.
- Vehicle operating costs are dependent on the conditions of the road network.

2.2 Framework for Assessing Road User Charges

In considering the general impact of RUCs on the economy, the following questions are of interest:

- Will RUC dampen overall economic activity?
- Will RUC change consumption platterns?
- Will RUC have an inflationary impact?
- Will RUC have an effect on tax incidence?

Each question has a macro-economic and a micro-economic perspective. Each of these need to be addressed somewhat differently, and it is the macroeconomic that

is of main interest in this study. However, as the macro-economy is made up of the totality of micro-economic effects, the two cannot be separated. The discussion that follows will thus consider first the micro-economic responses to the imposition of a RUCs as such, and then turn to the macro-economy.

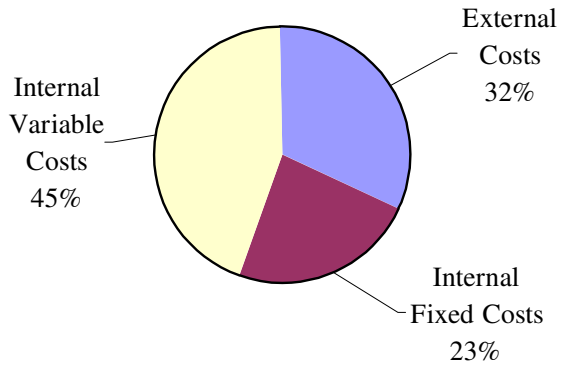
In applying the framework, three issues are covered. The first aspect is the allocative efficiency of RUC's as transfer mechanism for road transport costs. This is followed by a discussion of the micro- and macro-economic elements to evaluate the efficiency of various RUCs.

2.2.1 Allocative Efficiency of RUCs as Transfer Mechanism for the Financing of Road Transport Costs

It has been noted that RUCs will increase allocative efficiency. It does this by 'bringing to bear costs where they logically belong', internalizing externalities and thereby imposing on road users the full social / economic cost of their road use, and not just its direct financial costs. This section of the report covers two broad topics. In the first part a framework is discussed whereby the impact of Road User Charge instruments can be assessed. The second part discusses the conceptual issues relating to specific road user charge instruments with regard to the framework.

Motor vehicle use imposes many costs, including several that are external and others that are internal but fixed, and are therefore not perceived as being related to the distance driven. Chart 1 illustrates the distribution of costs for a typical automobile, showing that just less than half of all costs are marginal (internal and variable), Litman, T (1999:1).

CHART 1: DISTRIBUTION OF AUTOMOBILE COSTS



A majority of vehicle costs are "Internal Variable" and include vehicle-operating costs, user travel time and crash risk. "Internal Fixed Costs" includes vehicle depreciation, insurance, registration, and residential parking. "External Costs" includes congestion and accident risk imposed on others, a portion of road and parking facility costs, and various environmental costs.

It is economically inefficient if the price road users pay does not reflect the costs when making a particular trip decision. Only if drivers pay full marginal costs will they limit their vehicle travel to trips in which benefits exceed total costs. A price structure is inequitable if it forces people who drive less than average to subsidize the vehicle costs of those who drive more than average. For example, a low-mileage vehicle owner pays far more per mile driven for insurance, compared to a high-mileage vehicle owner. Since lower income households tend to own fewer vehicles and drive less than average, this is regressive, Litman, T (1999:1).

A more marginal pricing system like RUC returns to individual consumers a greater share of the savings created when they reduce their driving, increasing the incentive for more economically efficient travel. Shifting costs from being external or fixed to being internal and variable; increasing user choice. At worst consumers would simply shift the money saved to cover their higher variable expenses, resulting in no overall change in travel or cost. But they could enjoy savings that are not currently possible by foregoing low value trips or shifting to more efficient modes, Litman, T (1999:2)

TABLE 1: DIFFERENT TYPES OF RUCS AND MARGINAL VEHICLE COSTS

Rank	RUC Category	Examples
Best	**Time- and- location-specific road and parking pricing**	**Variable road pricing, location-specific parking management, location-specific emission charges.**
Second Best	**Mileage-pricing**	**Weight-distance charges, mileage-based vehicle insurance, mileage based emission charges.**
Third Best	**Fuel charges**	**Increase fuel tax, apply general sales tax to fuel, carbon tax.**
Bad	**Fixed vehicle charges**	**Vehicle purchase and ownership fees.**
Worst	**External Financing**	**General taxes paying for roads and traffic services, parking subsidies, uncompensated external costs.**

Table 1 ranks common vehicle charge options in terms of how well they represent the marginal costs of vehicle use. External costs, such as roads funded by general taxes, free parking, and uncompensated accident and environmental impacts are entirely non-marginal. Although fixed vehicle charges such as insurance and registration fees internalise costs to vehicle owners as a group, they are also not marginal, since once paid they have no

effect on vehicle use. This is economically inefficient and results in cross-subsidies between those who drive less than average and those driving more than average.

The most commonly used distance-based fee is a fuel tax. It is more marginal than a general tax or external fixed fee, but is not optimal since it does not reflect many of the factors that affect vehicle costs, such as vehicle type, driver, and travel conditions. Litman, T (1999:2).

A mileage or kilometre charge can be much more marginal. For example, it can be based on a particular vehicle's axle weight, accident risk, and pollution emission. Distance-based fees can reflect both vehicle value and vehicle use, resulting in charges that are progressive with respect to income, since higher income people tend to own more valuable vehicles and drive more per year, Litman, T (1999:2).

Road pricing that varies with time and place is even more marginal by nature. It is particularly appropriate for internalising congestion, accident and pollution costs. It is now technically feasible to use in-vehicle computerized meters or regional vehicle tracking systems to calculate vehicle charges, taking into account when and where driving occurs. However, such a system is constrained by relatively high transaction costs and concerns about privacy.

2.2.2 Micro-economic Issues

The four framework questions initially posed will firstly be considered.

- The economic rationale for RUCs is that it increases the efficiency of the road transport sector and consequently also that of the economy in general. Therefore it is to be expected that improved efficiency in this sector will filter through to enhanced performance in the economy overall. Rather than dampening economic activity, RUCs should rather serve to increase it through more economic efficiencies at micro level.

- RUCs may, nevertheless, change consumption patterns between economic commodities and services, where close substitutes exist and where consumers are sensitive to price changes. Bread and maize meal, for example, may be substituted.

- RUCs will have once-off cost impacts, offset in part or whole by changes in consumption patterns and efficiency gains.

- RUCs will shift tax burdens towards those groups in the community that are the most dependent on transport.

It must be noted that from a long-term perspective the micro-economic effects that occur are desirable, even if they cause some short-term disruptions. This is because they are symptoms of improving allocative efficiency in the

economy, which requires the price of all goods and services to reflect their full or true opportunity (marginal) costs. To put this another way, these effects indicate that there previously existed some form of subsidization, either explicit or hidden. By optimising allocative efficiency, an economy will produce the greatest possible economic (probably also social) well being within the constraints of its inherently limited endowments of productive resources.

Another way in which RUC increases efficiency is by revealing, again over the long term, road users' willingness to pay for roads, so that the demand for and supply of roads becomes more closely matched than may be the case when other means of road financing are employed.

There is a trade-off between expenditure on roads (which is in turn dependent on the revenue from RUCs) and road user cost savings (which mainly consist of vehicle operating cost (VOC) savings as well as value of time savings to a lesser extent).

Two other possible impacts of the introduction of RUC are less desirable. They are:

- Increased administrative costs. If the administrative costs of RUC are high, the resultant so-called X-inefficiency may considerably reduce – in extreme cases even outweigh – the allocative efficiency gains that RUC achieves. In practice, this means that RUC systems should be selected that do not impose high direct costs (i.e., are not over-elaborate and expensive while still making a marginal contribution to allocative efficiency) or high indirect costs (e.g. by making bureaucratic demands on road users) on the economy.
- A decrease in societal equity if RUC has an effect equivalent to a regressive tax and impacts relatively more heavily on low-income groups. The trade-off between efficiency and equity is always a difficult one to make, but usually the political process can be relied upon to signal situations where equity is decreasing.

2.2.3 Macro-economic Issues

As regards the macro-economic issues relating to RUCs, the principle issue to address is what RUCs is replacing. If RUCs did not exist, how would roads be financed? The obvious answer is: out of taxes. Taxes and user charges are much the same from a macro-economic perspective. So if RUCs are substituted more or less directly for pre-existing taxes, the macro-economy will be little affected in the short-term. However, the political economy that governs RUCs differ from that which governs taxation. Different rules apply to the two situations. Therefore it cannot be taken for granted that the substitution is a more-or-less direct one, or proportional in its dimensions. Nevertheless, to begin the analysis, the assumption is made that the revenue raised through RUCs is equivalent to that that would otherwise have been

allocated to road funding out of general tax revenues. The four framework questions listed earlier are now addressed on the basis of this assumption.

- There is no reason to expect that RUCs would have a significant effect on overall economic activity, or dampen economic growth.

- RUCs are also unlikely to have a significant impact on consumption patterns. Although there are differences between sectors' dependence on road transport, and that RUCs are likely to result in differential cost changes across sectors, there is little if any substitutability between the products delivered by these sectors.

- For the same reason, there will be no impact on tax incidence (although some symantic issues arise that will be discussed below.) As was mentioned above different rules govern RUC and road financing through the general fiscus. Therefore it is quite likely that different amounts will be spent on roads under the two funding systems.

- Two contrasting sets of multiplier effects need to be taken into account to determine whether there will be a reduction of economic growth. Firstly, more money than before is withdrawn from expenditures on consumption items. This reduces the number and size of transactions in the economy, and thus reduces its overall size. However, this money is not sterilized, but is promptly injected back into the economy via the roads sector, thereby triggering new multiplier effects. These will trace out a different pathway through the economy, but there is no reason to expect them to be significantly different in overall size to those that they replace. Thus the impact on economic growth is likely to be neutral over the short to medium-term.

- At the macro-economic level, consumption of other goods and services will have to be reduced as consumers switch a higher proportion of their disposable income to expenditure on road transport. (They might even reduce savings)

- The higher road user charges will probably be shifted forward to buyers of final consumer goods and services. This will cause a once-off increase in the prices of those goods and services, that will take place over time as the ripples of the multiplier effect spread through the economy. Once this has happened, there will be no reason for further price increases to occur. RUC is thus not inflationary, as inflation is a process of continuing price changes that is not "neutralized" by improvements in efficiencies in the economy.

- As regards tax incidence, some symantic issues must be considered. In general, taxes are usually spent on goods and services that have elements of 'collectiveness'. Disposable income after tax is usually spent on goods and services that have a greater degree of 'privateness'. Roads are a mixed case: having elements of both 'privateness' and 'collectiveness' is what makes it possible to finance them through either taxes or RUCs in the first

place. Any given country decides politically on its chosen mix of 'privateness' and 'collectiveness' in the goods and services it consumes, and this is reflected in the structures of its tax rates. Replacing tax-based road financing with RUCs has the appearance of lowering overall tax incidence: roads have been re-classified, as it were, from public to a more private good. But the subsequent raising of the amount of revenue spent on roads, above that which would have been appropriated when roads were tax-funded, nonetheless still has the effect of shifting expenditure from goods and services with greater elements of 'privateness' to ones with greater elements of 'collectiveness'. It is therefore equivalent to raising the economy's overall tax incidence.

2.2.4 Conclusion

The first conclusion that can be reached on the generic issues is that the direct impacts of RUCs on the macro-economy are quite limited, and differ little from those of an equivalent tax-based road financing system. However, if the sum of the charges raised are higher than the taxes that would otherwise have been allocated to road transport, the macro-economic effect will be similar to that of an increase in the overall tax burden.

The road transport sector has a pervasive impact on the economy, and allocative efficiency in this sector can therefore have a significant impact on the economy overall (by contrast, allocative inefficiency in the sector could limit overall economic performance).

RUCs can significantly increase allocative efficiency in the road transport sector. It does so by making variable road transport costs more transparent and by internalizing externalities in accordance with the use of road transport services by the different sectors in the economy.

More complex RUC systems are better at internalizing externalities. However, they are more expensive to operate and likely to impose greater compliance costs on road users. Thus there is a risk that they will introduce X-inefficiency into the road transport sector that will undermine the gains to allocative efficiency. The balance of the argument, however, indicates without doubt that an economy can only benefit from the introduction of RUCs.

2.3 Discussion of Conceptual Issues Relating to Specific Road User Charge Instruments

2.3.1 Vehicle Registration and Licensing Fees

The Road Funding Authority (RFA) of Namibia has to date implemented vehicle registration and licensing fees which are based on historical levels.

A conceptual distinction needs to be made between revenue from vehicle license fees which are raised in accordance with the principle that fixed fees should be used for the recovery of fixed costs and additional registration and licensing fees which may be added to heavy vehicle registration and licensing fees for purposes of equity and to supplement shortfalls resulting from the lack of a weight-distance charging system for heavy vehicles. The latter is a marginal cost recovery instrument.

2.3.2 Fuel Levies

The pump price of fuel consists of various components such as the In Bond Landed Costs (IBLC), the RUC component of the fuel levy, other taxes, levies and duties as well as industry and retail margins and transport costs.

2.3.3 Mass – Distance Charges (MDCs)

Mass-distance charges are the third tier of road user charges after vehicle license fees and fuel levies. This type of charge varies directly with road use in a similar way to a fuel levy but takes better account of the cost responsibility for a particular vehicle class. MDCs are intended to recover those variable road costs that are not recovered by the fuel levy. In general unrecovered costs relate to the heavier vehicles. MDCs could be used in place of fuel levies but are more expensive to administer than fuel levies, Kennard, A (1998:1).

Weight-distance charges for heavy vehicles are generally seen as supplementary to the fuel levy to eliminate the cross-subsidisation between different vehicle classes, which occurs when only a fuel levy is in place. Progressive rates are established for vehicles classified according to the weight transmitted through the vehicle axles. The distance travelled by the particular vehicle must also be recorded.

The disadvantage is that weight-distance charges impose additional costs on both the Government and the vehicle operator. On the one hand, auditors, inspectors and traffic law enforcement agents must be employed, in order to avoid evasion. On the other hand, the vehicle operator would face additional administrative costs and the expense of installing the distance meters (hubodometer) to monitor heavy vehicle usage.

For petrol-powered vehicles the simpler fuel levy is an obvious choice for recovering variable road costs for as many vehicles as possible. MDCs would then only apply to the heavier petrol-powered vehicles, Kennard, A (1998:1).

The issue is not so clear-cut for diesel-powered vehicles mainly because a significant amount of diesel is used in other than road vehicles. This means that, if a road user levy is applied to diesel, then it should be refunded on diesel used in other than road vehicles. Options such as having two sources of diesel; one with a road user levy and one without, have been investigated and discounted as being open to too much abuse, Kennard, A (1998:1).

The study of the Road Fund Administration Act, 1999 (Act No.18, 1999), placed several legal requirements on the RFA in terms of MDCs, should they be implemented. MDCs shall be for on-road use and shall be based on the actual distance travelled and on vehicle size.

Advantages of MDCs

MDCs have several advantages. The most significant is that a specific vehicle will be charged for road use based on its actual distance travelled and its specific GVM. This instrument therefore removes all the inflexibility problems caused by averaging fuel levies and license fees.

Disadvantages of MDCs

The introduction of MDCs also carries with it a number of risks that need careful consideration when such a system is implemented.

- The revenue collection cycle carries more risk. There is a concern for non-payment and slow payments and, ultimately, the losses the RFA would have to carry. Currently, the RFA has almost no risk with the collection of fuel levy revenues.
- There is a concern for non-compliance.
- The revenue collection cycle would be costlier than the current fuel levy collection cycle. Personnel would have to be appointed to manage the administration system. No additional traffic police enforcement is foreseen.

There are also other aspects that must be considered when introducing MDCs:

- Vehicle mass is based on GVM and not actual mass.
- Axle configuration. The actual load transfer from the vehicle to the road depends on the axle configuration of a vehicle. If the load were distributed evenly between the axles, the load transfer would be even. In some cases the vehicle can carry a load within its GVM, but due to poor axle configuration, one or more axles carry excessive loads.
- Tyre size. The larger the contact area between the tyres of a specific vehicle and the road, the lower the pressure the vehicle exerts on the road.

2.3.4 Cross – Border Charges

The current so-called "cross-border charge" is an "entry fee" in respect of a motor vehicle not registered in Namibia that temporarily enters Namibia. The entry fee is the counterpart of the annual vehicle registration and licensing fee payable in respect of Namibian registered vehicles.

A Namibian system of mass-distance charging is not yet operational and it has not been possible to fully implement all cross-border road user charges. It is assumed that foreign vehicles using Namibian roads will purchase fuel in Namibia and that they will therefore pay the same total road use charges as Namibians. This assumption is reasonable because the pump price of fuel in Namibia is currently similar to that in South Africa.

If this balance in fuel prices should change, special arrangements may have to be implemented to ensure that foreign road users pay the same as Namibians when using Namibia's roads.

It has been recommended that the current system for collection of cross-border road user charges be reviewed in due course with a view to see whether the collection costs can be reduced. As soon as a system of MDCs is implemented in Namibia the full cross-border road user charging system should be implemented.

3 EMPIRICAL ANALYSIS OF ROAD USER CHARGE INSTRUMENTS FOR THE NAMIBIAN ECONOMY

3.1 Introduction

Where the conceptual issues relating to road user charges (RUCs) have been considered in Section 2, this section will focus on the application of certain RUCs in the Namibian economy. The empirical analysis will utilize the Namibian SAM to firstly explore the detailed interaction of the road transport sector in the Namibian economy and then the SAM as a model of these interactions will be used to measure the macro-economic impact of three types of RUCs.

3.2 Review of Namibia's Macro-Economic Situation

To obtain a better understanding of the impact of RUCs on the Namibian economy, an overview of the economy is given below.

Namibia has a free enterprise economy. However, the Namibian economy is characterised by substantial direct and indirect public sector involvement, especially in fields where the private sector either has not, cannot, or does not want to enter. Direct public sector involvement varies from government business enterprise undertakings such as Trans Namib (a parastatal that dominates the transport industry), to the activities of public corporations such as Nampower and Namwater.

A feature of the Namibian economy is the important role that the primary sector, mainly agriculture and mining, plays in overall economic activity. In 2002 the primary sector contributed 22.7%[1)] to the GDP as compared to 28.4% in 1990. The contribution of secondary industries declined from 16.4% of GDP in 1990 to 14.2% in 2002. In contrast to the decline of the primary and secondary sectors, the contribution of the tertiary sector's share of GDP increased from 55.7% in 1990 to 63.1% in 2002.

Namibia is well endowed with natural resources and has large reserves of diamonds, uranium, copper and other minerals, as well as rich offshore fishing. The resource wealth is reflected in a relatively high annual per capita Gross Domestic Product of US dollar 1 550 (N$ 14 100) in 2002. A skewed income distribution in Namibia is, however, reflected in the fact that the highest income group (1%) of the population earns 32% of national income while the two lowest income groups, which make up 50% of the population, earn 42% of national income.

Trade is very well developed, both nationally and internationally. Commodities that cannot be produced locally are imported and care is taken to promote the acceptance of the free market in shaping the economy. A large proportion of goods and services for Namibian consumption is imported (49% of gross domestic expenditure) while exports represent 48% of the GDP of Namibia.

Against this background, there are two salient facts to be considered in considering Namibia's road transport sector / macro-economic interface. Firstly, Namibia is a developing country with a large section of poor people with low disposable income and where it must be applied as effectively as possible in satisfying basic needs. Secondly, Namibia covers a large geographical area where goods and services must be transported over long distances.

These two facts, taken together, suggest a hypothesis: road transport costs are likely to form a relatively large component of the price of consumer goods and

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[1)] Expressed as percentage of GDP at market prices. Source: Central Bureau of Statistics of Namibia.

services, including those consumed by the poor. This is confirmed by the fact that the transport sector contributed nearly 4 % to the GDP in 2002. It is therefore very important that for the economic development of Namibia, the road transport sector should operate as economically efficient as possible.

The Gross Domestic Product (GDP) for transport and storage amounted to Namibia dollar (N$) 1 119 million in 2002 according to the Quarterly Bulletin of the Bank of Namibia.

By using the contribution of each sub-sector of transport as depicted in the SAM, the GDP of the transport sector has been disaggregated to the various sub-sectors (modes) of transport as reflected in Table 2. The contribution of the sub-sectors is reflected by the GDP and the production/turnover. Production is defined by the volume of production of the sub-sector multiplied by the price. This concept double counts as it also includes intermediate inputs such as fuel. The true contribution of the transport mode to economic activity is captured in the GDP concept which only reflects value added.

It is evident from Table 2 that road transport fulfills by far the largest role in transport in Namibia – in terms of GDP and production/turnover. It is important to note the significant role own road transport fulfills. Nearly 60% of road transport is provided through own road transport.

TABLE 2: ECONOMIC CONTRIBUTION OF THE VARIOUS TRANSPORT MODES AT CURRENT PRICES

Transport Mode	Production/Turnover 2002 N$ million	Percentage composition	GDP 2002 N$ million	Percentage composition
Road Commercial	471	16.4%	226	20.2%
Minibus Taxi	232	8.1%	111	9.9%
Own Road Transport	1 349	47.0%	647	57.8%
Total Road Transport	2 052	71.5%	984	87.9%
Rail	212	7.4%	102	9.2%
Air	419	14.6%	23	2.0%
Sea	114	4.0%	6	0.5%
Other	73	2.5%	4	0.4%
Total	2 870	100%	1 119	100%

Source: 1) GDP: Quarterly Bulletin of the Bank of Namibia.
2) Contribution of sub-sectors, with regard to GDP & Production/Turnover are derived from the structure of the Namibian SAM for 1998.

For the detailed analysis of the role and interaction of the road transport sector in the economy of Namibia, a partial general equilibrium analysis for Namibia has been used. The Social Accounting Matrix (SAM) for Namibia was applied

for this purpose. The methodology of this analysis is explained below. This will be followed by a section on the dependency of stakeholders on road transport and finally measuring the macro-economic impact of road user charges by simulating some RUC regimes in the Namibian economy.

3.3 Methodology

It is important to note that a single and seemingly simple modification in an economy – for instance the increase in liquid fuel prices – will trigger complex ripple effects throughout all of the transactions that together make up 'an economy'. These interactions are captured in a SAM (or its close cousin, an input-output model). This explains why the SAM can be used in the analysis of the macro-economic impacts (i.e. the ripple effects) of price changes in the road transport sector.

3.3.1 Social Accounting Matrix (SAM) as an Analytical Tool

In June 2001, the National Accounts of Namibia were incorporated into a coherent economic modelling structure called the Social Accounting Matrix (SAM)[2)]. This model is available from the National Accounts Sub-Division of the Central Bureau of Statistics (CBS) in the Office of the National Planning Commission in Windhoek (an electronic version of the SAM accompanies this document).

The SAM is a matrix depicting the economic linkages that exist between all of the different role players in the economy i.e. business sectors, households, the government and the rest of the world. It is very similar to an Input/Output Table in the sense that it reflects all of the inter-sectoral linkages that are present in an economy. The SAM, however, also provides a framework within the context of the National Accounts in which the activities of households are accentuated and distinguished more prominently. Households are important economic role players because this is where significant decisions are made regarding economic variables such as, *inter alia*, expenditure and savings. By disaggregating the households sector into meaningful income groups, the SAM makes it possible to clearly delineate the interrelationships of the different income groups with the other economic role players and determine how these interrelationships affect their economic position.

Thus, the SAM serves a dual purpose in economic analysis. Firstly, it reflects the magnitude and linkages of all of the major stakeholders in an economy, and secondly, it is a powerful analytical tool that can be used to simulate various kinds of economic policy scenarios. Both of these qualities of the SAM will be utilized in this study.

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2) The Natural Resource Accounting Programme of Southern Africa (Funded by the USAID Regional Centre for Southern Africa) Pilot Social Accounting Matrix for Namibia, Conningarth Economists, June 2001.

3.3.2 Modifying the SAM

Due to the size of "own road transport" activity, some further modification of the SAM from its standard format was necessary in order to reflect the usage of own road transport in production activities and as a cost component of goods and services for final demand. The original SAM incorporates own road transport for each economic sector and final demand component by way of detailed expenditure on road transport cost items such as fuel, tyres, etc. and not as total expenditure on own road transport *per se*. The sub-sector 'own road transport' is not a normal feature of a SAM. However, to obtain a comprehensive view of road transport and its effects in the Namibian economy, it was necessary to introduce this sub-sector into this SAM.

3.3.2.1 Introducing the provision of own (internal) road transport into the SAM structure

The input costs of commercial road transport and mini-bus taxi's into the economic system can be directly calculated from the existing SAM structure. The cost of own road transport in relation to the value of production as well as final demand, however, had to be estimated. Own road transport expenditure/costs were derived by using expenditure on petroleum products as a proxy for the reliance on road transport by the different sectors or final user. The ratio of expenditure on fuel as a percentage of total vehicle running costs as determined by the Automobile Association (AA) was used to estimate expenditure on internal/own road transport services by sectors or final users (See Table 2a). A new activity "Own Road Transport", was created for this purpose.

TABLE 2A: FUEL DEPENDENCY COEFFICIENT

	Cars petrol							Heavy duty diesel
Size	**1300 cc**	**1500 cc**	**1800 cc**	**2000 cc**	**2500 cc**	**3000 cc**	**4000 cc**	**+ 3000 cc**
Coefficient	**0.615**	**0.608**	**0.547**	**0.546**	**0.512**	**0.478**	**0.432**	**0.507**

3.3.2.2 Determining the road transport component as part of the export value of goods and services

The value of exports (fob) contains a road transport cost element. The cost of transporting a commodity to the point of exit for export (i.e. a harbour or airport) is carried by the local (domestic) producer. This is usually referred to as a road transport margin that forms part of the fob price of an exported good or service. By using road transport margin coefficients, calculated from the SAM for each sector (i.e. transport input costs as a percentage of production

value) the road transport costs that form part of the exports per sector were determined.

3.3.3 Measuring the direct and indirect impact of road transport costs on the economy

For any sector to produce, inputs of various kinds are required from other sectors in the economy. These dynamic interrelationships set in motion different rounds of interactive processes that are technically referred to as the multiplier effect.

3.3.3.1 Direct effects

The first round effect is referred to as the direct effect and can be derived from the technical input coefficients which represent the magnitude of the direct first round input from supply sectors such as road transport. In view of the fact that these input coefficients add up to one, as a particular sector increases its production by one N$ unit, the supplying sector's outputs would be impacted upon in direct relation to the size of the input coefficients.

3.3.3.2 Indirect Effects

The effect of a change in demand (for a product of a specific sector), not only consists of a direct production impact on supplying sectors but also includes an indirect (secondary) production effect. This is brought about by first round impacts on supplying sectors. For a supplying sector to increase its production, it likewise needs suppliers from other sectors, and so the iteration or multiplier effect carries on through the economy for a long period of time.

In order to capture the successive impact rounds described above, use is made of the so-called Leontief inverse matrix. This matrix is obtained by determining the mathematical inverse of the direct input coefficient matrix. It has been proved theoretically that the Leontief inverse coefficients reflect not only the direct impact, but also the secondary or indirect production effects of a change in demand for the products of a specific sector. Each Leontief inverse coefficient indicates the production required directly and indirectly from each sector to satisfy an output/final-demand increase of one N$.

The above discussion can be simplified by a detailed example. Assume a loaf of bread costs N$1. To manufacture a loaf of bread requires the following inputs:

	N$
Flour	0.30
Electricity	0.15
Labour	0.25
Other	0.20
	1.00

If the demand for bread increases by one loaf because one additional tourist visits Namibia, the demand for flour will increase by 30c, that for electricity by 15c, and so on. This is the direct multiplier effect.

To produce the additional 30c worth of flour requires additional inputs of wheat, which for its production in turn requires inputs of farm equipment, diesel, etc. The farm equipment and diesel in turn require additional inputs for their own production. This long chain of events is called the indirect multiplier effect.

Finally, labour is used throughout the production chain, and rewarded with wages. When these wages are spent, yet another ripple effect of spending is triggered, this time known as the induced multiplier effect.

By manipulating the national accounts of Namibia mathematically as described earlier, the use of the SAM can determine all the multiplier effects.

3.3.3.3 A further application of multiplier analysis

The inverse matrix can be used to determine the impact of price changes or cost effects on the economy, for instance the impact of a change in road user cost on the cost of producing a product.

Assume that a household buys a loaf of bread each day from a supermarket. If the cost of transport increases as a result, say, of a rise in the price of liquid fuels, how would this affect the price of the bread? Firstly, the cost of transporting across the entire supply chain increases - from the farmer to the miller, to the baker, to the supermarket - including the cost of transporting inputs to the farmer (i.e. fertilisers, pesticides, seed, etc.). Secondly, the supermarket, the baker, the miller, the farmer and business that supply inputs to the farmer all employ labourers. These labourers use transport and consequently, the labourers may demand wage increases to compensate for their increased cost of transport – assuming that taxis and busses increase their fees.

The end result is that there are numerous routes by which an increase in the price of liquid fuels will increase transport costs that may impact on the cost of the loaf of bread. The extent to which it does impact will depend on the elasticities of demand that are found within each transaction that has been described.

3.4 Economic Stakeholders' Dependency on Road Transport

Road transport effects the production process and final demand by various ways and from different angles. This section will enlighten the role of road transport in further detail and how certain RUCs impact on different stakeholders. For this purpose the SAM for Namibia will again be utilized.

3.4.1 The most sensitive sectors to road transport costs

Table 3 ranks the ten sectors that are most sensitive to road transport (directly and indirectly). Sensitivity is defined as the ratio of the costs of road transport (direct and indirect) to total cost in the production process of a sector and not the nominal (absolute) amount directly spent on road transport by that sector. Any developments in the road transport sector, whether exogenous or endogenous, will affect the production of these sectors the most because of their high road transport dependency ratio. The bigger the relative direct dependency (see Table 3), the more likely the activity will be affected in the short run. The bigger the indirect effect (see Chart 2), the longer it will take for the sector to be affected. From Table 3 the sector that will be affected the most over the short-term is civil engineering (6,4% of costs) followed by commercial road transport itself due to the use of sub-contracting of commercial road transport (intra-transactions). More comprehensive data on road transport dependency ratios per sector can be obtained from Annexure A.

TABLE 3: SECTOR DEPENDENCY ON ROAD TRANSPORT

SECTOR	TOTAL	DIRECT	INDIRECT
Non-metallic minerals	19.8%	3.0%	16.8%
Informal business & social services	18.1%	4.0%	14.2%
Civil engineering	14.8%	6.4%	8.4%
Informal Trade	14.3%	2.6%	11.7%
Postal services	14.3%	3.2%	11.1%
Business services	14.2%	1.8%	12.4%
Basic metal products	14.2%	2.1%	12.1%
Chemicals (incl. petroleum)	14.1%	3.8%	10.3%
Commercial road transport	14.0%	5.2%	8.8%
Financial services	12.9%	1.3%	11.6%
Commercial trade	12.6%	1.9%	10.8%

Source: Annexure A

In Table 3a the main categories of household consumption's road transport dependency, are grouped, namely, food, clothing, housing and other. These categories form the basis of household consumption. The extent to which the different income groups are consuming these products will determine the impact

of a change in road transport costs on the inflationary effect the income groups will experience.

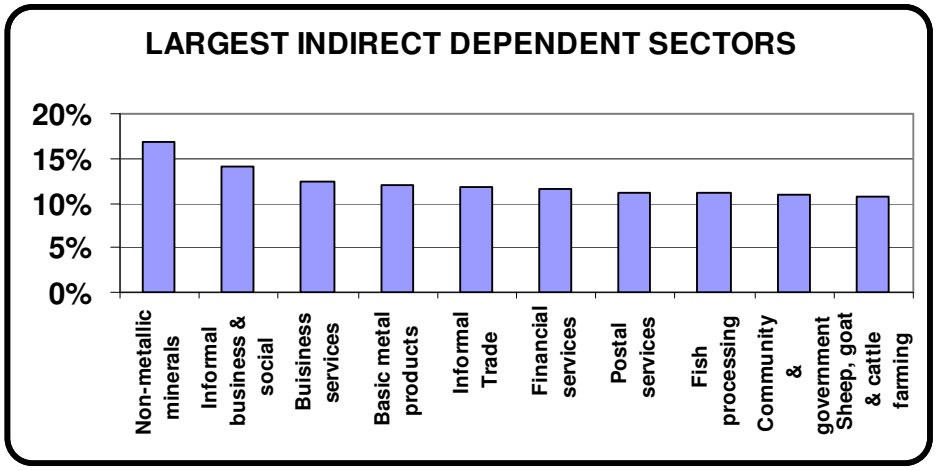
TABLE 3A: HOUSEHOLD CONSUMPTION CATEGORIES DEPENDENCY ON ROAD TRANSPORT

Consumption categories	Road Transport Dependency
Food	10.3 %
Clothing	11.6 %
Housing[1)]	12.9 %
Other	12.8 %
TOTAL	12.2 %

1) Housing also includes other Financial and Property services.

Chart 2 below reflects the knock-on effects that find their way into the cost of production through the multiplier processes. Usually these impacts do not occur immediately and only come about through the interactive production processes in the economy as described earlier.

CHART 2:



Source: Annexure A

3.4.2 The largest users of road transport for production purposes

In Table 4 the sectors that spend the most on road transport services (absolute value) are identified and the table also ranks the ten sectors that are the largest users of road transport in Namibia. It implies that policy decisions will impact the most on these sectors in magnitude or absolute N$ terms. The production processes of these sectors may, however, not be as sensitive to changes in road transport costs than that of the sectors mentioned in the previous section. Table

4 indicates that business services and commercial trade are the largest users of road transport.

TABLE 4: TEN LARGEST USERS OF ROAD TRANSPORT

SECTOR	% OF TOTAL DEMAND FOR ROAD TRANSPORT
Business services	11.0%
Trade commercial	9.5%
Community & government services	8.6%
Diamond mining	6.7%
Fish processing	6.6%
Fisheries	4.6%
Financial services	4.2%
Civil engineering	3.8%
Building construction	3.8%
Other mining and quarrying	3.3%

Source: Conningarth – Namibia SAM

3.4.3 Road transport in the exports process

The value of most goods exported contains a road transport cost element in order to deliver the goods at the point of export. This export delivery cost is for the account of the sector that produces these exports. As can be seen in Annexure A, non-metallic minerals (7,4%), basic metals (4,8%) and chemicals (3,4%) – goods with low value but high volume - carry the largest road transport cost from the factory gate to the export point.

3.4.4 Dependency on road transport by final users

It is important to determine the extent to which road transport is an element of final demand in order to gain a proper perspective on the possible impact that policy decisions and/or other exogenous developments (for example, an increase in the crude oil price) may have on expenditure patterns and household demand. Three categories of road transport that forms part of final use, namely, expenditure on own road transport, expenditure on commercial road transport and expenditure on minibus taxis have been distinguished for the purpose of this analysis.

3.4.4.1 Consumer dependency

For purposes of constructing the Namibian SAM, households were disaggregated into seven income categories (see Table 5 for details on income groups). The more affluent income groups are the largest road transport users. There is a major difference amongst the various income group in terms of road

transport usage. It varies from about 12% of expenditure for low income groups to 25% for high income groups.

TABLE 5: ROAD TRANSPORT USED BY HOUSEHOLDS

INCOME GROUP (percentile)	2002 AVERAGE INCOME PER ANNUM N$	ROAD TRANSPORT EXPENDITURE AS % OF TOTAL EXPENDITURE	DIRECT	INDIRECT
PCI < P25	9,400	11.7%	5.9%	5.8%
P25 < = PCI < P50	14,100	11.1%	4.8%	6.3%
P50 < = PCI < P75	24,600	17.5%	11.5%	6.0%
P75 < = PCI < P90	54,900	19.0%	13.0%	6.0%
P90 < = PCI < P95	118,000	20.7%	13.1%	7.6%
P95 < = PCI < P99	229,000	22.9%	15.3%	7.6%
PCI > = P99	460,000	25.0%	17.2%	7.8%
Average per household	39,920	15.2%	9.0%	6.2%

Source: Annexure B; Conningarth – Namibia SAM

CHART 3: ROADS TRANSPORT USAGE BY HOUSEHOLDS

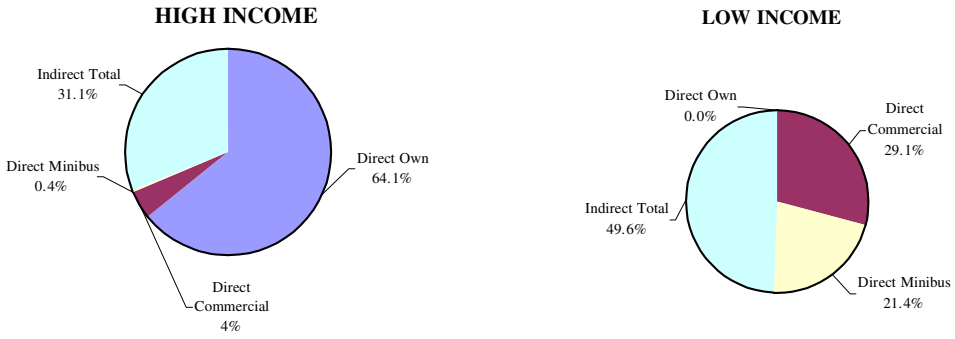


Chart 3 reflects the importance of the different modes of road transport that are utilized by households. The higher income groups spend the larger part on own road transport (64.1%) whereas the low income groups are very dependent on commercial road (29.1%) and minibus transport (21.4%). The low income groups are relatively more susceptible to the impact of indirect road transport as

a result of their consumption patterns (about 50%) that includes a high road transport content (input).

3.4.4.2 Government dependency

A relatively significant proportion of government spending is on road transport. A large portion of this spending, however, is indirect – i.e. the road transport content of goods and services purchased by government (see Table 6). The functions of public order and safety, and economic services, are the most sensitive to changes in road financing scenarios. (See Annexure B for details).

TABLE 6: GOVERNMENT ROAD TRANSPORT USE

GOVERNMENT FUNCTION	TOTAL	DIRECT	INDIRECT
General public services	15.5%	3.6%	11.9%
Public order and safety	21.7%	6.3%	15.4%
Education	17.6%	1.5%	16.1%
Health	13.1%	1.2%	12.2%
Social & community services	14.4%	5.1%	9.3%
Economic services	22.4%	9.1%	13.3%
Local government	17.6%	9.8%	7.8%
Total Government	17.8%	4.4%	13.4%

Source: Annexure B

3.4.5 Export dependency on road transport

The value of exported goods and services contains an average 5.8 % road transport costs (see Annexure B). This percentage is not as high as might have been expected. This is mainly due to the fact that rail, and not road transport, is mainly used in the transport of mineral commodities – minerals are an important element of Namibia's exports.

It should be noted that exports also include tourist spending. However, tourists spend only a small amount of their total expenditure on road transport, mainly on rental cars and tour buses.

3.5 Macro-economic impact of Road User Charge Instruments – Three Case Studies

3.5.1 Introduction

The modified SAM described in a previous section provides a framework within which the impact of different road transport financing scenarios on the

economy can be simulated. For purposes of illustration three scenarios are presented here, namely a 10% fuel price increase, an overall 10 % hike in road transport costs and mass-distance charges on heavy-duty vehicles. In all scenarios the impact will be viewed from two perspectives namely, (i) road transport costs in the production process and (ii) road transport as an inflationary element of goods and services for final use. Scenario results for the 10% fuel price increase and an overall 10% in road transport costs are listed in Tables 7, 8 and 9, and discussed later.

TABLE 7:

COST IMPACT OF RISE IN ROAD TRANSPORT COSTS				
SECTOR	10% FUEL PRICE INCREASE		10% TOTAL COST INCREASE	
	COST INCREASE	% EFFECT ON PROFIT	COST INCREASE	% EFFECT ON PROFIT
	(1)	(2)	(3)	(4)
Irrigated crop farming	0.349%	1.02%	0.96%	2.80%
Rainfed crop farming	0.357%	1.04%	1.11%	3.23%
Cattle farming	0.320%	1.24%	0.98%	3.82%
Sheep, goat & pig farming	0.337%	1.31%	1.15%	4.47%
Game farming	0.325%	1.22%	0.95%	3.57%
Ostrich farming	0.352%	1.32%	1.14%	4.29%
Other commercial farming	0.354%	1.33%	1.21%	4.53%
Communal crop farming	0.226%	0.63%	0.90%	2.50%
Communal livestock farming	0.224%	0.62%	0.84%	2.33%
Communal poultry farming	0.224%	0.62%	0.92%	2.56%
Other communal farming	0.224%	0.62%	0.85%	2.35%
Fisheries	0.335%	1.31%	0.93%	3.64%
Forestry	0.332%	1.14%	1.09%	3.76%
Diamond mining	0.359%	1.50%	0.99%	4.15%
Other mining & quarrying	0.380%	1.59%	1.18%	4.92%
Meat processing	0.281%	5.57%	0.92%	18.27%
Fish processing	0.370%	2.04%	1.11%	6.13%
Grain milling	0.316%	1.79%	1.12%	6.33%
Other food processing	0.336%	1.92%	1.05%	6.01%
Beverages & tobacco	0.316%	1.79%	1.00%	5.64%
Textiles, clothing & leather	0.359%	2.12%	1.16%	6.86%
Wood, paper & wooden furniture	0.390%	2.48%	1.25%	7.94%
Chemicals	0.355%	3.21%	1.41%	12.74%
Non-metallic minerals	0.503%	2.38%	1.98%	9.37%
Basic metal products	0.376%	2.02%	1.42%	7.61%
Metal products, machinery & transport equipment	0.336%	2.36%	1.02%	7.21%
Jewelry	0.264%	3.08%	0.71%	8.30%
Other commercial manufacturing	0.343%	1.84%	0.94%	5.04%
Micro-industry & handcraft	0.285%	3.74%	0.79%	10.33%
Electricity	0.368%	1.48%	0.95%	3.84%
Water	0.336%	1.46%	0.86%	3.75%
Building construction	0.300%	2.62%	1.10%	9.64%
Civil engineering	0.366%	3.20%	1.48%	12.92%
Construction informal	0.260%	3.89%	0.88%	13.16%
Trade commercial	0.440%	1.72%	1.26%	4.94%
Trade informal	0.459%	2.51%	1.43%	7.85%
Accommodation & catering	0.298%	1.55%	0.88%	4.58%
Transport rail	0.350%	1.64%	0.93%	4.34%
Transport air	0.235%	1.32%	0.67%	27.37%
Other transport	0.362%	1.50%	1.11%	45.15%
Postal services	0.475%	2.14%	1.43%	6.44%
Telecommunication	0.416%	1.36%	1.12%	3.66%
Financial services	0.474%	1.66%	1.29%	4.52%
Business services	0.506%	1.78%	1.42%	5.00%
Community & government services	0.431%	2.62%	1.21%	7.32%
Informal business & social services	0.540%	3.28%	1.81%	11.02%
Domestic services	1.456%	19.07%	5.56%	72.79%
Average	0.38%	2.02%	1.14%	6.48%

Source: Simulation results using Namibia SAM.

TABLE 8: HOUSEHOLD INFLATION DUE TO RISE IN ROAD TRANSPORT COSTS

INCOME GROUP (percentile)	10% FUEL PRICE INCREASE	10% TOTAL COST INCREASE
PCI < P25	0.6%	1.2%
P25 < = PCI < P50	0.6%	1.1%
P50 < = PCI < P75	0.9%	1.7%
P75 < = PCI < P90	1.0%	1.9%
P90 < = PCI < P95	1.1%	2.1%
P95 < = PCI < P99	1.1%	2.3%
PCI > = P99	1.1%	2.5%
TOTAL CONSUMER INFLATION	0.8 %	1.5 %

Source: Simulation results using Namibia SAM.

TABLE 9: GOVERNMENT INFLATION DUE TO RISE IN ROAD TRANSPORT COSTS

SERVICE	10% FUEL PRICE INCREASE	10% TOTAL COST INCREASE
Economic services	1.1%	2.2%
Public order and safety	1.1%	2.2%
Local government	0.9%	1.8%
Education	0.9%	1.8%
General public services	0.8%	1.5%
Social & community services	0.7%	1.4%
Health	0.7%	1.3%
Total Government Inflation	0.9 %	1.8 %

Source: Simulation results using Namibia SAM

3.5.2 Scenario I: Ten per cent fuel price increase

In this scenario, the fuel price as a cost component of road transport is increased by 10 %. The impact on the production cost of sectors and prices of products for final users will depend on the type of road transport used and road transport's reliance on fuel.

3.5.2.1 Sector inflation

Table 7 reflects the impact on production costs for the different sectors. All sectors will experience a cost increase as a result of the fuel price rise. This is due to the fact that all sectors make use of road transport directly and

indirectly and that road transport use fuel as an integral part of its production inputs. Column 1 in Table 7 reflects the percentage cost (inflation) that each sector will experience due to a 10 % fuel price rise. The meat processing sector will for instance experience total input costs rising by 0.28%. The impact on total cost for the sectors varies from a high 1.456% for domestic services to a low of 0.224% for communal livestock farming. In practice these figures can for instance be interpreted as follows: if there is a fuel price hike of 10%, the communal livestock farming sector's total cost increase of say 8% (before fuel price hike) over a year will now become 8.224% if the effect of the fuel levy is added.

The cost increases shown in column 1 are valid under the assumption that business will try to keep profit intact and pass on external cost pressures. It can also be argued that business may not be in a position to pass the cost increase onto its clients which implies that business will have to absorb the costs with detrimental effect on profit. Column 2 of Table 7 depicts the impact on total profit. The most important conclusion is the significant impact a 10% fuel price rise can have on profit. For instance 'profits' of domestic services, which are viewed as a sector in the Namibian SAM, could experience a serious decline of about 20%.

Producer Inflation as measured by the producer price index (PPI) will increase by 0.38 percentage points.

3.5.2.2 Household inflation

Table 8 presents the effects on costs for households. For the lowest income group (PCI<P25), a 10 % fuel price increase will imply that either the group will experience an overall 0.6% increase in prices of goods and services or the group will have to rearrange their expenditure pattern to accommodate the fuel price rise and its impact on their disposable income. The impact will be more severe on the high income groups (1.1% increase in prices). This captures the direct and indirect usage of road transport. The indirect impact comes about through the purchasing of goods and services according to its road transport content.

Consumer inflation as measured by the consumer price index (CPI) will increase by 0.8 percentage points.

3.5.2.3 Government inflation

Table 9 indicates the effects on the various government functions. The most affected government services will be economic services and public order and safety. It may mean that the budget will have to be adjusted to accommodate the extra costs. It may also imply that the government will not be able to deliver the service efficiently.

A 10% fuel price increase implies that the budget for economic services for instance must increase by 1.1% in order to deliver the services at the same standard. From Annexure B it can be seen that a large part of the inflationary effect comes about through indirect means, i.e. the road transport content of goods and services purchased in order to deliver the function. Of the total road transport dependency of 22.3% to deliver for instance economic services, about half the impact (13.3%) is through the goods and services purchases as inputs.

Government Costs in total will increase by 0.9 %.

3.5.3 Scenario II: Ten percent increase in overall transport cost

In this scenario total road transport cost is assumed to increase by 10 %. The impact is therefore not only determined by the fuel cost component of road transport as in the previous simulation, but by the increase of total road transport cost.

3.5.3.1 Sector inflation

Table 7 presents the impact of the higher production costs of this scenario on the various sub-sectors of the Namibian economy. As can be expected, the increase in costs of all the sectors will be much larger than in the fuel price rise scenario. In this case not only the fuel cost element has increased by 10%, but total cost of road transport have increase by 10%. The impact on the total cost is on average more than 1%.

If it is further assumed that the increased road transport cost will not be passed on but absorbed as higher costs, profits could be severely affected. See Column 4 for various sector impacts.

Producer inflation will increase by 1.14 percentage points.

3.5.3.2 Household inflation

Table 8 shows the effects on income groups while Table 9 reflects the impact of the cost increases on government services as a result of a 10% increase in total road transport costs. The impact of a 10 % increase in total road transport cost are much greater than that of only a fuel price increase. Higher income groups are again relatively more affected than lower income groups and to a large extent reflect higher reliance on own road transport by the high income groups.

Consumer inflation will increase by 1.5 percentage points.

3.5.3.3 Government inflation

The effect of the cost increase on government functions is more or less double that of a fuel price increase while the inflationary consequences on the government budget should result in bigger appropriations per function.

Government costs will rise by some 1.8 %.

3.5.4 Scenario III: Mass Distance Charges (MDCs)

3.5.4.1 Introduction:

Heavy-duty road transport is seen to inflict more road damage (usage) than lighter road traffic. A levy covering actual cost to roads by heavy-duty traffic can be instituted to recover these costs. Mass-Distance Charges (MDCs) are regarded as an avenue whereby the "cross-subsidization" sourced from lighter road traffic can be recovered from the heavy duty road users that is responsible for the biggest "usage" of the road infrastructure.

MDCs vary directly with road use - similar to a general fuel levy (the longer the distances travelled and the heavier the load, the more fuel is used). Apart from the distance travelled, MDCs should also attempt to cover the weight of heavy-duty vehicles on roads in order to recover the variable road usage costs associated with heavy-duty road traffic.

In this section, a scenario will be developed whereby the impact of the introduction of MDCs will be analysed. For purposes of comparison, the objective of MDCs will be to generate the same revenue as a 10% general road fuel levy. To introduce the MDCs with the same revenue effect as a 10% fuel levy, the cost of fuel for heavy-duty road transport should increase by about 40%. The use of a heavy-duty road transport fuel levy would probably be the best way to practically administer the MDCs.

3.5.4.2 Methodology:

A similar methodology that was used to analyse the impact of a general fuel levy will be used in calculating the impact of MDCs. The only difference is that a distinction had to be made with regard to the road transport sector's use of heavy-duty and light vehicles. In practice, it implies determining the usage of heavy and light road transport vehicles by a sector or final user. A further modification to the input and final demand structure for the road transport sector of the SAM was therefore necessary in order to capture the use of heavy-duty road transport in the economy.

Firstly, information on the direct use of own heavy-duty road transport and heavy-duty commercial road transport in the production process (intermediary input) was gathered from Transportek (Transportek: 2001) and is reflected in Table 10 and Table 11, respectively. According to Table 10, where own road

transport was split, the agricultural sector for instance uses 22% light and 78% heavy-duty vehicles. Table 11, which gives the division of commercial road transport, indicates that irrigated crop farming for instance uses 10% and 90% light and heavy-duty vehicles, respectively.

Table 10:

OWN ROAD TRANSPORT SPLIT		
SECTOR	**ROAD TRANSPORT TYPE**	
	Light %	Heavy %
Agricultural sector	22%	78%
Fisheries	14%	86%
Forestry	66%	34%
Diamond mining	7%	93%
Other mining & quarrying	19%	81%
Meat processing	69%	31%
Fish processing	69%	31%
Grain milling	72%	28%
Other food processing	69%	31%
Beverages & tobacco	69%	31%
Textiles, clothing & leather	69%	31%
Wood, paper & wooden furniture	66%	34%
Chemicals	72%	28%
Non-metallic minerals	68%	32%
Basic metal products	27%	73%
Metal products, machinery & transport equipment	70%	30%
Jewelry	95%	5%
Other commercial manufacturing	60%	40%
Micro-industry & handcraft	95%	5%
Electricity	100%	0%
Water	100%	0%
Building constuction	44%	56%
Civil engineering	39%	61%
Construction informal	95%	5%
Trade commercial	97%	3%
Trade informal	98%	2%
Accommodation & catering	81%	19%
Transport road own	90%	10%
Transport road commercial	18%	82%
Transport minibus taxis	100%	0%
Transport rail	0%	0%
Transport air	94%	6%
Transport sea	78%	22%
Other transport	98%	2%
Postal services	95%	5%
Telecommunication	98%	2%
Financial services	98%	2%
Business services	98%	2%
Community & government services	95%	5%
Informal business & sicial services	95%	5%
Domestic services	100%	0%

Source: Transportek

Table 11:

COMMERCIAL ROAD TRANSPORT SPLIT		
SECTOR	**ROAD TRANSPORT TYPE**	
	Light %	Heavy %
Irrigated crop farming	10%	90%
Rainfed crop farming	16%	84%
Cattle farming	52%	48%
Sheep, goat & pig farming	70%	30%
Game farming	50%	50%
Ostrich farming	36%	64%
Other commercial farming	33%	67%
Communal crop farming	95%	5%
Communal livestock farming	95%	5%
Communal poultry farming	95%	5%
Other communal farming	95%	5%
Fisheries	60%	40%
Forestry	33%	67%
Diamond mining	7%	93%
Other mining & quarrying	7%	93%
Meat processing	60%	40%
Fish processing	60%	40%
Grain milling	60%	40%
Other food processing	60%	40%
Beverages & tobacco	20%	80%
Textiles, clothing & leather	80%	20%
Wood, paper & wooden furniture	17%	83%
Chemicals	45%	55%
Non-metallic minerals	12%	88%
Basic metal products	12%	88%
Metal products, machinery & transport equipment	27%	73%
Jewelry	95%	5%
Other commercial manufacturing	12%	88%
Micro-industry & handcraft	95%	5%
Electricity	0%	0%
Water	0%	0%
Building constuction	20%	80%
Civil engineering	20%	80%
Construction informal	95%	5%
Trade commercial	20%	80%
Trade informal	95%	5%
Accommodation & catering	90%	10%
Transport road own	100%	0%
Transport road commercial	50%	50%
Transport minibus taxis	100%	0%
Transport rail	100%	0%
Transport air	100%	0%
Transport sea	100%	0%
Other transport	100%	0%
Postal services	95%	5%
Telecommunication	95%	5%
Financial services	100%	0%
Business services	100%	0%
Community & government services	100%	0%
Informal business & sicial services	100%	0%
Domestic services	100%	0%

Source: Transportek

Secondly, the use of heavy-duty road transport in final demand was assumed to be the following:

- households utilise no heavy duty own road transport;
- 95% of commercial road transport used by households is heavy- duty vehicles; and
- minibus taxis are regarded as light vehicles.

Thirdly, it is assumed that government does not use heavy-duty own road transport, but utilizes 95% heavy-duty transport when commercial road transport is applied.

These direct heavy-duty road transport usage coefficients (ratios) for the sectors and final demand aggregates were applied in order to adjust the original road transport technical coefficients as reflected in the Namibia SAM (Conningarth Economists: 2001). See Annexures C and D for detailed adjusted coefficients.

3.5.4.3 Impact of MDCs

As is the case with the other road financing scenarios, the impact of MDCs was determined from the cost structure of the various sectors (sector inflation) as well as the inflationary effects on households and government. The impact on the net profits was also calculated, assuming that the sectors are not in a position to pass on the inflationary effect to their clients and therefore have to absorb the higher costs, with a resultant decline in the net profit of sectors.

3.5.4.4 Sector inflation

In Table 12 the inflationary impact of MDCs of 40% on heavy-duty road fuel (probably only diesel) is reflected. It must again be emphasized that this impact constitutes the direct and indirect effect of using heavy-duty vehicles which are subject to MDCs.

The civil engineering and the building industry will be the most effected by the introduction of MDCs. Both these industries use a large proportion of heavy-duty commercial road transport directly, while a substantial part of other inputs (indirectly) contain a large heavy-duty road transport content .

From Table 12, the impact on net profits can also be deduced. Although the impact on cost is not that high, net profits are relatively more affected.

Producer inflation will increase by 0.47 % if MDCs are introduced.

TABLE 12

COST IMPACT OF MASS-DISTANCE CHARGES		
SECTOR	**COST INCREASE**	**% EFFECT ON PROFIT**
	(1)	**(2)**
Irrigated crop farming	**0.43%**	**1.25%**
Rainfed crop farming	**0.73%**	**2.14%**
Cattle farming	**0.40%**	**1.54%**
Sheep, goat & pig farming	**0.38%**	**1.49%**
Game farming	**0.36%**	**1.34%**
Ostrich farming	**0.39%**	**1.48%**
Other commercial farming	**0.40%**	**1.52%**
Communal crop farming	**0.54%**	**1.49%**
Communal livestock farming	**0.53%**	**1.47%**
Communal poultry farming	**0.52%**	**1.45%**
Other communal farming	**0.53%**	**1.47%**
Fisheries	**0.41%**	**1.60%**
Forestry	**0.68%**	**2.34%**
Diamond mining	**0.59%**	**2.45%**
Other mining & quarrying	**0.57%**	**2.38%**
Meat processing	**0.37%**	**7.37%**
Fish processing	**0.37%**	**2.03%**
Grain milling	**0.54%**	**3.08%**
Other food processing	**0.44%**	**2.53%**
Beverages & tobacco	**0.60%**	**3.39%**
Textiles, clothing & leather	**0.38%**	**2.24%**
Wood, paper & wooden furniture	**0.70%**	**4.45%**
Chemicals	**0.48%**	**4.36%**
Non-metallic minerals	**0.60%**	**2.85%**
Basic metal products	**0.49%**	**2.64%**
Metal products, machinery & transport equipment	**0.46%**	**3.22%**
Jewelry	**0.31%**	**3.59%**
Other commercial manufacturing	**0.42%**	**2.23%**
Micro-industry & handcraft	**0.24%**	**3.17%**
Electricity	**0.33%**	**1.33%**
Water	**0.28%**	**1.20%**
Building construction	**0.97%**	**8.47%**
Civil engineering	**1.41%**	**12.29%**
Construction informal	**0.26%**	**3.87%**
Trade commercial	**0.56%**	**2.18%**
Trade informal	**0.43%**	**2.35%**
Accommodation & catering	**0.30%**	**1.57%**
Transport rail	**0.33%**	**1.54%**
Transport air	**0.26%**	**1.05%**
Transport sea	**0.28%**	**1.15%**
Postal services	**0.42%**	**1.91%**
Telecommunication	**0.38%**	**1.26%**
Financial services	**0.36%**	**1.25%**
Business services	**0.35%**	**1.21%**
Community & government services	**0.41%**	**2.49%**
Informal business & social services	**0.40%**	**2.41%**
Domestic services	**0.24%**	**3.17%**
Average	**0.47%**	**2.75%**

3.5.4.5 Household and government inflation

Household inflation is reflected in Table 13. It is evident that the impact varies considerably across the income groups. The lowest income group's inflationary impact (0.95%) is more than double that of the highest income group (0.37%). MDCs mostly have an indirect impact on households via the products consumed by households (see Annexure D). The lower income groups spend a greater proportion of their income on basic consumer goods than the more affluent groups. This has the effect that the lower income groups, whose dependency on heavy-duty transport is much higher, bear a larger MDCs burden.

Table 13:

IMPACT OF MASS DISTANCE CHARGES ON HOUSEHOLD INFLATION	
INCOME GROUP (percentile)	**MDCs**
PCI <P25	0.95%
P25<= PCI <P50	0.74%
P50<= PCI <P75	0.70%
P75<= PCI <P90	0.86%
P90<= PCI <P95	0.58%
P95<= PCI <P99	0.43%
PCI >=P99	0.37%

Consumer inflation will increase by 0.79 percentage points.

Table 14 provides information on the inflationary impact of MDCs on government costs.

Table 14:

IMPACT OF MASS DISTANCE CHARGES ON GOVERNMENT COSTS	
SERVICE	**MDCs**
Economic services	1.22%
Public order and safety	0.81%
Social & community services	0.73%
General public services	0.71%
Education	0.63%
Health	0.56%
Local government	0.50%

Total Government cost will increase by 0.65 %.

3.5.5 MDCs and Fuel levy compared

From Table 15 it is evident that the impact on the costs of the various sectors differs markedly if MDCs rather than a general fuel levy are instituted. Inflation caused by MDCs for domestic services (rank 47) is the most affected of all the sectors, but if a general fuel levy is applied, inflation is the second least for domestic services (rank 2). Domestic services, business services and building construction have shifted the most positions in ranking when replacing the fuel levy by MDCs. The jewellery sector seems to be insensitive to either of the two road financing methods as it only shifted one place in the rankings.

Table 15:

RANKING OF THE INFLATIONARY IMPACT ON SECTORS		
SECTOR	**GENERAL FUEL LEVY**	**MDCs**
Domestic services	2	47
Informal business & social services	20	46
Business services	11	45
Non-metallic minerals	42	44
Postal services	26	43
Financial services	12	42
Trade informal	27	41
Trade commercial	38	40
Community & government services	24	39
Telecommunication	18	38
Wood, paper & wooden furniture	44	37
Other mining & quarrying	39	36
Basic metal products	32	35
Fish processing	14	34
Electricity	10	33
Civil engineering	47	32
Diamond mining	40	31
Textiles, clothing & leather	16	30
Rainfed crop farming	45	29
Chemicals	31	28
Other commercial farming	22	27
Ostrich farming	19	26
Transport rail	9	25
Irrigated crop farming	28	24
Other commercial manufacturing	25	23
Sheep, goat & pig farming	17	22
Water	5	21
Other food processing	29	20
Metal products, machinery & transport equipment	30	19
Fisheries	23	18
Forestry	43	17
Game farming	13	16
Cattle farming	21	15
Beverages & tobacco	41	14
Grain milling	37	13
Building construction	46	12
Accommodation & catering	7	11
Transport sea	6	10
Micro-industry & handcraft	1	9
Meat processing	15	8
Jewelry	8	7
Construction informal	4	6
Transport air	3	5
Communal crop farming	36	4
Other communal farming	35	3
Communal poultry farming	33	2
Communal livestock farming	34	1

The relative importance of the impact of MDCs in relation to the fuel levy with regard to households has changed substantially, as is evident from Table 16. A general fuel levy has a more profound impact on the rich than the poor (PCI<P25 ranked 7). In the case of MDCs the opposite is true. As explained earlier, the reason for the above phenomenon is that affluent income groups are more dependent on the use of light vehicles (for example own private vehicles). The poor are much more dependent on heavy-duty vehicles (passenger buses, etc.). MDCs are targeting heavy-duty vehicles ***per se,*** whereas a fuel levy is a more blunt road financing method.

Table 17 reflects the relative ranking of the impacts for government services with local government services (rank 1) being the least affected by MDCs.

Table 16:

RANKING OF THE INFLATIONARY IMPACT ON HOUSEHOLDS		
INCOME GROUP (percentile)	**GENERAL FUEL LEVY**	**MDCs**
PCI <P25	2	7
P25<= PCI <P50	1	5
P50<= PCI <P75	3	4
P75<= PCI <P90	4	6
P90<= PCI <P95	5	3
P95<= PCI <P99	6	2
PCI >=P99	7	1

Table 17:

RANKING OF THE INFLATIONARY IMPACT ON GOVERNMENT		
SERVICE	**GENERAL FUEL LEVY**	**MDCs**
Local government	**5**	**1**
Health	**1**	**2**
Education	**4**	**3**
General public services	**3**	**4**
Social & community services	**2**	**5**
Public order and safety	**6**	**6**
Economic services	**7**	**7**

4 CONCLUSIONS AND MAIN FINDINGS

4.1 General

An important conclusion that can be drawn from the conceptual discussion in this study is that the total impact of RUCs on the macro-economy is quite limited and differs little from those of an equivalent tax-based road financing system. If the sum of the road user charges raised are higher than the taxes that would otherwise have been allocated to road transport, the macro-economic effect will be similar to that of an increase in the overall tax burden. The road transport sector, however, has a pervasive impact on the economy, and allocative efficiency in this sector can therefore have a significant impact on the economy's growth potential.

RUCs make variable road transport costs more transparent and internalize externalities in accordance with the use of road transport by the different users in the economy. With RUCs, the user pay principle is applied in its full context and cross-subsidisation is eliminated.

RUCs do, however, have a higher administrative costs incidence on the road user, but efficiency gains more than recover these costs. A less effective system from an economic efficiency point of view is road financing through general tax income.

From an equity point of view, RUCs tend to shift the burden of road transport costs to low income groups and therefore have a regressive influence on their disposable income.

4.2 Empirical Analysis

Having regard to the conceptual issues that underpin the functioning of RUCs and their probable impact on the economy, the study did an empirical analysis of the impact of some user charges on the Namibian economy. Use was made of the Namibian SAM that provides useful information on the role of road transport in the various sectors of the economy. The SAM also served as a partial equilibrium model to quantitatively determine the ultimate impact on an important economic aggregate viz. inflation.

Dependency on Road Transport

- In most cases, the indirect dependency of sectors on road transport is more important than the direct dependency. Therefore, decisions regarding RUCs should not only be based on the direct impact of users.
- The high dependency of the informal activities are noteworthy. The informal business and informal trade sectors are amongst the ten sectors most dependent on road transport. The reason is that the informal sector has a high labour content, and labour has a high road transport usage in order to get to and from work.
- As far as households are concerned, the affluent groups are directly highly dependent on road transport as a result of the use of own road transport.

Macro-economic impact

With regard to the macro-economic impact of RUCs, the following is worth noting from the three case studies:

- 10% Fuel price increase:
  - Producer prices (PPI) on average will rise by 0.4% percentage points.
  - Sectors mainly affected are domestic services; other mining and quarrying; non-metallic minerals and informal trade.
  - CPI – will rise by 0.8 percentage points.
  - High income groups more severely affected.
  - Government spending will rise by one percentage point.

- 10% Total transport cost increase:

  - PPI: increase by 1.14 percentage points
  - CPI: increase by 1.5 percentage points
  - Government: cost increase by 1.8 percentage points
  - The same sectors mentioned under the 10% fuel price increase will be disproportionally affected, however, by a larger margin.

- Mass-Distance Charge (MDC)

As was indicated in the text, this was a useful scenario, taking account of the weight of a vehicle and the distance travelled.

- PPI: 0.5 percentage point rise
- CPI: 0.8 percentage point rise
- MDCs; will influence lower income groups more than higher income groups.
- Government cost will rise by 0.7 percentage points.
- Sectoral Perspective:
  Compared to the fuel levy increase, MDCs will impact more severely on informal business. However, communal farming will be much better off with MDCs as opposed to a fuel levy because of low road transport dependency. The impact of MDCs on a particular user will be also determined by the ratio between lighter and heavy vehicles that is used for road transport.

4.3 Main Findings

The study has brought forward a number of important findings in regard to road user charges that may serve a useful purpose in divising policies and instruments that will better fit the Namibian circumstances.

- First of all, the study proved convincingly that the Namibian SAM is a potent instrument to analyse the probable outcome of different road user charge scenarios on the economy in general and road users in particular.

- The results of the impact analyses conform largely with the existing economic theories in regard to road user charges. This to a large extent also confirmed the acceptability of the SAM – as a partial equilibrium model for analytical purposes in Namibia.

Given the unique structure of the Namibian economy as portrayed by the SAM, the outcomes of the three case studies of road transport cost increases, proved useful.

- On a macro-economic level the impact on the PPI, CPI and Government's costs did not differ markedly. The 10 % rise in total road transport costs of necessity would be higher than a 10% fuel price increase.

- Differences of note did come in with the variance of the impacts on households and certain sectors. Obviously these two domains are interrelated.

- Whilst the 10 percent fuel price increase impacted more severely on the higher income groups, the opposite was true of MDCs. This was also to some extent reflected in the different effects on sectors. MDCs are not so severe on certain communal farming activities. An exceptional result is with the building construction sector, where the MDC has a much smaller impact than the fuel levy.

- Given the qualifications and pre-conditions set out in this study, one can conclude that the MDCs as road financing mechanism is more preferable than the general fuel levy systems.

- From an equity point of view, the government should, however, devise methods to alleviate certain negative impacts on, for example, domestic services, informal business, business services, informal trade etc.

- The MDCs' overriding positive impact on a more efficient allocation of scarce resources, and resultant better long-term economic growth prospects, should be kept in mind.

- The rate of MDCs will have to be four times higher than a general fuel levy in order to raise the same amount for road financing.

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