

USER FINANCED ROAD INFRASTRUCTURE IN GHANA: OPPORTUNITIES FOR ROAD CONCESSIONING

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Dedication

This work is dedicated to my beloved wife Peace and our dear son Charles.

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LIST OF ACRONYMS

BOST	Bulk Oil Storage and Transportation
BOT	Build, Operate and Transfer
CEPA	Centre for Policy Ghana, Accra, Ghana
CIF	Costs, Insurance, Freight
CPI	Consumer Price Index
DFR	Department of Feeder Roads, Accra-Ghana
DOT	Department of Transport, South Africa
GHA	Ghana Highway Authority, Accra, Ghana
GIPC	Ghana Investment Promotion Council, Accra, Ghana
GIPC	Ghana Investment Promotion Council, Accra, Ghana
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit GmbH, Eschborn, Germany
ILO	International Labour Organisation, Geneva, Switzerland
IMF	International Monetary Fund, Washington, USA
KfW	Kreditanstalt für Wiederaufbau, Frankfurt, Germany
LSR	Loans Supportable by Revenue
MOT	Maintain, Operate and Transfer
MRT	Ministry of Roads and Transport, Accra, Ghana
N3TC	N3 Toll Concession, Pretoria, South Africa
NPA	National Petroleum Authority, Accra, Ghana
NRA	South African National Road Agency, Pretoria, South Africa
OMCs	Oil Marketing Companies
ROCKS	Road Costs Knowledge System
ROT	Rehabilitate, Operate and Transfer
SIC	State Insurance Company, Accra, Ghana
SPV	Special Purpose Vehicle
SSA	Sub-Saharan Africa
TOR	Tema Oil Refinery, Tema, Ghana
UPPF	Unified Petroleum Price Fund

ABSTRACT

Financing road network life-cycle costs on sustainable basis is one of the most crucial challenges facing many developing countries, as it requires a thorough awareness of road network costs and available sector funds. This thesis has developed a pragmatic cost-revenue model for estimating road network life-cycle costs and expected road revenues. The model calculates performance indicators for measuring the extent to which road users are contributing to the financing of network costs. The findings indicate that road user contributions in Ghana are sufficient to cover only the expected maintenance costs and three-quarters of estimated network life cycle costs. User contribution covers only one-half of the total costs when the costs of clearing existing maintenance backlogs are included. By comparing user contributions and actual allocated domestic funds, the cost-revenue model shows that nearly half of what users contribute is actually allocated to the road sector. This disparity between road network life cycle costs and available funds for road financing is a major development constraint, as needed road improvement projects cannot be undertaken due to lack of funds or under-allocation of available funds. This also implies that government must consider other sources of funds for the road sector. By drawing on the South Africa's highway tolling experiences, this thesis has considered road concessioning as a possible financing mechanism for bridging existing road sector financing gap in Ghana. Traffic levels on most highways in Ghana are generally low, though some roads have high enough traffic volume for a possible concession scheme. As also pertain in South Africa, road concessioning in Ghana should be done on project-by-project basis starting with those with high enough traffic. A public perception survey, conducted as part of this thesis has showed that awareness and support for highway tolling in Ghana is high. There is consensus among users that existing tolls are low and users are more likely to support future toll increases with a corresponding improvement in service delivery. Evaluation of selected highways in the country has identified some road projects for possible Build-Operate-Transfer (BOT), Rehabilitate-Operate-Transfer (ROT) and Maintain-Operate-Transfer (MOT) concession schemes.

Keywords: user contributions, domestic funds and road life-cycle costs, performance indicators, road concessioning

ZUSAMMENFASSUNG

Die nachhaltige Finanzierung des Straßennetzes über die gesamte Lebenszyklusdauer ist eine der größten Herausforderungen für zahlreiche Entwicklungsländer. Hierfür ist eine genaue Kenntnis des Kosten des Straßennetzes und der zur Verfügung stehenden Geldmittel erforderlich. Im Rahmen dieser Arbeit wurde ein pragmatisches Kosten-Nutzen Modell zur Bestimmung der Lebenszykluskosten des Straßennetzes entwickelt, auf der Grundlage der für den Verkehrssektor ausgewiesenen Geldmittel. Das Modell berechnet die Leistungsindikatoren, aufgrund derer bestimmt werden kann, in welchem Ausmaß die Verkehrsteilnehmer zur Finanzierung des Straßennetzwerks beitragen. Die Ergebnisse zeigen, dass die Beiträge der Verkehrsteilnehmer in Ghana nur ausreichen um die zu erwartenden Wartungsarbeiten auszuführen, d. h. sie decken bloß $\frac{3}{4}$ der Lebenszykluskosten des entsprechenden Straßennetzes ab. Die Beiträge decken sogar bloß die Hälfte der Kosten ab, wenn es darum geht, auch noch den Arbeitsrückstand bei der Wartung des Straßennetzes aufzuholen. Durch den Vergleich der Beiträge der Verkehrsteilnehmer mit den tatsächlich zugewiesenen Mitteln aus dem öffentlichen Haushalt, zeigt das Kosten-Nutzen-Modell auf, dass nur die Hälfte der Straßennutzungsgebühren dem Verkehrssektor zugeschlagen werden. Diese Diskrepanz zwischen den Lebenszykluskosten des Straßennetzes und den tatsächlich hierfür vorhandenen Geldmitteln wirkt als Hemmschuh für die Entwicklung des Straßennetzes. Insbesondere können die erforderlichen Straßenverbesserungsprojekte nicht in Angriff genommen werden können, weil die hierfür benötigten Mittel nicht zur Verfügung stehen oder infolge der Haushaltslage die zugewiesenen Summen zu gering sind. Somit wird deutlich, dass die Regierung sich nach zusätzlichen Finanzierungsquellen für den Verkehrssektor umsehen muss. Auf der Grundlage der Erfahrungen aus Südafrika mit einer Straßenmaut hat diese Arbeit das Konzept einer Straßenkonzession als möglichen Finanzierungsmechanismus zum Ausgleich des Finanzbedarfs im Straßensektor unter die Lupe genommen. Auf den meisten Hauptverkehrsstraßen in Ghana herrscht eine eher geringe Verkehrsdichte, was gegen eine generelle Mautfinanzierung spricht. Die Verkehrsdichte auf einigen Straßen lässt eine Konzession plausibel erscheinen. Wie auch in Südafrika sollte die Einführung einer Straßenkonzession projektbezogen in Angriff genommen werden, beginnend mit jenen Straßen, die aufgrund ihrer Verkehrsdichte hierfür besonders geeignet sind.

Im Rahmen dieser Arbeit wurde auch eine Befragung über die öffentlichen Wahrnehmung des Straßenbaus und -unterhalts durchgeführt. Die Befragung hat gezeigt, dass das Bewusstsein für die Notwendigkeit von Mautgebühren und somit auch die Unterstützung einer Finanzierung der Straßeninfrastruktur über diesen Weg hoch sind. Die Verkehrsteilnehmer sind der Ansicht, dass die Mautkosten niedrig sind und sie würden eine Erhöhung dieser Kosten gerne in Kauf nehmen, wenn diese mit einer

Verbesserung der Servicequalität der Straßen einhergehen. Durch die Untersuchung ausgewählter Hauptverkehrsstraßen in Ghana wurden eine Reihe von Straßenprojekten für folgende in öffentlich-privater Partnerschaft Finanzierungsmöglichkeiten ausgewiesen. Im Einzelnen wurden die Ansätze Build-Operate-Transfer (BOT), Rehabilitate-Operate-Transfer (ROT) und Maintain-Operate-Transfer (MOT) untersucht und anhand einer Indikatorenliste bewertet.

Schlüsselbegriffe: Straßennutzungsgebühren, Haushaltsmittel, Lebenszykluskosten des Straßennetzwerks, Leistungsindikatoren, Straßenkonzession.

1 INTRODUCTION

1.1 Financing the road sector

Road transport continues to play an indispensable role in the movement of passengers and freight. This is a necessary requirement for poverty alleviation and socio-economic development in developing countries. Roads serve as the circulation system in the promotion of commerce, communication, and socio-economic development. The provision of road infrastructure gives both the rural and urban poor access to health, education, employment and other needed social services. This means that without efficient transport infrastructure in place, economic and social development would be severely hindered.

Despite the importance of roads in overall economic development, efficiency of road transport systems in many developing countries are often constrained by high vehicle operation and maintenance costs due to poor road conditions. While demands for transport infrastructure continue to grow - a result of high population growth rates, urbanisation and growth in economic activities - resources for road maintenance and road network replacement continue to be a burden for many developing countries.

Domestic funds, which predominant come from road user charges and other general budget allocations, are often not sufficient to cover estimated life cycle cost of the road network. The sector therefore relies heavily on donor support. For example, in Ghana, between 1996 and 2003 donor funds constituted roughly 40% of total road sector budgets (MRT, 2004). The question here is not about the necessity of donor supports but rather the extent to which such levels of reliance on foreign assistance is sustainable. Even though donor support might seem indispensable, it is safe - from funding sustainability perspective - to focus only on available domestic funds when assessing developing countries' efforts at preserving their road assets.

Again, sustainable road financing requires an awareness of both the expected network life cycle costs on the one hand and available domestic funds on the other hand. The sustainability of any road-financing plan is therefore measured by the extent to which these domestic funds cover the expected life-cycle costs of the road network.

How do we measure the balance between road costs and available domestic funds? This thesis has developed a pragmatic cost-revenue model for identifying and estimating, in a systematic, transparent and a logical manner, all road costs, user contributions and available domestic funds. Firstly, unit cost values for road construction and maintenance are estimated. Secondly, user contributions are estimated from road user charges. Thirdly, all funds from domestic sources - that is - funds actually allocated to the road

sector, are estimated. Finally, using these costs and revenue figures, sets of performance indicators for measuring the extent to which road users contribute to road sector financing are developed.

To help raise additional funds and bridge existing gap between road costs and available domestic funds, road tolling on concession basis is proposed and the possibilities explored. First, the state of the existing tolling system in Ghana is reviewed and shortcomings are identified. Secondly, results of a public perception survey to assess the level of public support for a road concessioning scheme in Ghana is presented and discussed. Thirdly, the performance of road concessioning in South Africa – another African country with over 20 years experience in the implementation of road concessioning schemes – is reviewed. Finally, some guidelines for implementation of highway tolling in Ghana are discussed.

The general framework for this thesis is illustrated by *Figure 1*.

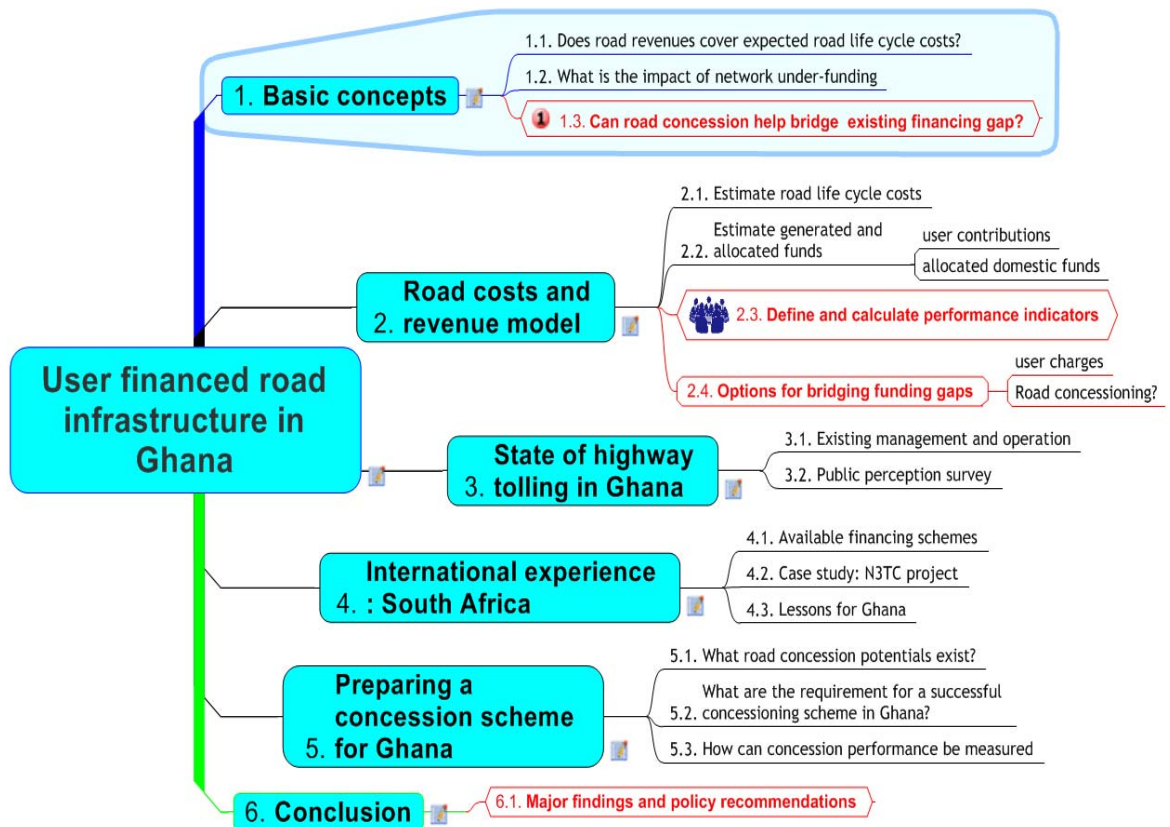


Figure 1 General framework of the thesis

1.1.1 The impacts of under-funding of road investment

Inadequate financial allocation to the road sector is a primary cause of road deterioration in developing countries, as necessary maintenance works are deferred. For example, in Ghana backlog of maintenance works is believed to have left nearly half of the entire national road network in poor condition (MRT, 2003, p.64) – a situation that makes future maintenance works even more expensive. This is similar to what pertains in many Sub-Sahara African countries, where on average about one-fourth of the entire network are in poor condition and require urgent interventions to prevent the networks from complete collapse.

The problem of inadequate road financing is in two folds. First, countries with oversize network often do not have sufficient financial resources for maintaining them. The second problem is the generally low priority for road maintenance by many governments in developing countries. Road maintenance is financed from the general budget and hence competes with other sectors for often very limited funds.

The negative impacts of inadequate road maintenance are obvious. Allowing roads to deteriorate, say within less than half their life span, only to spend additional scarce resources to rebuild them is economically unjustifiable. Poor road network condition

also translates into poor and often expensive transport services (GIPC, n.d.). This is a serious development constraint, especially in countries, where transport cost is a major determinant of prices of basic goods and services (FEWS, 2004).

Sustainable road network financing requires a comprehensive understanding of road life cycle costs and available road sector funds. Often the road administration is limited in its ability to determine these network funding needs due, in part, to constraints in obtaining road network information and tools for calculating costs and revenue figures.

1.1.2 Importance of timely road maintenance

Roads are valuable national assets, which must be preserved. According to Heggie (2004, p.4), developed countries spend about 1.2 to 2.5% of their GDP on roads. The need for sustained road maintenance is of primary importance, especially with respect to road safety and economic development. The timing of the execution of maintenance activities is particularly important, as it can impact significantly on the overall network life-cycle costs. A European Commission (2006) review of the transport sector showed that deferred maintenance had resulted in the loss of one third of the road infrastructure investments in Sub-Sahara Africa. Another recent research findings by the South African National Road Agency (NRA, 2005) on the importance of timely execution of maintenance works also confirms that delays in road project implementation have contributed to a disproportionately high road construction and maintenance costs.

South Africa

To illustrate the importance of timely execution of maintenance works, this section discusses the basis of the South Africa's asset preservation policy, in which number one priority is given to timely road maintenance. This policy review was obtained from NRA (2005).

Let us suppose that current required road maintenance would cost 1 unit of currency per km to perform. If these maintenance works are not undertaken, simply because there may not be any visible sign of asset deterioration, it may seem the road agency has made "savings" by deferring maintenance works. As illustrated by *Figure 2*, if the road is allowed to deteriorate for say another three years, it will now cost 6 units of currency per km at this stage to maintain the same road. This implies that, for every 1km of poor road, which ought to be maintained now, 6km of good roads cannot be maintained. Again, suppose the road maintenance is deferred for a further five years, not only will vehicle operating costs increase disproportionately, but also 18 units of currency per km will now be required to maintain the same roads. Extending the analogy again implies that for every 1km of poor roads, which ought to be maintained now - that is five years after the time it was actually needed - 18km of good roads cannot be maintained.

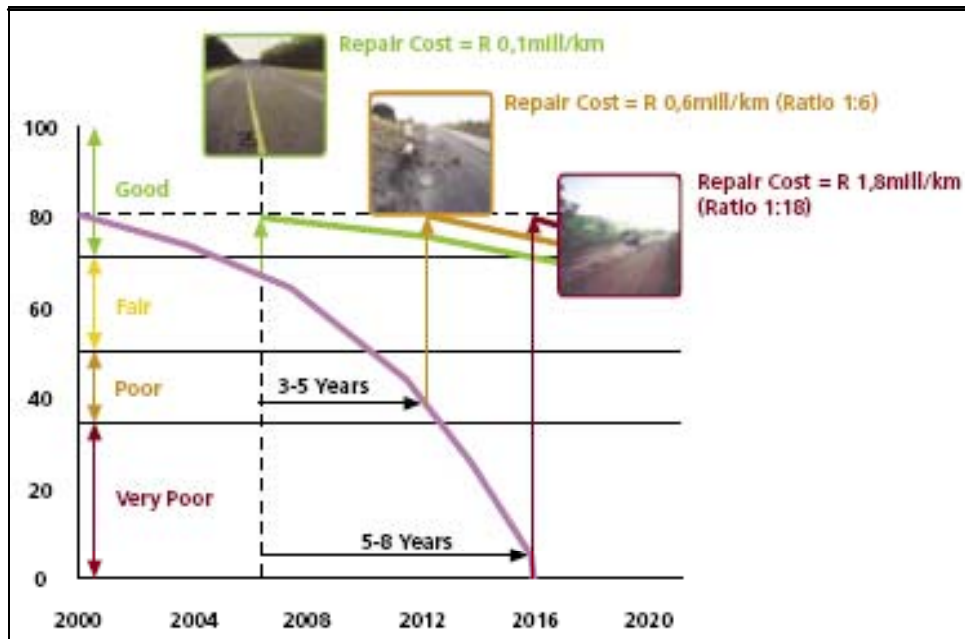


Figure 2 Cost of delayed maintenance

Source: NRA (2005). *Declaration of Intent 2005-2008*. South African National Roads Agency, Pretoria, South Africa.

The South African case shows that deferring road maintenance, because of lack of funds, will lead to a more costly long-term road costs compared to when maintenance works are performed when they are required.

Cambodia

Another negative impact of delayed road maintenance is illustrated by an International Labour Organisation (ILO) supported rural road project in Battambang Province in Cambodia. In 1998, ILO assisted the Battambang Province to improve about 170km of its tertiary rural roads, which was handed over to the local authority at the end of that year. This network size had an estimated asset value of US\$2.5 million. A road condition survey performed in 2000-2001 showed that only 112km of this network was in a maintainable condition and the value of the asset had declined to below US\$1.7 million (ILO, 2001, p.3).

To paint a better picture of the impact of delayed maintenance, this ILO project has shown that within a period of only three years, 58km of road length or asset value of about US\$800 000 was lost. This amount is equivalent to a lost in asset value of US\$4 600 per kilometre per year and also implies that at least US\$4 600 will be required each year to restore each kilometre of the network to the original condition. This current maintenance budget is about three-folds the amount required should maintenance have been performed when it was actually needed. As further highlighted in the figure below, this decline in the asset value of the network is attributable to neglect of both routine and periodic maintenance.

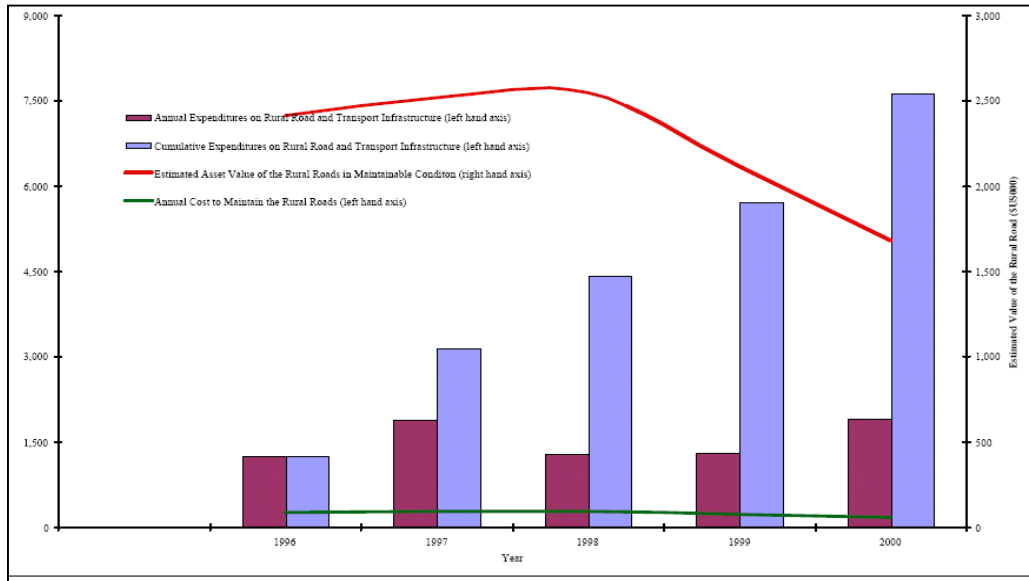


Figure 3 Expenditures and asset value for rural roads in Battambang, Cambodia

Again, according to Heggie (1998), “when a road is allowed to deteriorate from good to poor condition, each dollar saved on road maintenance increases [vehicle operation costs] by between \$2 and \$3. Far from saving money, cutting back on road maintenance increases the cost of road transport and raises the net cost to the economy as a whole.”

1.2 The need for a sustainable road sector financing scheme in Ghana

1.2.1 Correlation between road network condition and poverty levels

To what extent does inadequate transport infrastructure in Ghana constitute decisive obstacles to poverty reduction and socio-economic development of Ghana?

This section establishes a possible correlation between road condition and the incidence of poverty. First it is important to mention that in Ghana, extreme poverty is a rural problem. This can be seen from the significant disparities in poverty levels across the various regions of Ghana and also among the various socio-economic groups. A key feature of poverty in Ghana includes a lack of income-generating opportunities outside of agriculture especially for rural dwellers, and inadequate access to economic and social services. In many cases, the character and extent of these problems are largely a function of the inadequate provision of travel and transport infrastructure and services, especially at the village and community levels (World Bank, n.d and Porter, 1999).

According to the Ghana Living Standards Survey (GLSS 2000), with adequate provision made for other sectors, demand for transport is the main linkage that has the greatest impact on the poor. Transport services play a direct role in the lives of the poor,

by enabling access to markets, jobs and health and educational centres (MRT, 2002). Investment in roads and transport services will provide access to markets creating economic opportunity for the poor. The Roads and Transport Ministry's goal of improving transport systems is based on the economic rationale that an efficient transport system will significantly reduce transaction costs, promote economy of scale and specialisation, lower domestic production cost and hence lead to an overall poverty reduction. The table and chart below indicate a link between poor road conditions and levels of poverty in Ghana.

Table 1 Impact of poor road condition on poverty

<i>Region</i>	<i>Area (sq.km)</i>	<i>% living below poverty line (1999)</i>	<i>Length in poor condition (km)</i>	<i>% of roads in poor condition</i>
Upper East	8 842	88.2	1 620	65.0
Upper West	18 376	83.9	1 663	59.4
Northern	70 386	69.2	4 235	64.1
Brong Ahafo	39 557	35.8	2 942	39.0
Ashanti	24 389	27.7	3 350	40.9
Volta	20 570	37.7	1 488	34.5
Eastern	19 323	43.7	2 140	47.3
Greater Accra	3 245	5.2	1 005	33.0
Central	9 826	48.4	1 375	35.8
Western	23 921	27.3	2 645	45.0

Source: Ministry of Roads and Transport (MRT, 2002)

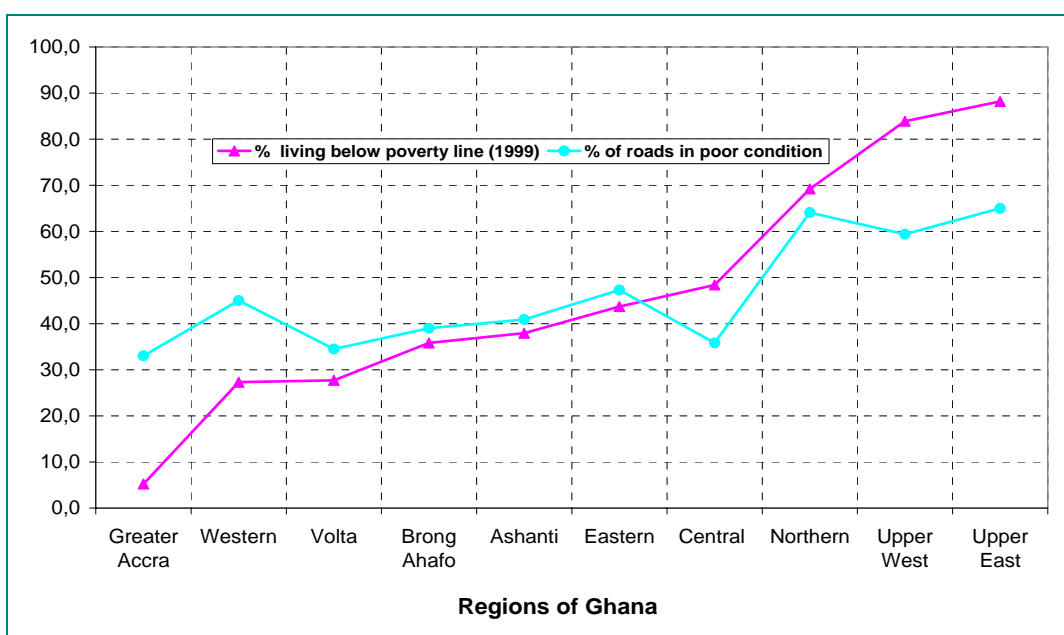


Figure 4 Correlation of poverty level and road condition

Considering the existing road condition of the country's transport network region by region indicates a strong direct link between road condition and poverty levels across region. In general, regions with higher proportion of network in poor condition also have a corresponding higher incidence of poverty. It is expected therefore that an increase road investment in regions with poor road condition could contribute to a reduction in poverty in those areas.

1.2.2 Improved road transport infrastructure as catalyst for socio-economic development in Ghana

In reviewing the impact of road provision and poverty reduction, Howe (1984, p.80) observed, "the continuing optimism with which most road investment programmes are still regarded in relation to their effect on poverty reduction cannot be sustained". Road infrastructure must be complimented by supply of adequate transport services. Howe admits that though road infrastructure and transport services alone are not panacea to poverty eradication, they should be seen as catalysts to creating wealth and giving opportunities for people to access various economic resources (MRT, 2003).

Hine (1993) and Scott (2000) also observe that "one of the links made between improvements in rural transport infrastructure and increasing the economic opportunities of the poor is through income increases stemming from improvements in the commodity terms of trade for rural producers." They further argued that, "better transport is hypothesised to increase farm gate prices received for farm products and to lower the price of inputs and purchased consumption goods." This therefore means that the role of transport in its entirety in realising the objectives of the various sectors of the economy (with respect to poverty alleviation) cannot be overemphasised.

Ghana Government objective of investing into road infrastructure and transport services – for the achievement of its Millennium Development Goals (MDGs) is based on the following perceived growth in socio-economic development opportunity. The following benefits have been identified:

Health service delivery

With respect to health service delivery, improved road transport will enhance access to health centres, timely delivery of drugs and logistics for health personnel and also encourage health personnel (doctors and paramedic staff) to accept postings to previously inaccessible areas.

Education

It has been observed that student performance in schools with good access to transport facilities were better than schools with poor access to means of transport. This is because schools located in less accessible areas are less able to attract qualified teachers. Teachers' decision to accept posting to rural areas is partly based on the availability and quality of transport infrastructure and services in those areas. It is also a fact that logistics distribution, such as textbooks and teaching aids, is a problem in the poorly accessible schools.

Food production and distribution

Transportation costs contribute up to about 70% of food prices in urban centres. Farmers have greater incentive to produce more if they will be able to efficiently transport them from the farm gates to the markets. This will also lead to a decrease in food prices in urban centres. Prices of agricultural inputs are high. This is coupled with lack of availability of Farm Extension Services in the areas with poor transport infrastructure and services. Location analysis also shows that areas with good transport infrastructure and services relative to the location of Agro-based Industries tend to be more favourable than those with poor accessibility (MRT, 2003).

Social cohesion – good governance

Efficient transport systems have the potential of promoting social cohesion and stability and help reduce the current high level of rural-urban migration. Improved transport system will also enhance good governance, as policymakers and community leaders will be able to directly reach the populace. It will help facilitate the implementation of ongoing decentralisation process, which enhances good governance by ensuring that local governments are able to quickly identify and meet the needs of their people.

2 ROAD COSTS AND REVENUE MODEL

This section presents a model for estimating road network cost and sector funds. The cost-revenue model is designed to assist road administrators and policymakers to estimate, in a simplified, transparent and logical manner all road life cycle costs, revenues from user charges and actual domestic funds allocated for road financing. The results of the model are used later used to calculate performance indicators.

The objectives of the cost-revenue models are basically to provide answers to the following questions:

- are sufficient funds allocated to cover expected road network life-cycle costs (i.e. maintenance and reconstruction costs) and
- to what extent do road users contribute to the financing of these life-cycle costs?

By estimating both the funding needs of the entire road network of the country and also revenues from user charges, the model assesses the extent to which these domestic funds and revenues from user charges cover the expected life cycle costs of the road network.

2.1 Road network classification

As a first step to estimating funding needs, the national road network has to be classified. This is important since different unit costs can be associated with different road types. In many countries each road class is often administered by a separate road agency. Classifying the network, according to the different road agencies, is also essential for budget allocation purposes. Since unit cost also depends on the road surface type, it is recommended to sub-classify the network under the different road agencies by surface types.

The road classes in Ghana are described below:

Trunk (or national) roads: These roads link regional (and district) capitals and form the main frame of the national road network. Trunk roads are of national strategic and economic importance. The Ghana Highways Authority administers trunk roads in Ghana

Urban roads: These consist of roads within major town and cities. The Department of Urban roads has the responsibility for the entire network within five cities (Accra, Kumasi, Secondi-Takoradi, Tema and Tamale) and the urban areas of the Ga District

Feeder (rural) roads: These roads are classified as inter-district, connectors or access roads. Inter-district roads cross more than one district. Connectors are feeder roads that

link a trunk road to either another trunk road or feeder road. Finally, an access feeder road provides a link between a trunk road and a (farming) community. The surface type can be earth, gravel or bituminous surface treatment. Most feeder roads in Ghana have earth surfacing. Feeder roads are under the control of the Department of Feeder Roads.

The surface types of in Ghana roads are Portland cement concrete, asphalt concrete, bituminous surface treatment, gravel and earth. Each road and surface type has an associated unit cost of construction and maintenance.

2.2 Identifying and estimating road costs

This section identifies all road activities and estimates the financial requirements for the road sector. Typical road cost activities are routine maintenance, periodic maintenance and reconstruction or asset replacement. The classification is usually based on the required frequency for the road improvement activity and the costs involved. There are additional cost items relating to road administration overheads and cost of capital. With these cost information, annual life cycle costs of the road network can be estimated.

Estimation of unit cost figures for road construction and maintenance depends very much on how road projects are contracted. Where contracts are awarded on fixed price basis, the unit cost could be taken as the average per km cost of current road projects. The unit cost is simply the fee contractors accept in order to perform particular road activities. In this model, unit costs figures used were obtained from unconstrained road budgets between year 2003 and 2005.

The time interval for each road activity is also estimated.

2.2.1 Routine maintenance cost

Routine maintenance are maintenance measures aimed at enhancing the *functional integrity* of the road by ensuring a conducive road environment and riding surface. It is required, for example, to keep “good” roads in “good” condition. Routine maintenance can be classified into two categories, namely; pavement and non-pavement related. Pavement related maintenance activities are required at intervals during the year with a frequency depending on the condition of the pavement and traffic volume or traffic composition. One example is pothole patching.

Non-pavement related routine maintenance on the other hand is required on all roads (paved or unpaved) during the year irrespective of traffic or pavement conditions. Activities include “bush clearing, drain clearing, ditch cleaning, culvert cleaning, road sign cleaning, repairs of minor damage to side slopes, levelling of shoulders and verges” (ILO, n.d., p.2). Routine maintenance interval used in this model is one year.

The unit cost of routine maintenance (measured in US\$/km) is the unit contract price for routine maintenance in the case of fixed contract projects. For each road class (and surface type), the unit cost can also be estimated by simply dividing the contract sum for routine maintenance project by the total length of road involved. The average unit cost of several routine maintenance projects can then be estimated.

2.2.2 Periodic maintenance cost

This maintenance type is required at intervals of several years. The interval depends on the type of activity and the road surface type. The aim of periodic maintenance is to preserve the *structural integrity* of the road. Periodic maintenance is needed, for example, to bring “fair” roads to “good” condition. Some periodic maintenance activities include resealing, regravelling, pavement overlay, spot improvement, asphalt concrete resurfacing (or partial reconstruction), walkway repairs, reconstruction of drainage structures (including culverts and bridges), roadway markings, installation of traffic signals and speed bumps (MRT, 2005, p.9). Periodic maintenance interval can range from three years for regravelling to 12 years for asphalt overlay.

The unit cost of periodic maintenance is estimated by dividing the contract sum of periodic maintenance project by the road length in kilometres. The average unit cost is then determined from all periodic maintenance projects undertaken within a given period. Unit cost of periodic maintenance is estimated for each road class, and for each road class a distinction is made between unit cost figures for different road surface types. The annual unit cost is then calculated by dividing the periodic maintenance unit cost by the average periodic maintenance time interval. Maintenance interval is the number of years after which that maintenance activity has to be repeated.

For example, asphalt concrete roads often have design life of 30 years, but an overlay - a periodic maintenance measure- may be required every 12 years. Periodic maintenance for bituminous surface treated roads is either a resealing or resurfacing depending on the road surface condition at the time and available funds. For the purpose of this model, all bituminous surface treated roads are assumed to require resealing after nine years. For gravel roads, the number of years required for periodic maintenance (regravelling) is often a function of the prevailing traffic volume on the road. The average time interval for regravelling used is four years.

2.2.3 Asset replacement cost

Road infrastructure is designed to have a specific life span. At the end of this design life, the bearing capacities of the road sub-layers reduce to the point where they are

unable to carry the expected traffic loads. At such a point it will not be economically worthwhile to continue with just maintenance works. The entire infrastructure (both sub- and super-structure) has to be replaced. Road asset replacement involves the reconstruction of the whole pavement structure including provision of new subbase, gravel base and a surfacing. Since road asset replacement involves a complete reconstruction, such a reconstruction cost could be as high as the cost of a new construction.

The construction cost of a road is therefore assumed to be equivalent to the asset replacement cost. The unit cost of construction/reconstruction (measured in \$/km) is the average per km cost of a newly constructed or reconstructed road. The unit construction cost should be estimated for each road class and surface type.

2.2.4 Administrative cost

Administrative costs include all other costs not directly related to specific road projects but which are required for the efficient functioning of the institutions and agencies responsible for road management and planning in the country. Typical administrative costs include traffic management and road safety, environment and social management, consultancy and technical support, training and institutional support.

The administrative cost is taken as the proportion of total costs required to cover road agency overheads. It is expressed as a percentage of the total road budget. This benchmark is derived from past road administration overheads.

2.2.5 Cost of capital

The cost of capital is the sum of the cost-of-equity and the cost-of-debt. If a government has to finance construction or maintenance works using borrowed money, without any equity contribution, then the cost of capital is the cost-of-debt. The cost of debt, which is simply the expected interest payments, depends on the source of funds. It can range from 0% (in the case of interest free-loans from some development banks) to say 15% (for many commercial banks). A sensitivity analysis may be performed on total road costs, and hence performance indicators, using different costs-of-debt.

The choice of appropriate interest rate to use in the model is based on the following interpretations:

1. That government expects some minimum returns on investment when building transport infrastructure (otherwise it invests the money elsewhere)

2. In order to improve transport infrastructure the government takes a loan that has to be serviced
3. The transport sector is perceived as a business that must generate returns on investment

2.2.6 Summary: road cost items and unit cost information

This section presents a summary of the methodological framework for estimation of unit costs figures and other inputs to the model already discussed above (see *Figure 5 and Table 2*).

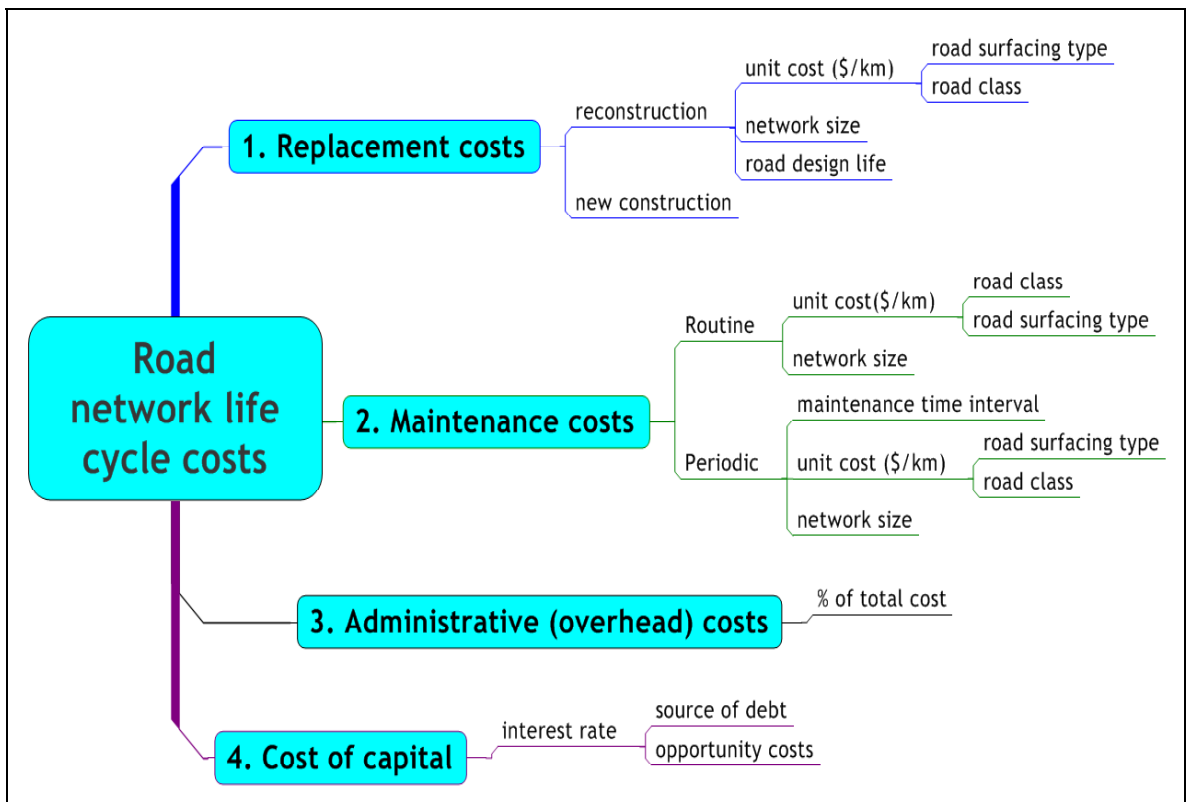


Figure 5 Road cost items and input variables

Table 2 Unit costs and life of key road works in Ghana

Road class/ surface type	Routine maint. costs	Periodic maint. costs		Construction cost		Sources
	Unit costs	Unit costs	Intervals	Unit	Intervals	
	US\$/km/year	US\$/km	years	US\$/km	years	
Trunk roads						
Asphalt	1 150	110 000	10	500 000	30	GHA, 2005
Bituminous	1 040	61 000	9	300 000	30	GHA, 2005
Gravel	1 020	22 000	4	200 000	20	GHA, 2005
Urban roads						
Asphalt	1 900	83 550	10	404 400	30	MRT, 2004
Bituminous	1 900	51 000	9	227 300	30	MRT 2005
Gravel	1 700	14 450	4	133 000	20	MRT, 2004
Feeder roads						
Bituminous	470	45 250	9	141 300	30	DFR 2004
Gravel	470	6 300	4	30 000	20	MRT,
Earth	300	1 250	2	12 300	15	DFR 2004

Source Own estimation and compilation from the above sources

The total annual life cycle cost is calculated by aggregating the routine maintenance, periodic maintenance and asset replacement costs.

2.2.7 Total road costs

In estimating road life-cycle costs, the model examines two costing scenarios. These are the “Base” and “Extended” scenarios. What constitutes road network life-cycle costs? What is the road financing burden on government? An accurate knowledge of road life cycle costs is crucial for preparation of a reliable road network financing plan.

Base scenario

The base scenario considers the case of “theoretically” new roads or a network in good condition. By assuming that the road network is already in good condition, the base scenario estimates the annual financial requirements for keeping the network in its good condition. The idea here is that, supposing donors were to help Ghana to construct new roads or rehabilitate the existing network, would the country be able to generate and allocate sufficient funds to cover:

- required routine and periodic road maintenance costs and
- annual road asset replacement costs? That is, will the country be able to make necessary monetary savings to replace the network at the end of the economic or design life?

The base scenario therefore aims at assessing the sustainability of donor-funded reconstruction and rehabilitation projects. Many donor-funded road projects have failed in the past because often counterpart local funds required for routine or periodic maintenance are not made available. This model will therefore assist policymakers and the road administration to estimate how much funds will be needed annually for road maintenance and replacement and assess whether existing user contributions and allocated funds are adequate to cover these road life-cycle costs.

In the base scenario, the life cycle costs therefore consist basically of the annual routine maintenance, the annualised future periodic maintenance and the asset replacement costs. There is also provision for administrative overhead and financing cost. It assumes an administrative cost of 5% of net total road costs and a cost of capital of 0%. With cost of capital of 0%, we are considering the case where road costs are financed from, for example, interest-free loans. Though this may represent a rare scenario, by excluding the any possible interest payment, the results of the model presents the least costs the road sector must bear irrespective of the sources of funding available to it. See *Table 3* for a complete overview of the total network life cycle costs.

Table 3 Annual network life-cycle costs (base scenario)

Road class	Network Size(2003)	Asset replacement costs				Routine maint. costs		Periodic maintenance. costs			Total maint	Annual life-cycle costs	
		US\$ /km	US\$m	years	US\$m /year	US\$/km /year	US\$m	US\$/km	years	US\$m /year	US\$m /year	US\$m /year	% Asset cost
Trunk Roads	12 690		3 493		137.6		13.3			61.8	75.0	212.7	6.1%
Asphalt	1 600	500 000	802	30	26.7	1 150	1.8	110 000	12	14.7	16.5	43.3	5.4%
Bituminous	4 730	300 000	1 420	30	47.3	1 040	4.9	23 000	9	12.1	17.0	64.4	4.5%
Gravel	6 360	200 000	1 271	20	63.6	1 020	6.5	22 000	4	35.0	41.5	105.0	8.3%
Urban Roads	4 060		796		31.3		7.3			15.2	22.5	53.8	6.8%
Asphalt	410	404 400	167	30	5.6	1 900	0.8	83 550	12	2.9	3.7	9.2	5.5%
Bituminous	1 520	227 300	346	30	11.5	1 900	2.9	27 580	9	4.7	7.6	19.1	5.5%
Gravel	2 130	133 000	283	20	14.2	1 700	3.6	14 400	4	7.7	11.3	25.5	9.0%
Feeder Roads	32 610		873		43.5		13.0			38.8	51.8	95.4	10.9%
Bituminous	1 210	141 300	172	30	5.7	470	0.6	16 200	9	2.2	2.8	8.5	4.9%
Gravel	17 770	30 000	533	20	26.6	470	8.4	6 300	4	28.1	36.4	63.1	11.8%
Earth	13 630	12 300	168	15	11.2	300	4.1	1 250	2	8.5	12.6	23.8	14.2%
Total	49 370		5 162		212.5		33.6			115.8	149.4	361.8	7.0%
Adm. costs (5%)					10.6		1.7			5.8	7.5	18.1	
Grand total			5 162		223.1		35.3			121.6	156.8	379.9	7.4%

Aproximately US\$ 380 million is required annually to cover road maintenance and replacement costs (see *Table 3*). This amount is equivalent to 7.4% of the national road asset value.

Extended scenario

The extended scenario on the other hand considers the financing needs of the network in its current condition. By classifying the national road network under “good”, “fair” and “poor” conditions, the extended scenario estimates both the cost of bringing the entire network to good condition and the recurrent costs for maintenance and asset replacement.

The assumption here is that, as a first step, if the country’s network is in a poor condition, it would require funds to bring it to a good condition and then later maintain it as the need arises. This scenario is particularly important where the government must finance from its own resources rehabilitation, maintenance and also future road asset replacement costs. The extended scenario therefore, in addition to the recurrent maintenance and future asset replacement costs, estimates the initial costs of clearing existing backlog of deferred maintenance activities. The only difference between the base and extended scenarios therefore is the initial cost of clearing maintenance backlog in the case of the extended scenario.

To estimate the additional cost of network rehabilitation, the entire road network is reclassified based on road class, surface type and surface condition as shown in *Table 4*. For each surface type in poor or fair condition, an appropriate maintenance intervention is recommended. Each intervention has an associated unit cost and a time interval for repeating that activity.

Table 4 Cost of clearing existing backlog

Road class / Surface type	Network condition	Network needs	Network length [2003] km	Cost of clearing backlog		Over 10 years
				US\$/km	US\$m	US\$m/year
Trunk roads			8 911		1 271	127.1
Asphalt			412		86	8.6
	<i>Poor</i>	<i>Reconstruct</i>	104	500 000	52	5.2
	<i>Fair</i>	<i>Overlay</i>	308	110 000	34	3.4
Bituminous			2 650		336	33.6
	<i>Poor</i>	<i>Reconstruct</i>	994	300 000	298	29.8
	<i>Fair</i>	<i>Reseal</i>	1 657	23 000	38	3.8
Gravel			5 848		848	84.8
	<i>Poor</i>	<i>Reconstruct</i>	4 043	200 000	809	80.9
	<i>Fair</i>	<i>Regravel</i>	1 805	22 000	40	4.0
Urban roads			2 889		396	39.6
Asphalt			240		62	6.2
	<i>Poor</i>	<i>Reconstruct</i>	132	404 400	53	5.3
	<i>Fair</i>	<i>Overlay</i>	107	83 600	9	0.9
Bituminous			883		122	12.2
	<i>Poor</i>	<i>Reconstruct</i>	487	227 400	111	11.1
	<i>Fair</i>	<i>Reseal</i>	396	27 600	11	1.1
Gravel			1 767		212	21.2
	<i>Poor</i>	<i>Reconstruct</i>	1 575	133 000	210	20.9
	<i>Fair</i>	<i>Regravel</i>	192	14 400	3	0.3
Feeder roads			26 267		448	44.8
Bituminous			522		45	4.5
	<i>Poor</i>	<i>Reconstruct</i>	291	141 300	41	4.1
	<i>Fair</i>	<i>Reseal</i>	231	45 300	4	0.4
Gravel			14 568		311	31.1
	<i>Poor</i>	<i>Reconstruct</i>	9 239	30 000	277	27.7
	<i>Fair</i>	<i>Regravel</i>	5 330	6 300	34	3.4
Earth			11 177		93	9.3
	<i>Poor</i>	<i>Reconstruct</i>	7 088	12 300	87	8.7
	<i>Fair</i>	<i>Reshape</i>	4 089	1 300	5	0.5
Total			38 068		2 115	211.5
Adm. costs (5%)					110	11.0
Grand total					2 221	222.1

The annual road network life-cycle costs for the extended scenario are shown in *Table 5*. The total network life-cycle costs therefore consist of the annualised costs of (1)

clearing existing maintenance backlogs, (2) current maintenance requirements and (3) future asset replacement. Detailed calculation of annual life cycle cost is presented in *Table 33* in Appendix C.

Table 5 Annual life-cycle costs (extended scenario)

Road class/ surface type	Cost of clearing backlog		Annual maintenance costs	Annual Asset replacement costs	Annual life cycle costs
	Total	Over10years*			
	US\$m	US\$m/year	US\$m/year	US\$m/year	US\$m/year
Trunk roads	1 271	127.1	75.0	137.6	339.7
Asphalt	86	8.6	16.5	26.7	51.8
Bituminou	336	33.6	17.0	47.3	97.9
Gravel	848	84.8	41.5	63.6	189.9
Urban roads	396	39.6	22.5	31.3	93.4
Asphalt	62	6.2	3.7	5.6	11.8
Bituminou	122	12.2	7.6	11.5	31.3
Gravel	212	21.2	11.3	14.2	46.7
Feeder roads	448	44.8	51.8	43.6	140.2
Bituminou	45	4.5	2.8	5.7	13
Gravel	311	31.1	36.4	26.6	94.1
Earth	93	9.3	12.8	11.2	33.3
Total	2 115	211.5	149.4	212.5	573.4
Adm. costs	106	10.6	7.5	10.6	28.7
Grand total	2 221	222.1	156.8	223.1	602.0

Notes: *Cost of clearing backlog is spread over 10years. Interest rate used is 0%.

Approximately US\$2.2 billion (see *Table 5*) is needed to clear existing maintenance backlog in order to bring the entire network to good condition. A national road development objective could, for example, involve a programme for clearing all road maintenance and reconstruction backlogs within a defined time frame. In this case study, a 10-year network rehabilitation programme is assumed. This implies that the initial cost of network rehabilitation will be financed within a 10year period at an annual cost of US\$222 million, excluding interest on capital.

Additional funds will also be needed for maintenance and asset replacement at the end of the network life. From the base scenario, annual maintenance and asset replacement costs are US\$156.8 million and US\$223 million respectively. The annual life cycle cost of the national road network therefore amounts to US\$602 million. This is the amount required, at least for the next 10years, to pay for current network improvement works and subsequent maintenance and network replacement costs. At the end of the 10th year when payment for the initial cost of clearing backlog is completed, the life cycle cost reduces to US\$414.5 for the rest of the network life.

The next step is to estimate user contributions and domestic funds dedicated for roads. The purpose is to assess the extent to which existing user contribution and actual allocated domestic funds cover the expected life cycle costs of the road network.

Domestic funds for the road sector have mainly come from fuel levies, vehicle registration, vehicle inspection, toll and transit fees. In addition, the road sector also received annual budget allocations from the consolidated fund.

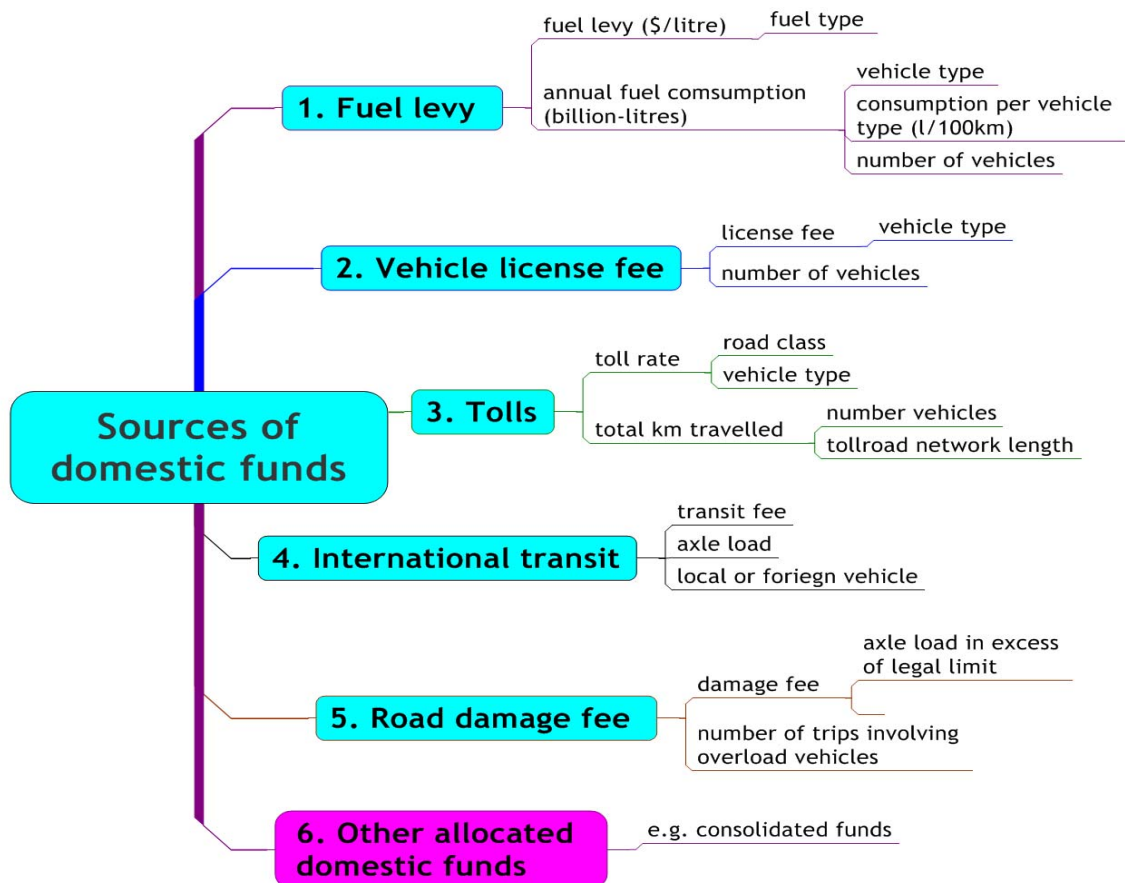


Figure 6 Input parameters for estimating domestic funds

2.3 User contributions and domestic funds

User contributions are all funds generated directly or indirectly from road user charges and domestic fund are all funds from domestic sources, which are directly allocated to the road sector.

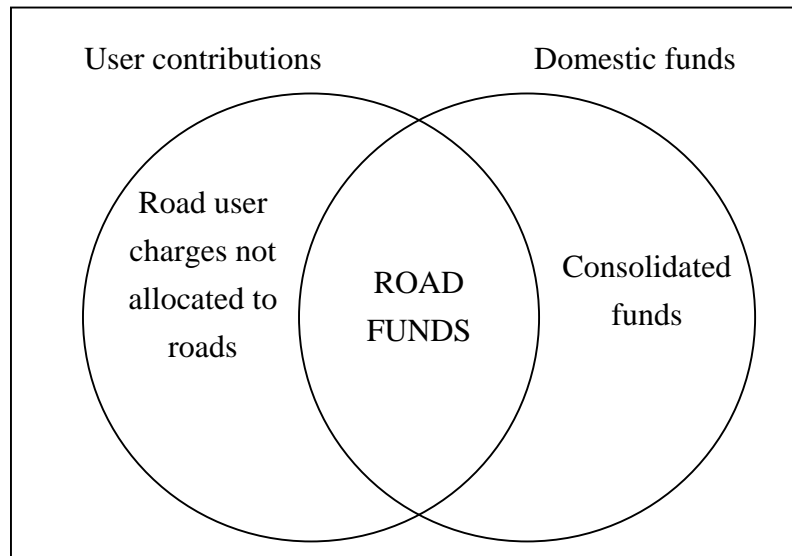


Figure 7 User contribution and domestic funds

As illustrated by **Figure 7**, user contribution comes exclusively from road user charges (including fuel levy, which is also considered a road user charge). The major sources of road user contributions in Ghana are the (1) fuel levy (2) vehicle registration fees (3) vehicle inspection fees (4) international transit fees and (5) road/bridge/ferry tolls. The objective of the government is to ensure that allocated user charges cover at least annual maintenance costs (MRT, 2005, p.21). This objective has been constrained by the low political support for review of user charges. These user charges are legislated and always require parliamentary approval for review, but this political consensus is often difficult to reach. Apart from fuel levy, which has benefited from some increases in recent years to account for inflation and increasing road maintenance costs, the other user charges have not seen any review since year 2000. Due to non-increment, coupled with the decline in value of the domestic currency, the real value of user charges in year 2005 has decreased by about 25-32% of year 2000 figures (MRT, 2003).

Fixing of user charges take into account the damaging effect of vehicle types on the country's road network. They are therefore set based on axle loadings, with heavy vehicle paying relatively higher fees. The same vehicle classification system is used for fixing all types of user charges (see **Table 6**).

Table 6 Vehicle classification and population in Ghana

Category	Description	Vehicle Population
Motorcycles		112 400
Cars	Taxis, private cars (saloon or estate)	427 300
Pick-up/Small buses	Pick-up, landrover, jeep, buses with seating capacity up to 25 persons	48 800
Large Buses	Buses with seating capacity > 25 persons	107 400
Light Trucks	2-axle trucks with single rear wheels	37 500
Medium Trucks	2-axle trucks or tanker with twin rear wheels	16 600
Heavy Trucks	3-axle (or more) trucks or tankers	13 700
Total		763 700

Source Own compilation from DVLA (2006)

2.3.1 Fuel levies

Fuel taxes contribution to the economy is not limited to road financing alone, it is also a source of revenue for other sectors. In the past, fuel received heavy state subsidies by amounts exceeding total revenue from fuel taxes. In 2004, while the total road fund revenue was only about US\$ 100 million, fuel subsidy for the same year amounted to about US\$200 million (Energy Ministry, 2005). Since the implementation of the petroleum deregulation policy, which began in 2003, subsidies for fuel have been largely reduced. Furthermore, ex-refinery prices are determined by an independent body and are based on such factors as prevailing world market oil prices and refinery costs. As can be expected, deregulation led to increases in ex-pump prices. By April 2006, ex-pump fuel prices in Ghana were nearly 500% of year 2000 prices (see *Figure 8* below). With the removal of subsidies, fuel taxes now represent a “true” source of revenue both for the roads sector and for the national economy.

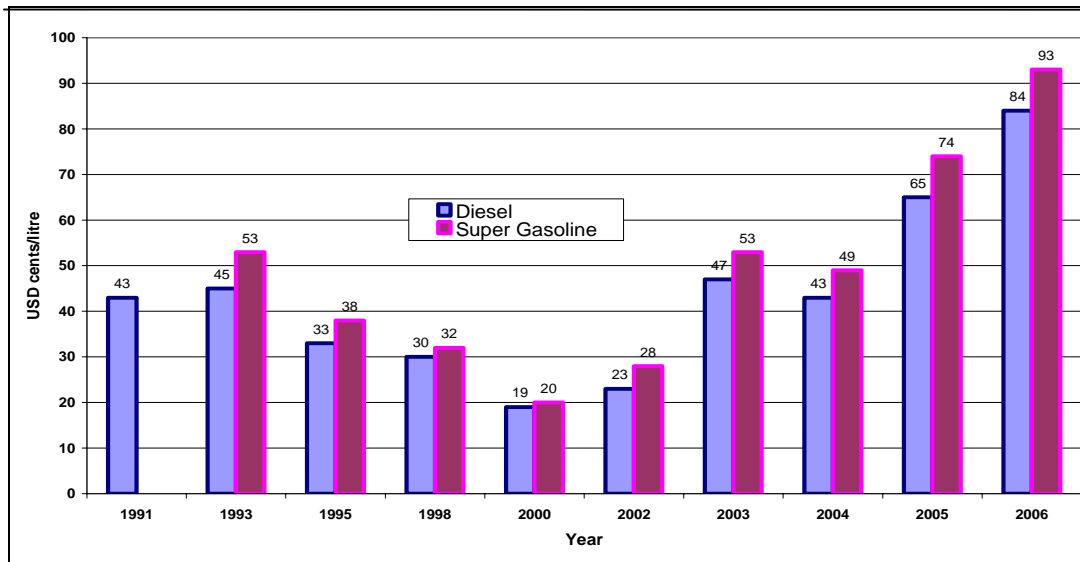


Figure 8 Trends in fuel prices in Ghana

Source: own compilation from GTZ (2005, p.15) and NPA (April 2006)

The fuel levies are legislated and charged per litre of fuel purchased. The total revenue that can be generated is therefore dependent on the amount of the fuel tax and the level of fuel consumption by all vehicles. In estimating the fuel tax revenues, two types of fuel levies are distinguished; that is the “road fund fuel levy” and actual “user contribution” through extra fuel taxes.

The fuel levy, which is factored into the ex-pump fuel price, is usually collected and paid directly by the oil companies directly into the Road Fund.

The road fund fuel levy is that component of fuel tax which goes directly into the road fund and used exclusively for financing roads. User contribution, on the other hand, is the amount of fuel tax in excess of normal sales taxes. The analogy here is that, if fuel should be sold under normal market conditions just like “mineral water”, with no specific fuel related taxes added, then any tax amount in excess of normal sales taxes can be viewed as road users “extra” contribution to the economy. The essence of this distinction is that, by just looking at the road fund fuel levy to “judge” the extent to which road users are “paying their way” we will be underestimating road users’ actual contribution to road funding in the country. In other words, road users may be paying more for using the road network than what the road fund levy revenue is telling us.

In this section, the road fund revenue will be estimated and compared with the actual user contribution. To estimate this user contribution, it is necessary to distinguish between “normal” and “extra” fuel taxes. It is these extra taxes, which represent users’ actual contributions. The road fund component of the domestic funds is obtained from the road fund fuel levy.

In Ghana, fuel taxes and margins constitute 46% of ex-pump prices. The sources of the taxes and how these tax revenues are used are discussed below:

Unified Petroleum Price Fund (UPPF): This fund was initiated by the Government as a means to motivate transporters to travel to rural and distant locations, outside a radius of 200 km from the refinery. The fund has the following objectives:

- To ensure regular supply of petroleum products to all parts of the country,
- To ensure that prices of petroleum products include an element that represents the estimated cost of distribution, and
- To achieve a petroleum products distribution system that is efficient.

A UPPF Management Committee consisting of various stakeholders from the transport industry are responsible for the collection and disbursement of the fund. To benefit from the fund, the Oil Marketing Companies (OMC) presents a report each month detailing total trips made in excess of 200km from the refinery. The committee sets the unit cost of transporting fuel, based on which the OMCs are paid.

Cross-subsidy levy: Here, super gasoline is charged an additional levy, which is used to subsidise prices of other petroleum products e.g. kerosene and premix fuel. This levy will be phased out at the final stage of the deregulation process. At this point there will be no cross-subsidisation at the ex-refinery level. Rather, government taxes on specific products will be varied to ensure the appropriate level of subsidy for each product.

Debt recovery levy: Revenue from this levy goes directly to the Tema Oil Refinery (TOR). The fund is used to pay for TOR's accumulated debt arising from past fuel subsidisation. This levy will be removed once the debts are completely paid.

Road Fund levy: Revenue from road levy is directly channelled into the road fund, which is administered by a Road Fund Board and is used mainly for financing road maintenance activities.

Deregulation mitigating levy: The purpose of this levy is to generate revenue for mitigating the socio-economic impact of the upward price adjustment of petroleum products on the general public, especially the poor. The fund is distributed among the various ministries and government agencies (as part of their annual budget allocations) for provision of social services targeted at the poor. The fund is currently used for subsidizing mass transport (metro buses), capitation grant and low-income housing.

Gross margin: This margin consists of both the dealer and marketer's margins.

BOST margin: Revenue from the BOST margin is paid directly to TOR and the Bulk Oil Storage and Transportation Company (BOST) to fund the development of needed

capacity for providing the required (six weeks) supply reserve. It currently supplies only a two-week reserve.

Table 7 shows the petroleum pricing mechanism used in Ghana and how user contribution is estimated from the various fuel taxes. The pricing mechanism for Ghana is illustrated using data obtained from IMF (January 2004).

The ex-refinery prices are calculated using the world market crude oil prices with mark-ups for insurance, transportation, suppliers' commission, refinery costs and other related charges. The supplier commission, which is often the outcome of tendering and negotiations, is US\$ 12.87 per ton. The suppliers insurance is US\$0.36 per ton. Other related charges including offloading, in transit losses, demurrage, financial costs, storage, in-plant losses, operation margin etc are pegged at 13.9% of Costs, Insurance, and Freight (CIF). In the fuel pricing mechanism illustrated in **Table 7**, world market price of diesel and gasoline used were respectively US\$77 and US\$75 per barrel (June 2006).

Table 7 Description of fuel taxes and margins (September 2006)

Fuel tax /margins	Gasoline US\$ cents/ litre	Diesel US\$ cents/ litre
Ex-Refinery Current Price (1)	46.65	55.21
Excise Duty Specific	7.85	9.95
Cross-Subsidy Levy	5.47	(3.00)
Primary Distribution Margin	0.48	0.48
BOST Margin	0.96	0.96
UPPF Margin	3.06	3.06
Gross Margin	7.11	7.11
"Normal" taxes & margins (2)	24.93	18.57
Debt Recovery Fund Levy	5.47	5.47
Road Fund Levy	6.56	6.56
Energy Fund Levy	0.05	0.05
Exploration Levy	0.11	0.11
Deregulation Mitigating Levy	4.84	0.00
"Extra" taxes (3)	17.03	12.19
Ex-pump price (4) = (1)+(2)+(3)	88.61	86.01
User contribution = (4)-(1)-(2)= (3)	17.03	12.19

Source Own compilation and analysis with data obtained from NPA (September 2006) and IMF (January 2006). Exchange rate US\$ 1=GHC 9,145

From **Table 7** the total user contribution, which is all "extra" taxes, is US\$ 17.03 cents for gasoline and US\$ 12.19 cents for diesel. It is also equivalent to the ex-pump price less ex-refinery price and "normal" taxes and margins. The road fund fuel levy is

currently fixed at US\$ 6.6 cents. This implies that only about a half of what users contribute, in terms of extra fuel taxes, go to fund roads.

The next stage is the estimation of annual fuel consumption. With fuel having limited alternative use in Ghana aside the transport industry, it is convenient to assume that vehicles use all premium and diesel produced. Moreover, since fuel taxes are fixed into the ex-depot prices, consumers' pay the taxes even if the purchased fuel will be used for other purposes. There is current no fuel tax refund for none transport use of fuel in Ghana.

Annual gasoline and diesel consumption in Ghana is about 1.6 million metric tonnes with about two-thirds been gasoline. The estimated user contribution and revenue from road fund fuel levy is presented in *Table 8*.

Table 8 User contribution and road fund revenues from fuel taxes

Fuel type	Consumption [2005]	Revenue from road fund fuel levy		User contribution from fuel	
		Levy	Revenue	“Extra taxes”	Revenue
	Metric tons	US\$-cents	US\$m	US\$-cents	US\$m
Gasoline	652 400	6.56	57.3	17.03	148.8
Diesel	961 000	6.56	72.3	12.19	134.4
Total	1 613 400		129.6		283.2

Source: MRT, 2005 and TOR, 2006.

2.3.2 Vehicle registration fees

In addition to vehicle import duties, imported vehicles are charged a one-time registration fee. This fee is collected by the custom agency and paid directly into the road fund. On average, about 50,000 vehicles are imported annually into the country. Even though the number of registered vehicles continues to increase consistently, revenue is still low due to declining real value of the registration fees.

Table 9 Registered vehicles and current user charges

Vehicle category	Registration fee per vehicle (US\$)	Number of Vehicles registered in 2005	Total revenue US\$m
Motorcycles	5.6	15 150	0.08
Cars	22.0	29 600	0.65
Pick-up/Small buses	33.0	8 700	0.29
Large Buses	43.9	5 600	0.25
Light Trucks	55.6	2 500	0.14
Medium Trucks	72.2	960	0.07
Heavy Trucks	131.8	1 380	0.18
Total		63 870	1.66

Source: Own compilation from MRT (2004). Exchange rate US\$ 1=GHC 9000

2.3.3 Vehicle inspection fees

Vehicles in Ghana are required to undertake a compulsory semi-annual vehicle roadworthiness test. Revenue from vehicle inspection is therefore based on the level of compliance. The current level of compliance is only 40%. To add to this constraint, current fees are low in real terms, as they have not been reviewed since 1998. (See *Table 10* for current inspection fees and estimated annual revenue)

Table 10 Inspected vehicles and user charges in 2005

Vehicle category	Inspection fee per vehicle (US\$)	Vehicles inspected in 2005	Total revenue US\$m
Motorcycles	2.2	89 900	0.20
Cars	2.2	341 800	0.75
Pick-up/Small buses	3.3	39 000	0.13
Large Buses	3.8	85 900	0.33
Light Trucks	3.3	30 000	0.10
Medium Trucks	4.4	13 300	0.06
Heavy Trucks	11.0	11 000	0.12
Total		610 900	1.69

Source: Own compilation from MRT (2004). Exchange rate US\$ 1=GHC 9000

Other constraints on revenue mobilisation from vehicle inspection are (MRT, 2004, p.43):

- incomplete database of registered vehicles, retired vehicles or vehicle due for inspection,

- almost complete reliance on voluntary inspection by vehicle operators due to inadequate enforcement and,
- testing of vehicle before registration does not attract any inspection fee.

2.3.4 Tolls and international transit fees

Tolling of roads, bridge and ferries is another important road user charging instrument. It is a direct charge for the use of specific facilities designated as toll roads or bridges. The fee is based on the axle load configuration of vehicle. In Ghana, only about 4% of the national trunk roads currently tolled. The Ghana Highway Authority, on behalf of the government, has contracted private companies to collect tolls (on roads, bridges and ferries) and pay a fixed monthly amount to the road fund. The road fund board determines the toll rate to be charged by the private companies. All toll revenues are channelled directly into the Road Fund.

International transit fees operate in a similar way. The only difference is that custom agents collect the transit fees at the border, instead of private companies, and pay directly to the road fund. Domestic and foreign vehicles of the same class pay the same transit fees. The transit fees and tolls charged depend primarily on vehicle axle loading.

Due to non-increment current transit fees and tolls are very low compared to international standards. *Table 11* estimates revenues from international transits and tolls.

Table 11 Annual toll road trips and international transits with user charges

Vehicle category	Toll revenues			International transit revenues		
	Fee (US\$-cents)	No. of trips	Total revenues	Fee (US\$-cents)	No. of transits	Total revenue
Motorcycles	2.2	3 237 400	0.07			
Cars	5.5	12 308 700	0.68	2.2	179 500	0.39
Pick-up/Small	8.8	1 405 300	0.12	2.4	76 900	0.19
Large Buses	14.3	3 094 500	0.44	4.4	59 700	0.26
Light Trucks	19.8	1 079 200	0.21	2.6	20 500	0.05
Medium Trucks	19.8	479 300	0.09	4.4	9 200	0.04
Heavy Trucks	44.0	395 600	0.17	5.5	7 200	0.04
Total		22 000 000	1.80		353 000	0.98

Source: Own compilation from MRT (2004). Exchange rate US\$ 1=GHC 9000

Notes: Number of toll road trips and international transits were estimated from year 2005 toll and international transit revenues. Assumption: total toll road trip is distributed in the same proportion as existing vehicle categories.

2.3.5 Total domestic funds and user contribution

Having identified all relevant road revenue sources and discussed the inputs for estimating the annual road revenue, *Table 12* shows the model results of domestic funds and road user contributions. Detailed calculation of the total road fund revenue and user contribution can be found in *Appendix D*.

Table 12 User contributions and total domestic funds for Ghana

Sources	Domestic funds	User contribution
Fuel	129.60	283.30
Vehicle registration	1.66	1.66
Vehicle inspection	1.69	1.69
International transits	0.98	0.98
Tolls	1.80	1.80
Consolidated funds	49.40	
Total	185.13	289.43

As can be observed, total user contribution is about US\$290 million but domestic fund allocated to roads is only US\$185 million. In assessing the extent to which users are contributing to road financing, policymakers must be aware of the fact that over 45% of what they actually pay are not allocated to roads.

2.3.6 Total road costs and available domestic funds

Due to limited financial resources, road budget allocations are often far less than needed funds for both new investment and maintenance costs. As can be observed in *Table 13*, current domestic fund budget is can cover 53% of needed maintenance costs and 47% of annual replacement costs. Periodic maintenance appears to be the most heavily under-funded. The available budget is able to cover only 41% of the expected costs. If the cost of clearing existing backlog is included, then Ghana's existing domestic fund budget is only able to cover 31% of annual road sector expenditure.

Table 13 Comparison between total road costs and available domestic funds

Road activities	Total costs	Available domestic funds	Ratio of domestic funds to total road costs
	US\$m	US\$m	%
(a) Routine Maintenance	33.6	37.5	112%
(b) Periodic Maintenance	120.8	41.0	35%
(c) <i>Total maintenance</i>	154.4	78.5	53%
(d) Replacement	212.5	99.4	47%
(e) Administration	18.3	7.4	41%
Total costs (interest rate=0%)	385.2	185.2	49%
Total costs (extended)	602.0	185.2	31%
(a) Main roads	208.6	78.2	37%
(b) Urban roads	54.4	48.7	91%
(c) Feeder roads	103.9	47.9	50%
(d) Administration	18.3	10.4	57%
Total (interest rate=0%)	385.2	185.2	49%
Total costs (extended scenario)	602.0	185.2	31%

Source own analysis and compilation with data obtained from MRT (2005)

Trunk roads constitute only 26% of the total network size but accounts for 54% of total annual road life-cycle costs. Due to inadequate financial allocation, only 37% of the estimated annual cost of US\$208.6 million for trunk roads is allocated.

3 ROAD FINANCING PERFORMANCE INDICATORS

3.1 Objectives

How do we measure the extent to which sector objectives have been realised? How do we assess the performance of the road administration in the achievement of these objectives? To ensure that results of the model are useful to policymakers and the road administration, performance indicators that are measurable, comprehensive and holistic are developed. The indicators are tools for measuring the road sector performance in terms of revenue generation and allocation and the extent to which these funds cover estimated life cycle costs of the network. To be objective and relevant, the performance indicators ought to be broad enough to capture the essential concerns of the government and road administration (Talvitie, 1998, p.25). They should also be flexible enough for use across different country contexts, and specific enough to be measured.

To summarise, performance indicators developed in this chapter is intended to assist the road administration to:

- assess the degree to which road sector programmes have achieved their intended objectives,
- assess the efficiency in the road administration in implementing sector policies,
- develop alternative means of achieving financial objectives – for example by considering alternative sources of user revenues or cost minimisation strategies, and to
- make comparison between different countries – i.e. through benchmarking and providing opportunities for sharing experiences.

Since the purpose of developing performance measurement tools is to monitor performance and reveal areas of road asset management that require improvement, it is important that the appropriate indicators are identified. The road administration should use its vast experience and data collected over the years to identify relevant performance indicators. Perhaps the most important criteria for the selection of indicators are that they should be both relevant to the country context and measurable at reasonable costs.

Two sets of performance indicators are discussed in this section, namely; key and secondary indicators.

3.2 Key performance indicators

3.2.1 Definition

Based on the objectives of the thesis, the definition of key performance indicators for the road sector includes the three main measurement parameters, namely; user contribution, domestic funds and total road costs. The key indicators therefore examine specific performance measurements such as allocated domestic funds as share of users' actual contribution, and domestic funds in relation to estimated road life-cycle costs. For example, user contribution in relation to total road costs measures the extent to which road users are contributing to the financing of road network life cycle costs. It also attempts to ask the questions; are current user charges high enough to recover expected costs? Will user charges have to be increased? Should government consider alternative sources of revenue?

The indicator – domestic funds in relation to total road costs – is concerned about the funds allocation issues. It asks the question; how much of domestic financial resources are invested in roads? It measures a country's effort in financing its road network. It indirectly measures the extent of donor support required for a sustainable financing of the network. Finally, by comparing this indicator with user contribution it is possible to estimate the extent to which the road sector cross-subsidizes other sectors of the economy.

Table 14 defines and describes these key performance indicators.

Table 14 Key performance indicators

Performance Indicator	Description	Purpose	Considerations	Source
User contribution in relation to total road costs	The expected user contribution (to the economy) in comparison with total road costs.	To what extent are user contributions covering estimated total road costs?	Total user contribution expressed as percentage of total road costs.	Own contribution
Domestic funds as share of total road costs	The expected funds from domestic sources in comparison to total road costs.	Is the country able to fund estimated road life-cycle costs solely from the allocated domestic funds?	Total domestic funds expressed as a percentage of total road costs.	Own contribution
Domestic funding as share of user contribution	The proportion of user contributions that actually goes to fund roads.	What is the extent of cross-subsidization between the road sector and other sectors?	Total road fund revenue expressed as a percentage of total user contributions	Own contribution

3.2.2 Results

This indicators measure the extent to which existing user contributions and allocated domestic funds cover estimated life cycle costs of the road network.

Table 15 Key performance indicators

Performance indicator	Ghana
User contribution in relation to	
(a) routine maintenance costs	862%
(b) total maintenance costs	194%
(c) total costs (base scenario)	76%
(d) total costs (extended scenario)	48%
Domestic funds in relation to	
(a) routine maintenance costs	551%
(b) total maintenance costs	124%
(c) total costs (base scenario)	49%
(c) total costs (extended scenario)	31%
Domestic funds as share of user contribution	54%

User contribution

From *Table 15*, existing user contributions in Ghana are sufficient to cover all expected maintenance costs but can fund only up to 76% of the estimated total road costs. This implies that if government decides to allocate all revenues from road user charges to the road sector, these user contributions are sufficient to finance up to 76% of expected road costs. Moreover, if the cost of clearing existing maintenance is included, then user contribution can cover only up to 46% of total road costs.

This funding gap means existing user charges do not sufficiently cover the cost of the road network and government must develop strategies to address this funding shortfall.

Domestic funding

On domestic funds as share of user contribution, the results show that only 54% of what road users in Ghana contribute is eventually allocated for road financing. This also implies that 46% of what road users in Ghana are contributing actually goes to subsidize other sectors of the Ghanaian economy. Again, existing allocated domestic funds are sufficient to fund road maintenance, but are only able to finance 49% of the total costs in Ghana. If the costs of clearing current maintenance backlogs are included, domestic funds are only able to cover 30% total road costs in Ghana.

3.3 Secondary performance indicators

3.3.1 Definition

The secondary indicators (described in *Table 16*) measure indirect impacts of road sector under funding and also help in appropriately interpreting the key indicator figures and to make cross country comparisons. For example, if country A has a higher user contribution as share of total road costs than country B, it may not necessary mean that road users in A are paying higher user charges compared to B. it may fair comparison it will be important to consider the various parameter which affect values of the key parameters. Countries with say a low level of motorisation may still have a higher user contribution if user charges are higher. This implies that the key parameter does not consider what individual users are paying but rather the aggregated amount. Again, countries with huge network size, because of say dispersed population, will have relatively higher network life cycle costs with must be must be financed by few users. Network size and level of motorisation will therefore make significant differences in indicator values measure at the macro and the micro levels.

Some examples of the secondary indicators used are road density and road costs in relation to annual GDP, user contribution per vehicle, total road costs per vehicle and total road costs per citizen.

Table 16 Secondary Performance Indicators

Performance Indicator	Description	Purpose	Considerations	Source	Benchmark (target)
Road density	Road length per land area	To measure the extent of a accessibility by road	Total network size divided by the country's land area. Measured in km/km ²	Own contribution	N/A
User contribution per vehicle	The average expected user contribution (to economy) from each registered vehicle	To estimate the expected (and relative) contributions from each vehicle	The user contribution per vehicle is the annual expected contribution from each vehicle	Own contribution	N/A
User contribution as share of GDP	The total amount road user contribution to the economy, measured in relation to annual GDP	To estimate road users contribution to the economy	The user contribution per GDP is the annual expected contribution from road users as a percentage of annual GDP	Own contribution	N/A
User contribution per capita	The average expected revenue from each citizen	To estimate expected revenue when population size is known	The user contribution per capital is the annual average expected revenue contribution from each citizen	Own contribution	N/A

Performance Indicator	Description	Purpose	Considerations	Source	Benchmark (target)
Allocated domestic funds as share of GDP	Total annual funds from domestic sources as share of annual GDP	To monitor the extent of national self-support to network preservation	Domestic funds allocated to the road sector expressed as a percentage of GDP	Own contribution	N/A
Road maintenance costs as share of GDP	The ratio between estimated cost of road maintenance and GDP	To measure the road maintenance burden on government	Total road maintenance costs as percentage of GDP. Useful for cross-country comparison	Heggie I.G. (2004)	0.5-1.0 %
Total road spending as share of GDP	The ratio between annualised life cycle cost of road and GDP	To measure the road costs burden on government	Estimated road costs as percentage of GDP. Useful for cross-country comparison	Heggie I.G. (2004)	1.0-2.0 %
Affordable (or maintainable) network	The percentage of road network, which can be effectively managed or maintained.	To estimate the network size that can be effectively managed by the Road Authority.	Represent the proportion of the national road network which can be adequately maintained from available funds	Own contribution	N/A

3.3.2 Results

The second set of indicators, previously defined and described in *Table 16* in Appendix B, examines more general performance indicators, which can assist stakeholders in properly interpreting the results of the key indicators (see *Table 17* for results of secondary performance indicators).

Table 17 Secondary performance indicators for Ghana

Performance indicator	Ghana	Unit
Road density	0.21	km /km ²
User contribution per vehicle	379.0	US\$/year
User contribution as share of GDP	3.3	%
User contribution per capita	13.8	US\$/year
Domestic funds as share of GDP	2.1	%
Road maintenance costs in relation to total road costs	39.3	%
Road maintenance costs as share of GDP	1.7	%
Total road costs as share of GDP	4.3	%
Affordable network (with domestic funds)	35.7	%
Affordable network (with user contribution)	76.2	%

User contribution

If a government policy requires that road costs be solely financed from user charges, then with the same network size and comparable costs, countries with higher levels of motorisation can expect to have relatively lower user charges. To what extent should users contribute to financing an oversized network? Will it be economically justifiable for road user to pay for roads, which have been oversupplied?

Road maintenance costs

Road maintenance is an important component of a road-financing plan. The cost-revenue model indicates that to ensure that maintenance is not under funded, road maintenance funds should be about 39%. In other words, for maintenance to be fully carried out in Ghana, on an annually basis, government must allocate 1.7% of annual GDP for road maintenance. The total road cost as share of GDP is 4.3%. This figure will be higher if the costs of clearing existing maintenance backlogs are included. Currently government annual road budget allocation from domestic sources to the road sector stands at 2.1% of GDP – which is roughly 50% of what is actually required. Current maintenance spending is 0.9% of GDP. *Table 18* compares maintenance spending among selected developing countries.

Table 18 Road maintenance spending in relation to GDP

	Year	Maintenance expenditure US\$ million	GDP in 1998	Maintenance as share of GDP
Africa:				
Benin	1996	6	2 300	0.25
Burkina	1996	9	2 600	0.33
Kenya	1996	202	11 580	1.74
Lesotho	1996	13	790	1.64
Malawi	1996	7	1 690	0.41
SA	1996	720	133 500	0.54
Tanzania	1996	43	8 000	0.54
Average				0.78
Latin America:				
Bolivia	1996	58	8 590	0.67
Costa Rica	1996	32	10 480	0.30
Ecuador	1997	89	18 360	0.48
Average:				0.49
Asia:				
Korea	1996	1 780	320 750	0.56
Thailand	1996	878	111 300	0.79
Average				0.67
Eastern Europe:				
Croatia	1998	100	21 750	0.46
Czech	1998	240	56 380	0.42
Hungary	1998	305	47 800	0.64
Latvia	1998	76	6 400	1.19
Lithuania	1998	58	10 700	0.54
Poland	1998	1 100	158 600	0.70
Slovakia	1996	240	20 360	1.17
Slovenia	1998	320	19 500	1.64
Average				0.84

Source: International Road Fund 2000. World Road Statistics, Geneva.

Affordable (or maintainable) network size

Supposing domestic funds are the only sources of funds for the road sector, then this means that based on existing level of domestic funding, only 36% of Ghana's road network is "affordable". On the other hand, if user contributions are the sole source of sector financing and if all were allocated to the road sector, then up to 76% of Ghana's road network is maintainable with current user contributions.

Another indicator, which measures the burden of road costs on a country, is road density. As can be expected, countries with higher road densities (measured in km/km²) will have relatively greater road funding burden compared with countries

with lower road densities. Higher road density means greater accessibility, but it also implies higher required road investment and maintenance costs. It is therefore important for a country to strike an appropriate balance between the need to increase accessibility - by building more roads – and reducing life cycle costs by keeping to an affordable (or maintainable) network size.

3.4 Trend analysis: required funds, available funds and reliance on donor funds

Total funds released to the road sector have been on average US\$ 200 million per annum. On average government has contributed some US\$ 110 million and the donors some US\$ 90 million on an annual basis (Danida, 2000).

Trend analysis over the past decade shows that funding for the road sector has been very unpredictable. There has been a consistent disparity between required road sector funds and actual realised (or available) funds. During the implementation of Government’s Highway Sector Investment Programme (HSIP¹ for the period 1996-2000), average annual releases for the road sector amounted to US\$200 million. These annual releases declined to US\$115 million on average for the period (2001-2003).

Table 19 Comparison of required, approved and released funding (1996-2003)

Year	Required funds	Approved funds	Released funds	% Required funds released
1996	284	264	204	72
1997	310	238	233	75
1998	402	244	220	55
1999	375	208	219	58
2000	357	216	135	38
2001	280	110	95	34
2002	295	205	109	37
2003	402	223	143	36
Average	338	213	170	50

Evaluation of the HSIP for the period 1996-2003 indicates that, due to limited available funding, only 63% of required sector programmes were approved and only 50% of the required funds were finally released (see *Table 19*). As can be observed,

¹ The HSIP was developed by the MRT with donor agencies in 1996 on finding a common approach to road maintenance and development. The objective was to address a common programme, remove duplicity and multiplicity of efforts and achieve a common goal of improving road infrastructure in the country (Source: MRT, RSDP Review Report 2003)

the released funds have been declining both in value and as share of required funds. This shortage of funding, together with high rate of inflation, resulted in deferred execution of both road maintenance and road development programmes. The shortfall also indicates that projects with very high economic returns are not been undertaken because of lack of liquidity (MRT, 2004).

Another trend worth discussing is the extent to which the road sector reliance on donor grants and loans. Even though road funds releases are increasing and taking a larger share of total available funds, the sector still depends very much on donor support to meet both road maintenance and asset replacement requirements (see *Figure 9*).

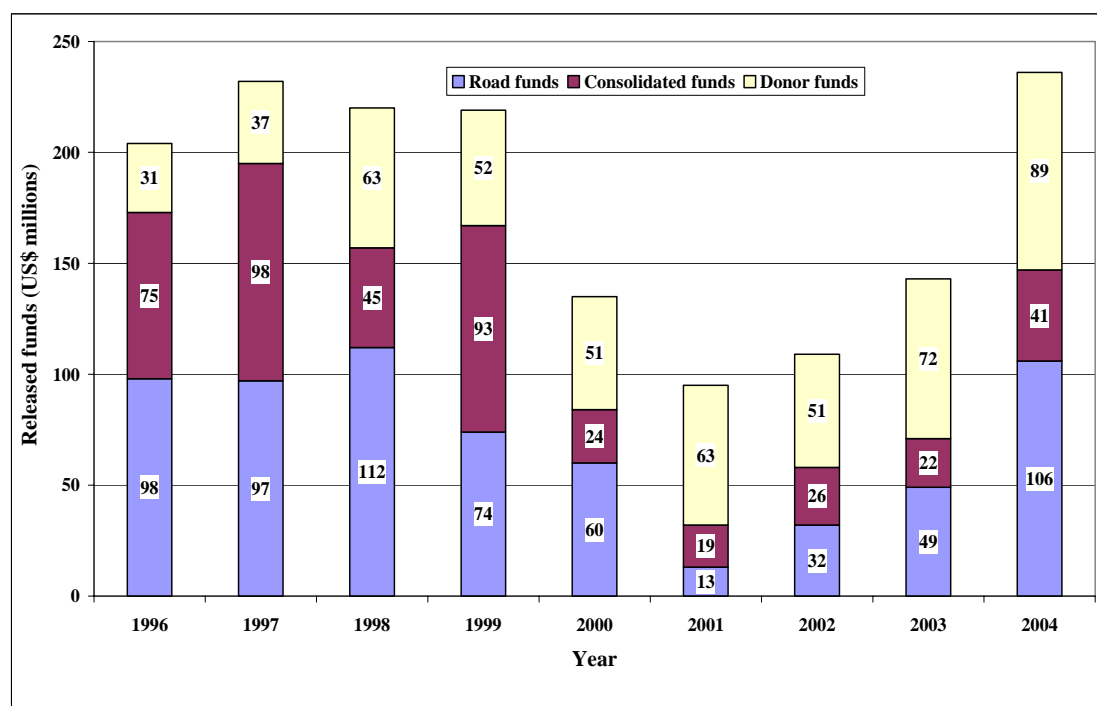


Figure 9 Road sector financing trends in Ghana (1996-2003)

Donor support for the implementation of the Road Sector Development Programme (RSDP, 1996-2003) was about US\$530million, representing about 40% of total funds released during the period.

For the planned programme 2002-2004, donor contribution secured was US\$877million (about 70% of estimated total road sector budget). This target was not achieved, a situation which resulted in backlog of road maintenance for that period. The financial status of the RSDP (2002-2004) as of June 2004 is shown in the *Table 20* below. The table also shows the main donors, and their contributions, over the past decade (MRT, 2003).

Table 20 Financial analysis of the RSDP as of June 2004

Funding Source	Secured Fund (US\$m)	Commitments (US\$m)	Disbursements (US\$m)
Consolidated Fund ²	114	60	51
Road Fund ³	230	281	-
HIPC	9	9	9
AfDB	133	53	19
BADEA	17	14	8
AFD	22	25	12
Chinese Govt.	28	28	-
Danida	66	9	10
DFID	60	35	28
Dutch Government	27	-	-
Ecowas	6	-	-
EU	100	61	18
IDA	238	176	62
JICA	93	93	5
KfW	58	58	16
Opec Fund	21	17	12
Saudi Fund	11	-	-
Total Fund	1 203	918	249

Source: MRT (March 2005). *First Quarter Report*. (Electronic Version) Accra: Ministry of Roads and Transport, Ghana.

To elaborate, by mid-2004 cumulative donor fund commitments and disbursements amounted to only 56% and 40% of secured donor funds respectively (from **Table 20**). Although donor funds have been critical in financing past needed road improvements, existing level of disparities between secured, committed and actual disbursed donor funds clearly indicates that government cannot (or must not) rely on donor pledges for long-term financial planning of the road sector. Discussions with road administrators in the country appear to suggest that government is aware of the fact that a long-term measure to sustainably fund the road sector is taking steps to increase the Road Fund share of total sector budget. There is a consensus that, to finance the road sector on a sustainable basis it must be made less dependent on donor support. In order to meet increasing road funding needs, government plans to expand the user-pays concepts generate more funds from road users.

² Funding provided for the period 2002-2004

³ Funding provided for the period 2002-2004

The next chapter discusses the current state of highway tolling, in the context of private sector participation initiative in infrastructure financing in the country. It particularly reviews existing shortcomings with toll management and operations systems, legal framework and suggests ways of improving on existing tolling operations in the country.

4 STATE OF HIGHWAY TOLLING IN GHANA

Due to dwindling budgetary allocation for routine and periodic maintenance of roads in Ghana, the Government under the Ghana Road Fund Act 1997 endorsed road tolling as one of its major sources of revenue. Toll revenues currently constitute about 2.5% of total Road Fund revenue. Unfortunately, tolling as a source of Road Fund revenue is not properly developed. With the implementation of current policies on tolling of roads in Ghana this share is expected to increase.

In Ghana, only the Accra-Tema Motorway and selected bridges and ferry crossings were initially tolled under the Toll Decree, NRCDC 153 (1973)⁴. With further developments in the road sector from the 70's through to the 90's came the need to expand the principle of "fee-for-service" towards the cost of road maintenance and reconstruction of roads across the country. Since 1999 approximately 280km of additional highways have been tolled.

The Ghana Road Fund Board is responsible for collecting tolls on selected roads/bridges on the national road network, depending on traffic levels, the condition and importance of the infrastructure. The Ghana Highway Authority and some private firms collect the tolls on behalf of the Board.

4.1 Existing legislative framework

The Public Works Department was responsible for toll collection at the inception. The responsibility was transferred to the Ghana Highway Authority on its creation in 1974 under NRCDC 298. This function has been retained under the GHA Act, 1997 (ACT 540).

The Tolls Decree (1972) empowered the then commissioner of Works and Housing to make regulations by Legislative Instruments declaring any road, bridge and ferry to be tolled, fix the tolls to be levied and to exempt any class of motor vehicles from the payment of such tolls.

The current legal basis for private sector involvement in the development toll roads are the Ghana Investment Promotion Centre (GIPC) Act, 1994 (Act 478) and the Ghana Highway Authority Act, 1997 (Act 540). The GIPC Act provides that non-Ghanaians may invest and participate in any operations in Ghana. By virtue of this provision, BOT road projects may be lawfully undertaken.

⁴ Ministry of Roads and Transport, Government's Policy on Tolling of Roads, Ghana, January 1997. p.1.

The GHA Act specifically empowers the Authority, subject to cabinet’s approval, to negotiate concession agreements with private sector entities to enable them finance, build and operate selected trunk roads as toll roads.

The draw back in the legal framework of the provisions for private sector participation is that the policies (MRT, 2003)⁵ are still very general in outlook and do not appear to provide any specific guidelines, processes and procedures by which road projects may be undertaken under the various financing schemes.

4.2 Toll road network

The key criteria for selection of roads for tolling is the traffic level, which gives an indication of possibility of regrouping investments made within an agreed concession period for the operation of the facility. Irrespective of the total length, each toll road has only one toll point.

Table 21 Existing toll roads and the locations

	Name of Road	Location of toll station	No. of toll Points	Length (Km)
1	Accra – Tema	Tema Accra	1 1	20
2	Kumasi – Sunyani	Tabere, Ashanti Region Bechem, Brong Ahafo R.	1 1	129
3	Kumasi- Mampong - Ejura	Aboaso, Ashanti Region Kyeremfaso, Ashanti R.	1 1	85
4	Tema – Akosombo	Afienya, Greater Accra	1	75
Total				309

Source: GHA (2004, p.1). *Report on Traffic Studies on the 13 No. Road /Bridge Sites for the Ghana Road Fund*. Ghana Highway Authority.

⁵ Ministry of Roads and Transport, Government’s Policies on Tolling of Roads, Draft Policy Paper, MRT, Ghana; January 2003.

Table 22 Existing toll bridges and their locations

	Name of bridge	Location of toll station	Number of toll points
1	Adomi	Atimpoku, Eastern Region	1
2	Sogakope	Sogakope, Volta Region	1
3	Kade	Kade, Eastern Region	1
4	Assin Praso	Assin Praso, Central Regions	1
5	Adiembra	Adiembra, Ashanti Region	1
6	Ankobra	Ankobra, Western Region	1
7	Jumoro	Jumoro, Western Region	1
8	Bamboi	Bamboi, Northern Region	1
9	Asukawkaw	Asukawkaw, Volta Region	1

Source: GHA (2004, p.1). *Report on Traffic Studies on the 13 No. Road /Bridge Sites for the Ghana Road Fund*. Ghana Highway Authority.

With appropriate policies that involve the private sector, Ghana can expand its existing toll road network and serve as a good source of road funding in the country. Some developing countries have successfully developed toll road concessions of which Ghana can share in their experiences.

Table 23 below summarizes the scope of toll road provision in selected countries in comparison with Ghana. The trend towards increased tolling of road is very clear. Toll roads in these countries form a significant proportion of their expressway network and plays important role in intercity and international trade. It has also been an important source of revenue for funding road construction and road maintenance activities.

Table 23 Toll road network size in selected countries

Country	Total road network	Total expressway network	Tolled road network	Tolled roads	Tolled roads
	km	km	km	(% total)	(%)
Argentina	500 000	10 400	9 800	1.96	94
Brazil	1 980 000	-	856	0.04	-
Chile	79 800	-	3	0.00	-
France	966 000	14 900	6 300	0.65	42
Hungary	156 600	440	57	0.04	13
Indonesia	260 000	530	530	0.20	100
Italy	314 360	6 400	5 550	1.77	86
Japan	1 144 360	15 100	9 200	0.81	61
Korea,Rep.	77 000	1 880	1 880	2.44	100
Malaysia	94 000	1 700	1 130	1.20	66
Mexico	303 260	5 700	5 680	1.87	100
South Africa	525 000	1 440	825	0.16	57
Spain	343 200	7 200	2 250	0.66	31
Ghana	40 190	30	309⁶	0.77	100

Sources Heggie and Vickers (1998). *Commercial Management and Financing of Roads*. Technical Paper No. 409. World Bank, Washington, D.C., USA.

4.3 Private sector participation

Considering the proportion of the road network in poor condition, roughly 40% by 2003 (MRT, 2004), it will take the Government of Ghana, even with development partner support, a very long time to clear existing backlog of required maintenance works. The need for private sector support in road transport financing and management is therefore crucial for road network preservation and economic growth.

The following concurrent events have strengthened the justification for the involvement of the private sector in the development and tolling of roads in Ghana:

- Shortfall in traditional sources of revenue,
- growing popularity and acceptance of the fee-for-service concept and
- the trend to privatise services

Management and operation of tolls has been the responsibility of the public sector since the inception of tolling in the country in 1963. The Accra-Tema motorway is the

⁶ Only 30km of the road network is expressway. Some truck roads (total of about 280km) have also been tolled in addition to the 30km expressway.

first highway in the country to be tolled. The Ghana Highway Authority collected tolls on the Accra-Tema motorway and other highways, which were subsequently tolled, but the process was plagued with many problems. Some of the problems encountered with the public collection arrangement were:

- laxity in ensuring that all users of the facility pay approved pays,
- leakages in revenue collected and
- ineffective monitoring and control systems

Due to the above shortcomings with the public sector toll collection, the need to involve the private sector became more imminent. In 1999, a pilot scheme of involving the private sector in the collection of toll was introduced. In this scheme, individual private companies could bid for toll collection contracts. The contract basically allows the private sector to collect tolls at the various toll plazas and then pay a fixed monthly amount into the Road Fund Account.

The involvement of the private sector in toll collection led to about 50% increase (including agency overheads) in revenue generation on Accra-Tema Motorway alone. Government intends to fully explore the possibility of the private sector participation in the development of toll roads in an effort to access additional funds for improving the road network. The major schemes identified (MRT, 2003) are

- Build, Operate and Transfer (BOT and its derivatives
- Rehabilitate, Operate and Transfer (ROT) and its derivatives
- Maintain, Operate and Transfer (MOT) and its derivatives and
- Toll Collection Only

4.4 Toll collection contracting

The existing practice of involving the private sector in the management and operation of road toll collection is through competitive tendering. The main objective has been to maximize toll collection to meet routine and periodic maintenance. The Ghana Road Fund Board selects candidate roads for tolling based on set guidelines that include road quality and traffic volume. The scope of the services to be provided in a Toll Collection Only contract typically includes:

- Management and collection of approved tolls on the toll roads;
- Payment of agreed monthly amount into the Road Fund Account;
- Provision of needed security for the safety of the collection and
- Maintenance of the toll facility.

The bid defines the responsibilities of parties and calls for submission of both technical and financial proposals from prospective bidders. The contracts are awarded

for a two-year renewal option, with negotiation of the monthly fee at the break point. The contract states the fee for each class of vehicle and the expected monthly remittance to the Road Fund Board for each candidate road.

Table 24 Existing toll collection companies and contracted annual remittances

Infrastructure type	Toll collection company	Annual remittance (US\$)
Roads		
Accra – Tema	Crown Channel	280 000
Tema – Accra	Sedan Ventures	325 000
Kumasi – Sunyani	Oti Yeboah	200 000
Sunyani – Dormaa – Ahenkro	Kapkkon	79 000
Kumasi – Mampong - Ejura	Seidu Mahama	135 000
Kintapa – Tamale - Bolgatanga	Alolo Brothers	167 000
Tema – Akosombo	Crown Channels	122 000
Bridges		
Adomi	K.D.V. Lexicon	90 000
Beposo	Abba Bild. Centre	173 000
Dunkwa-On-Offin	Top Target	20 000
Sogakope	Prime Stars	96 000
Total		1 687 000

Source PricewaterhouseCoopers, (March 2004). *Preparation of the Economic, Financial, Technical and Administrative Framework for Road Concession Projects in Ghana*, Inception Report, Ministry of Roads and Transport, Ghana. p.19.

4.5 Toll management and operation

4.5.1 Tolling Method

Manual collection method is currently used on all toll roads in Ghana. The drawback is that it is slow and has been one of the major causes of congestion on toll roads in the country especially the Accra-Tema Motorway. It has also been a source of road accidents. There have been cases where vehicles ran into tollbooths as well as bumper-to-bumper accidents as vehicles queue at toll points.

4.5.2 Ticketing

Tickets are printed by the GHA. They are in the denominations of ¢200, ¢500, ¢800, ¢1000 and ¢2000. Combinations of these tickets are also used. For example, ¢500 and ¢800 for vehicles that have to pay ¢1300. Crown Venture, operators of the Accra-

Tema Motorway operates three (3) work shifts; these are; 7am-1pm, 1pm-7pm and 7pm-7am. Toll Collection is done everyday of the year.

Crown Venture has put in place measures to minimize revenue leakages. These include “Stop Checks” by security staff at the toll points to ensure that drivers pay. There are also random checks on Collectors. The relative better service conditions offered by the private operators to their collectors appear to have helped minimize pilfering of toll revenues as was commonly associated with GHA management.

4.5.3 Safety and security

It is the responsibility of the operator to ensure safety of motorist, pedestrians and vehicles in and around the immediate environs of the toll points as well as provide a service patrol along the toll road. Crown Ventures Toll operators have Workman Compensation Insurance with State Insurance Company (SIC) for their staff.

The company has employed security agents to ensure the safety of toll collection personnel. There have also been attempted cases of armed robbery at toll points in the past.

4.5.4 Toll rates

The toll rate to be paid by each category of vehicles is set by the Ghana Road Fund Board. The operators are required to display a copy of the approved toll rates in a conspicuous location within the toll point for the information of all motorists at all times. The vehicle categorization for tolling purposes is done by the Board. The Board also determines which classes of vehicles are exempted from paying tolls.

There is currently no road pricing formula being used in the determination of tolls. They are very low compared to international standard and are the same for all roads and bridges irrespective of the condition or level of service provided by these infrastructure. There are periodic percentage adjustments, but prices have not been adjusted since 1997 even though consumer price index has increased by approximately 135% between 1997 and 2005.

There is need to research into and apply road pricing in Ghana, so that prices reflects cost of actual road use. Tolls are levied on a single point basis, with most roads and bridges having only one toll plaza, irrespective of their length. Existing tolls are not distance related. It is intended that on the longer roads toll plazas should be spaced at intervals of about 50km, depending on junction layout. but considering existing low levels of toll rates, it does not appear economical to invest in the provision of more toll plazas.

5 PUBLIC PERCEPTION SURVEY ON HIGHWAY TOLLING IN GHANA

Funding for highways come from the Consolidated Fund, the Road Fund and donor assistance. However, total revenues from these sources are not adequate for meet the financial requirement of highway network expansion and maintenance. Currently, road and bridge tolls account for less than 5% of total road funds for only maintenance activities. To bridge the existing gap between available funding and needed highway improvement and maintenance in the country, the Ghana Road Fund is putting in place the system expansion of toll roads involving the use of various concession schemes. To ensure sustainability of any road concessioning policy, it is imperative to assess the level of support from stakeholders in the transport industry - especially highway users. A toll road policy cannot be successful in the long run without sufficient public support, which should be reflected in road users' willingness-to-pay. This chapter reports on a public perception survey conducted in Tema in April 2006.

5.1 Survey background

The target group of this survey was the users of the Accra-Tema Motorway. Accra is the capital of Ghana and Tema is the country's industrial hub and one of two harbour cities in the country. This toll road was selected because it is currently the only motorway in the country and has the required features that make it suitable for a typical concession scheme. This 20-kilometre dual-carriage has Portland cement concrete surfacing and daily traffic in excess of the required 15,000 vehicles threshold for typical BOT concession projects.

The purpose of the survey was to inform road users about a set of road tolling policies designed to improve road transport operations and help refinancing of highways in Ghana, and to estimate respondent support for those policies. After receiving some information about these policies, respondents were polled on whether they would support a tolling scheme that will require them 'to pay more for better roads'. The subject of the survey was public support for improved toll road operations in Ghana.

The specific objectives of the survey were the following:

- Assessment of level of public satisfaction with existing tolling operations,
- Public expectations from government and toll road operators,
- Public willingness-to-pay higher tolls and
- Public recommendations for improved road transport service delivery

The survey intends to achieve two important goals; firstly, the Ghana Road Fund Board can use the results of this survey to plan an information campaign to increase awareness of and support for tolling, and secondly the results can also be used to better inform and shape road tolling policies in Ghana by addressing road users concerns.

5.2 Survey description

The survey target group was private car drivers resident in Tema who use the Accra-Tema Motorway. The survey sample was a stratified random sample of adults above 18 years. Adults who own or use private cars but do not use the Accra-Tema Motorway were screened out. The excluded drivers might be expected to be more supportive of any tolling policy, as they will not be paying into the system. The survey initially included the public transport drivers. However, taxi and trotro (mini bus) drivers contacted preferred presenting a common opinion through their “Station Masters”. Their views will therefore be discussed under Survey Results but will not be analysed statistically.

The interviews were conducted with the assistance of four students from the University of Ghana. Respondents were selected and contacted at random in their homes and at various car parks. The questionnaires were uncomplicated and required straight forward answers. The average survey length was 15 minutes.

There were a total of 23 questions in the survey and a total of 115 completed interviews. The survey was conducted in the English language but some respondents gave answers to some questions in a local Ghanaian language (Twi). All the interviewers speak perfect Twi and therefore had no difficulties explaining questions in the Twi language so as to get the required responses. Furthermore, many Ghanaians speak Twi, especially those living along the middle and southern belt of the country. Some interviews were refused, but the cooperation rate⁷ was approximately 90%. The high cooperation rate was perhaps due to the fact that respondents were interviewed under a relaxed atmosphere of their homes or at their workplaces. Generally respondents were willing to be interviewed; it appeared many of the respondents saw the interview as a special opportunity to express their opinion on an important national issue. Transportation is a very important subject for residents of Tema, especially for workers who travel in and out each day to work in Accra

⁷ Cooperation rate is defined as the quotient of total completed interviews and the total viable contacts that qualify as respondents.

using the country's only motorway. Actually, for most residents of Tema who work in Accra, there is no viable alternative route to the motorway. The existing alternatives, "Beach Road" and "Spintex Road", are single carriageways, which are often congested especially during the morning and afternoon peaks.

There were few instances of item non-response. The items with the highest non-response rate were time-savings using motorway compared with the alternative routes and household income. Though most respondents believe they make significant saving by using the motorway, only 45% could easily estimate their average travel times on the motorway and on other alternative routes. Again, 19% of respondents were unable to provide information relating to their household income. There appear to be two classes of people in this group. One group consists of people who were perhaps not willing to provide any income related information because they felt it was very personal. The other group consist of people who worked in the informal sector and by the nature of their jobs it is difficult to estimate a monthly household income.

The survey questionnaire consisted of three main parts. The first part elicited from respondents standard demographic information: age, gender, household size, car ownership, employment status and income. However, income was the last question asked in the survey because of the very personal nature of it. The second part of the survey asked fairly detailed questions about the respondents travel behaviour such as trip purpose, frequency of travel, travel mode, use of toll roads and existence of alternative routes. Both demographic and respondents travel characteristics were to be useful in estimating respondents' toll payment obligations and also explaining the observed voting patterns elicited by the survey.

The final set of questions, drew from respondents their opinion on issues such as road congestion, road safety, toll evasion, preferred toll management and financing options and willingness to pay.

5.3 Survey results

The issue of public perception of existing level of tolls is very crucial for correctly assessing users support for a new policy that will require toll rate increases. Most respondents (85%) think current toll levels are "just ok" compared with 13% who believe existing **toll rates** are either "high" or "too high". On the contrary, transport administrators interviewed claim existing toll rates are very low because there have

not been any increases since 1997 even though consumer price index has increased by more than 130%.

In order to measure willingness to pay higher tolls, respondents were asked to state the **highest toll** they were willing to pay. To ensure a common understanding, respondents were made to select the toll rate beyond which they are more likely to consider using a public transport or a non-tolled alternative route to their destinations. Since respondents were not assured of any improvement on the existing road as a precondition for toll increases, the stated tolls represent the highest tolls users wish to pay taking into account the existing level of service of the road. Only 22% of respondents were more likely to change to public transport or use an alternative non-toll route should there be any increases in current toll rate. At least 60% were more likely to accept up to 100% increases in existing toll rate and approximately 6% could afford 10 times current rates. It was also observed that respondents who initially said existing rates were either “low” or “very low” were willing to pay at least twice the current rates. Finally, 21% of those who think existing toll were “just ok” to “very high” were less likely to accept higher tolls.

Students and the unemployed, perhaps because of their low economic status, appear less likely to accept any toll increases. About a third in these groups was also less likely to support any toll increases and may consider changing travel mode or route should there be any increases in tolls. Again, people who use the motorway to get to their work places were more likely to accept toll increases. This is because they are likely to value getting to work on time than those visiting or shopping. There was no clear correlation between household size and willingness to pay. It could be expected that users with bigger household sizes already have high expenditure and may be less willing to spend more on transport.

Furthermore, 44% of respondents did not have **alternative routes** to their destinations. There were no significant differences in support for toll increases between users with alternative routes and those without alternatives routes. It is more likely that because they have no other option, apart from travelling by public transport, users without alternative routes to their destinations will more likely accept future toll increases. Considering the fact that these alternative routes are often congested during peak hours, they will be less likely options for workers – who may value getting to work on time. About 80% of all respondents claim they save between 50% to over 100% of their time by using the motorway.

More than half of the respondents spend between ₺200 000 (US\$22) and ₺1million (US\$110) on **vehicle maintenance**. This excludes the cost of fuel and other operating costs. Moreover, approximately 15% of households spend over US\$220 on vehicle

maintenance. The average monthly spending on vehicle maintenance for all respondents is ₵ 750 000 (US\$82). Considering the fact that 80% of all households have only one vehicle, this monthly spending can be taken as the average maintenance spending per vehicle. These levels of household spending on vehicle maintenance, though high for a developing country, is not surprising since most vehicles on Ghanaian roads are “used” or “second hand” vehicles imported mainly from Western European countries. As can be expected, these used and often over-age vehicles easily breakdown and require frequent replacement of parts. Due to high custom duties, costs of vehicle spare parts in Ghana are high.

Support for higher tolls appears less correlated with **income** and **trip frequency**. Nearly 65% of all respondents were frequent toll road users (that is, they make at least three return trips per week). It was also observed that employees undertake more trips than other socio-economic groups. Over 60% of employees make at least three return trips per week using the motorway. This also implies that employees have the highest toll payment obligations compared with other users. Current tariff system does not provide any discounts for frequent toll road users. Support for toll policies are more likely to increase among employees and local residents (who are frequent users of the toll road) should there be a discount policy that significantly reduce their weekly or monthly toll payment obligations. Many respondents have recommended for the implementation of a discounted weekly or monthly motorway pass or some forms of discount policies or exemptions for those living along toll roads as they are less able to avoid the use of the toll road.

Again, in order to indirectly measure users support for any future road concession scheme, which would obviously require payment of tolls higher than what is currently been charged, respondents were asked to suggest **how highways in the country should be financed**. Approximately 70% believe the cost of highways should be finance using toll revenues. About 14% agree to the use of Consolidated Funds and another 6% of respondents support financing highways with fuel taxes. Only 3% favour highway financing using donor funds. Some respondents support the use of revenues from toll roads to finance the maintenance of those roads. Many of those who oppose the concept of tolling, in its entirety, appear to do so because the revenues collected are not reinvested on those roads. They claim the Accra-Tema Motorway, for example, since it construction in the mid 1960s has not seen any major improvement though tolls have been collected from users over these years. Workers, both employees and self-employed, and frequent toll road users were more likely to support tolls as a source of highway financing, because they appear to benefit most from the quality of service of existing toll roads.

Asked to choose between **toll management** using the public and the public/private partnership, 49% of respondent support a public management system compared with 40% in support of a public/private partnership. 12% had no preference for either management systems. Support for public management system was high among older individuals (40-60years), students and the unemployed. If respondents had been informed about recent increase in toll revenue collection due to private sector participation, support for partnership was more likely to be higher. The generally high support for public management system is perhaps because many respondents perceived private sector participation to be synonymous with toll rate increases.

The **type of highway to toll** is another important issue respondents were made to state their preferences. Overall, 50% agree that drivers should pay tolls on both existing and new highways with 26% supporting tolling of new highways only. Approximately 23% were more likely to support tolling of existing roads only. Employees and users who save more time using toll roads were more likely to support tolling of existing roads only. All respondents appear to support one form of tolling or another.

Another issue of great concern to respondents was the high level of road accidents on the Accra –Tema tolled motorway. There was consensus on the causes of accidents on the motorway. Approximately 78% of respondents believe driver behaviour is to blame for most accidents on the motorway. These driver behaviours, which often lead to road accidents, include careless overtaking, over speeding and drink driving. Other causes of accidents on the motorway relate to vehicle condition (14%), road condition (6%) and road environment e.g. poor lightening (2%).

To address government concerns on the use of unauthorised routes along the 20-km motorway, respondents were polled to suggest reasons for this phenomenon. Respondents appear fairly divided on the possible reasons; traffic avoidance 28%, driver indiscipline 20%, and “shortcut” 29%. Considering the fact that the motorway has no bypasses, drivers looking for shortcut route to their residence or workplaces along the toll road are more likely to use unauthorised routes.

Another issue of concern among respondents was congestion on the motorway especially during the morning and evening peak periods. Most respondents (49%) think increasing the number of booth at the plazas will more likely control congestion on the motorways. 35% support the use of electronic tolling as a more effective congestion control measure. Another 19% believe congestion can be more likely controlled if users are charged higher peak hour tolls.

5.4 Conclusions from survey results

There is common understanding on the important issues that affect the performance of road tolling among residents of Accra and Tema. The results show that road users are more likely to support tolling of both existing and new roads, higher tolls, and public management of toll roads and financing of highways using toll revenues. It is also anticipated that implementation of road concession scheme would address existing problems relating to urban congestion, and road safety.

6 INTERNATIONAL EXPERIENCE: ROAD CONCESSION IN SOUTH AFRICA

6.1 Background

6.1.1 Institutional framework and road network

The South African National Roads Agency Limited (NRA) is an independent, statutory company responsible for the development, maintenance and management of South Africa's 7,000 km national road network comprising over R30 billion in assets, excluding land (NRA, 2005). The South African Government is the sole shareholder and owner of the Agency.

The planning, construction and maintenance of roads and bridges, other than those falling under the NRA or local governments, is the responsibility of the provincial governments. The figure below shows the entire road network size in South Africa. Only national roads and some provincial roads are currently suitable for tolling.

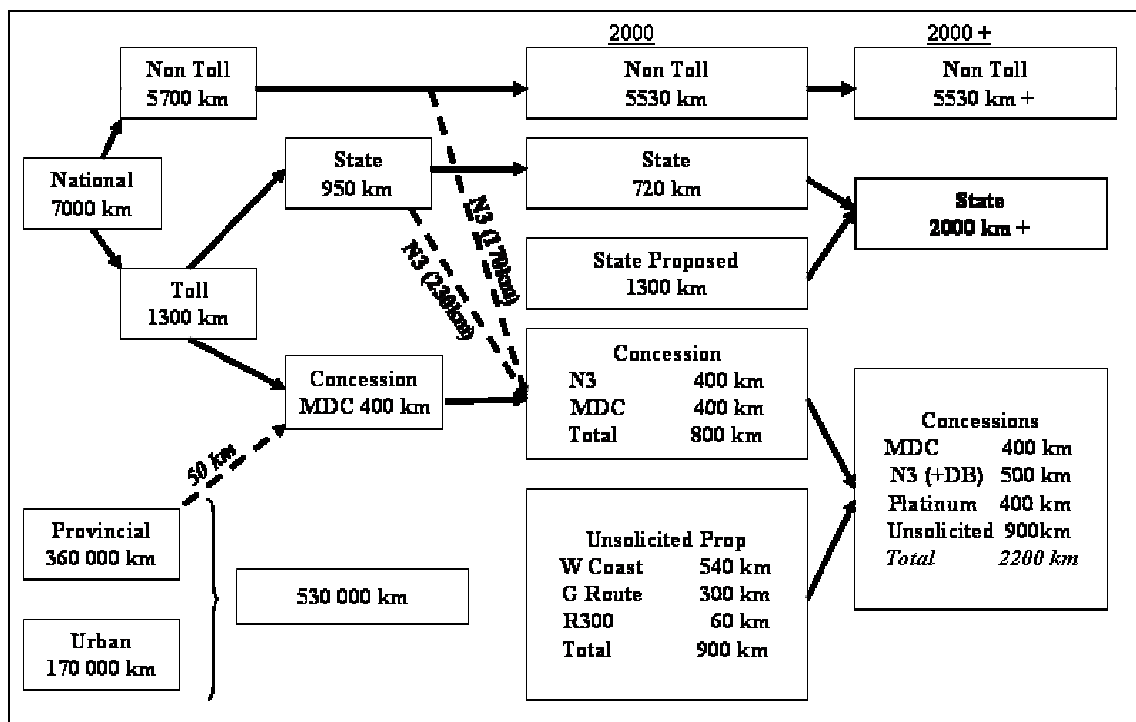


Figure 10 South Africa toll and non-toll road network size

Source: Alli, N. (1999). *The South Africa Model for State and Private Toll Roads*. A PowerPoint presentation at the Annual Road Management Seminar: Innovative Maintenance Contracting Practices. World Bank, Washington, D.C.

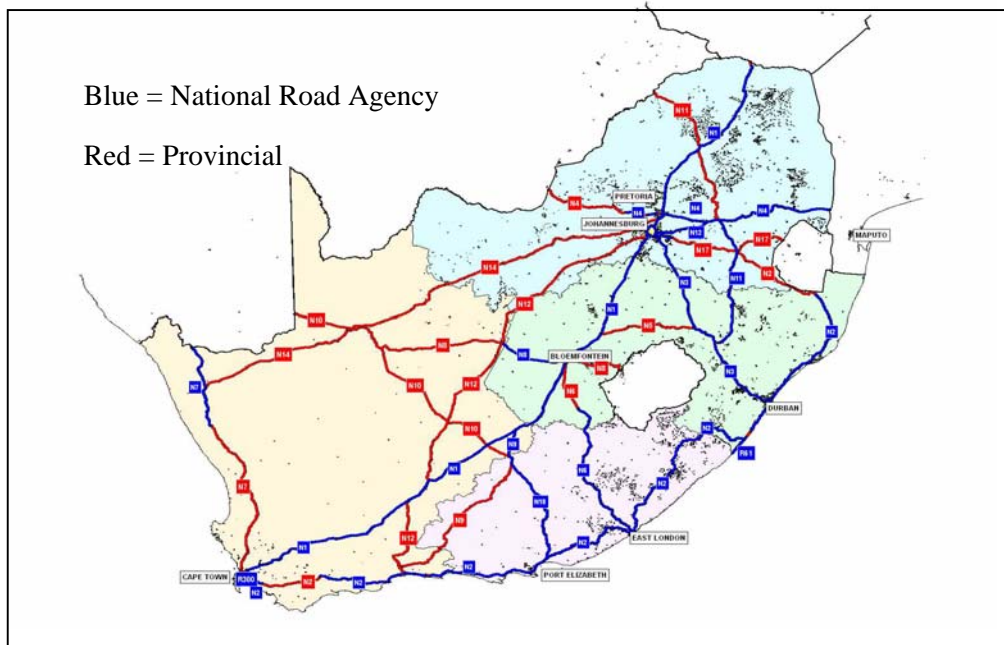


Figure 11 Primary road network and responsible agencies

Source: Alli, N. (1999)

Due to poor funding allocation, about 38% of provincial and 17% of national roads are assessed as being in poor or very poor condition. This situation has resulted in substantial backlog of both road maintenance and rehabilitation and about half (the non-tolled) network older than its design life. The existing backlog of maintenance would require between R25 (US\$4.2) and R35 (US\$5.8) billion to clear (DOT, n.d.). Apart from funding inadequacy, the current high share of network in poor condition is also the result of abnormal spatial development pattern from apartheid policies.

6.1.2 Financing national roads

The budget of the NRA is derived from various sources. These include levies on petrol and distillate fuels, loans granted to or raised by NRA, income from tolls charged, income earned in terms of joint ventures, fines and penalties. The main source of funding for non-toll national roads is the annual national budget, which is allocated by the National Treasury but must be approved by Parliament. Unlike the current trend in many developing countries, the South African constitution prohibits revenue earmarking (i.e. devoting certain revenue to be spent on specific sectors of the economy). All road fund revenues go directly to the National Treasury, which is then distributed among the different economic sectors. The road fund budget is used for the following purposes:

- Routine, periodic and special maintenance and provision of support to increase road safety, and

- Improvement of the network, rehabilitation and reconstruction, upgrading and provision of new facilities.

Current annual expenditure on road maintenance is only R4.6 billion, though NRA estimates an amount of R11 billion as required annual road maintenance expenditure to keep the network in good condition (DOT, n.p.).

6.1.3 Why South Africa opted for road tolling

Road tolling in South Africa started as far back as the 1700's when the then governor of the Cape Colony collected tolls to effect repairs to the roads. Tolls were also levied on roads in the former provinces of Natal and Orange Free State up to the end of the 19th century. The first modern toll road was established in 1983 in the Tsitsikamma province (NRA, n.d.).

The South Africa National Road Agency outlines the following as its primary objectives of introducing road tolling (Alli, 1999, p.12):

Reduce government role in the economy: this is in line with South Africa government policy of increasing private sector involvement in the economy and for the government to focus more on the establishment and maintenance of the needed institutional and regulatory frameworks for private sector activities.

Mobilizing needed private sector finance: road concessioning has enabled the government to fund more projects outside its own financial resources. By relying on loans from private financial institutions or designing completely non-recourse project financing schemes, the NRA has been able to finance about 20% of the national road network through the private sector. About 90% of private finance come from domestic sources.

Allow off-balance sheet financing for government: with road concessioning, NRA is now able to undertake expensive road construction project off-balance sheet. By financing some toll roads 'off balance sheet', the NRA can avoid showing the debt borrowings for the project on its books and hence avoid breaching any borrowing covenants. According to Clifford Chance (1991) and Nevitt (1995) by developing a project off-balance sheet, government also preserve its borrowing capacity for other projects, which cannot be developed on a stand-alone basis.

Foster innovation: competition among different toll companies to win toll contracts foster innovation in tolling technology, financing options and management of toll facilities.

Finally, full concessioning *allow for optimum apportionment of risks*. Road concession ensures an efficient risk allocation. Through the concession design, government is able to allocate to the private sector those risks the private sector is best able to manage. In a well-planned road concession scheme, specific risks are allocated to parties best able to manage them. For example, it is common for government to take care of political, traffic and construction risks while the private sector manages financing risk.

To illustrate the distinguishing features of concession projects, **Table 20** makes a comparison between concessions and conventional (state) financed schemes.

Table 25 Comparison between concession and conventional schemes

Item	Concession	Conventional
Speed	Fast, but may require many initial inputs from designers for tender purposes, particularly if the road design is poorly defined.	Slower, but can lead to a better quality of design as all options can be investigated more thoroughly in stages.
Public Acceptance	Difficult, particularly where local communities are affected. Funds are normally available to address issues optimally.	Less user resistance but still problematical where property issues and noise are concerned. May not have adequate funds to address all issues optimally.
Cost	Apparently more expensive than government funding in view of risk transfer to Concessionaire, but generally lower quality construction. If risks are too great then financing will be difficult.	Can become expensive if client does not have appropriate standards that are well controlled. Meaningful cost comparisons can only be made by means of a public sector comparator where value for money and risk pricing are some of the important determinants.
Maintenance	Very good transfer of maintenance obligations to an effective team. Need well-structured and clear maintenance specification, but funding constraints should not be an issue.	Maintenance quality depends on types of maintenance contractual models as well as the capability and motivation of public sector, and above all, availability of funding.
Construction	Few controls and self-approvals can result in poor quality IA and Concessionaire can play a key role in ensuring quality.	Good quality provided contract documentation and contracting environment is well managed and controlled.
Expansion	Able to plan for expansion and improvements in an environment of definitive funding.	All funding and future expansions are planned in an uncertain environment leading to planning inefficiencies or deferred maintenance and network deterioration.

Source: Alexander, P., Burger D., Esterhuysen, G., Smit, J., and Taute, A., (2004). *Cost and Quality Issues in Road Concession Contracts*. A paper presented at the 8th Conference on Asphalt Pavement in South Africa. Sun City, North West Province, South Africa.

6.2 Available toll road financing mechanisms

Three main types of ownership options are identified in South Africa, namely; state, partial and full concessions. The classification is based on the extent of government support required to carry out the toll project. The existing toll network consisting of both state and concession toll roads is shown in *Figure 12*.

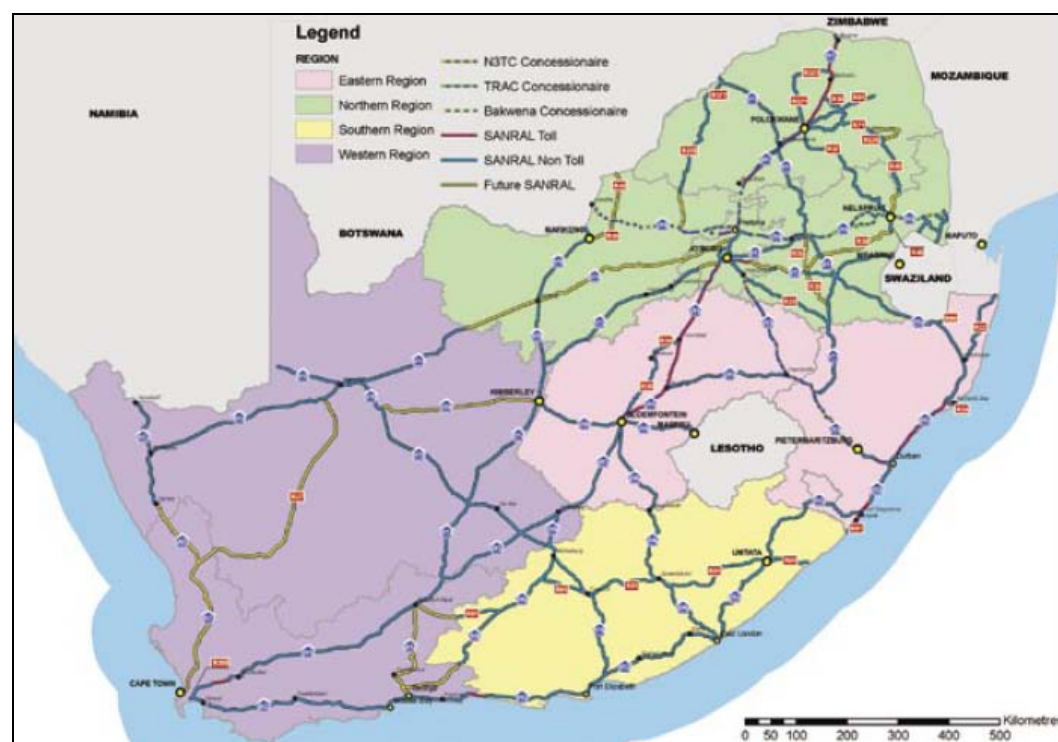


Figure 12 State and concession road network

Source: NRA, (2005b). *Declaration of Intent 2005-2008*. South African National Roads Agency, Pretoria, South Africa.

6.2.1 State financing

Under this option, government provides financing for the project implementation from its own resources or borrows money from the private sector. All risks (both project and financing) accrue to government. This option is used when either traffic levels are not high enough to attract private sector participation, private sector is less developed or do not have the needed resources for such long term investments. State road tolling may also be employed when country (political, economic) conditions are not attractive for both local and foreign investors.

The sources of funding for South Africa state toll road construction, maintenance and operation are long-term debt, short-term debt and soft loans.

1. *Long-term debt (from capital market)*: the capital market is the market for securities, where companies and governments can raise long-term funds. The capital market includes the stock market and the bond market. It consists of the primary market, where new issues are distributed to investors, and the secondary market, where existing securities are traded.
2. *Short-term debt* is obtained from the money and secondary markets. As shown in **Figure 13**, secondary loans are a major and increasing source of funding for state toll projects in South Africa.

All funding for toll roads has come from the domestic market (Alli, n.d.)

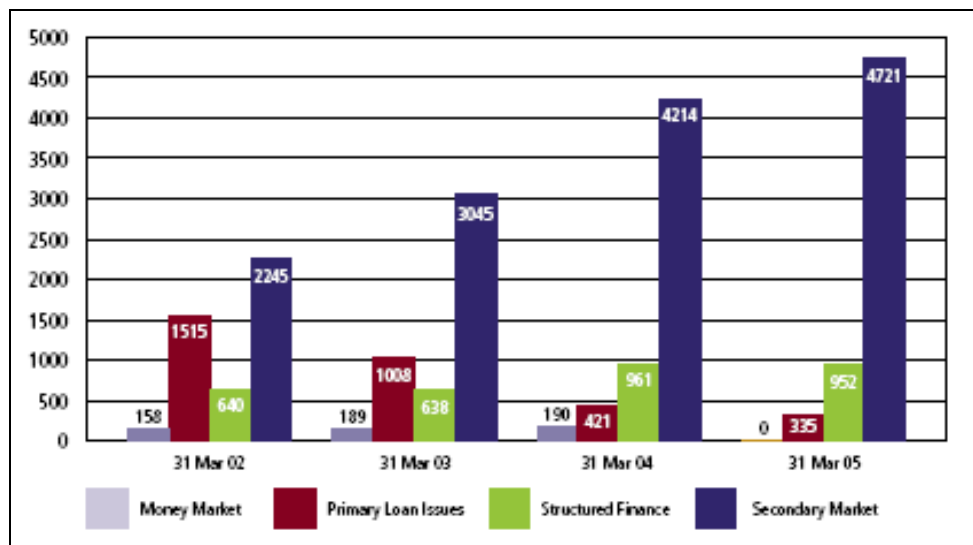


Figure 13 Sources of funds for state toll roads

Source NRA, (2005b). *Declaration of Intent 2005-2008*. South African National Roads Agency, Pretoria, South Africa.

The South African government in 2000/2001 approved a loan guarantee of up to R6 billion on behalf of NRA. This meant that NRA could borrow up to this amount from the capital and money markets for the sole purpose of financing toll roads in South Africa. With existing interest rate at 8%, it is estimated that the Agency will require loan guarantees of about R10 billion by 2019 (NRA, 2004). As of March 2005, about R5.7 billion of government guarantee has been utilised. The long-term objective of the government is to limit state guarantee for state financed toll roads to R10 billion. Considering the increasing funding requirement for toll road development and financing, the Agency will have to find ways of obtaining additional sources of funds or pursue other financing schemes which will require limited state guarantee.

3. The third source of funding for state toll roads is the road fund debt. This revenue comes from fuel tax.

6.2.2 Partial concessioning

Here private sector debt is employed for the project financing. The “concessionaire” shares the risk with government. Risk sharing is negotiated between the parties, but the private sector typically bears the design, construction and maintenance risks. This option is most suitable when:

- there is less public support for completely private ownership of road infrastructure
- government requires private sector debt to fund road infrastructure, while public sector still maintain ownership
- government wants to share project risks with private sector, by allowing the private sector to carry those risks it can best manage

6.2.3 Full concessioning

In full concessioning, a private sector entity is granted a concession by a governmental entity to design, build, and/or operate transport services or infrastructure for a specified period. The concessionaire is typically responsible for raising the finances required to carry out the project. At the end of the concession period, the facilities and their operation may be transferred to the host government, depending on the nature of the contract. The concessionaire will typically take care of forming a Special Purpose Project Company, also called Special Purpose Vehicle (SPV).

The SPV usually consists of the consortium shareholders who may be investors or have other interests in the project (such as contractor or operator). The SPV is created as an independent legal entity, which enters into contractual agreements with a number of other parties in a project finance deal. A typical project finance structure is shown by *Figure 14*.

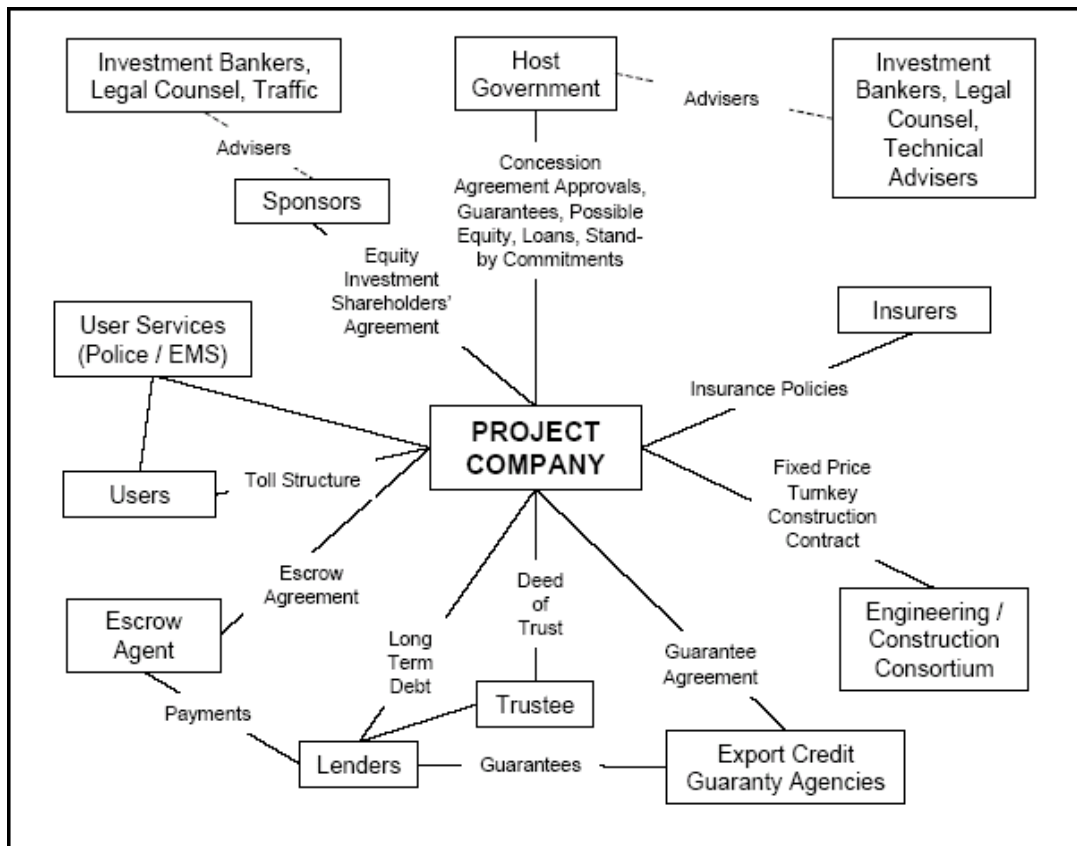


Figure 14 Special purpose vehicle

Source: Roth, G. (1996). *Roads in a Market Economy*. Hants, England: Avebury.

A typical special purpose vehicle for a toll road project will include the following major interest groups (Estache and Strong, 2002):

1. *Host government*: except in the case of unsolicited bid, it is usually the government who identifies the need for provision of certain road infrastructure, prepares the needed feasibility studies and approach the private sector for funding of the project.
2. *Concessionaire*: he obtains a right to build, finance and operate a particular road infrastructure. It will be the responsibility of the project sponsors to form a SPV to act as the concessionaire. The relationship between the sponsors needs to be clearly defined and will usually be set out in a shareholders' agreement. The SPV might have other equity investors, such as development finance institutions or the government. "The SPV will be capitalized by the sponsors in agreed proportions, normally on the terms set out in an agreement that deals not only with the sponsors' initial capital investments but also with any further obligations with respect to future contribution obligations".⁸

⁸ These may be supported by guarantees of parent or affiliated companies of the sponsors.

3. *Lending banks*: most project finance funding to date has been in the form of commercial debt. The percentage of the anticipated project cost that commercial banks will be prepared to lend will vary depending on such issues as the size and sector of the project, the projections and sources of project revenues, and the banks' evaluation of the other risks of the project. The banks usually lend directly to the SPV (Estache and Strong, 2002). Before extending finance for projects, the economic feasibility and financial viability of the project in relation to the macro economic conditions prevailing at the time of conceptualisation of the project and also the likely scenario that may prevail during the normal life span of the project is established. The project should be able to withstand reasonable levels of variation in crucial parameters, which should be established by sensitivity analysis of the cash flows.

Currently, the NRA has implemented three (3) full concession road projects. The Agency is now in the process of preparing six (6) additional projects to be implemented by 2008 (see Table 26).

Table 26 Existing and planned concession toll roads in South Africa, 2004-2008

Project	Status	Length	Capex
N3 Cedara-Heidelberg	Underway	420 km	R 2200 m
N4 Witbank-Maputo	Underway	350 km	
N4 Platinum	Underway	124 km	
N1 Huguenot Tunnel – Second bore	Planned		R 550m
N1 South and R30 Welkom- Bloemfontein	Planned	196 km	R 444m
N2 Tsitsikamma Extension	Planned	14 km	R 199m
N3 Pietermaritzburg to Durban	Planned	85 km	R 881m
N17 East Toll Road Extension	Planned	180 km	R 629m
Guateng Network	Planned	329 km	R 4 565m
N2 Knysna Toll Highway	Planned	23 km	R 519m
Various bridges	Planned		R 900m

Source: NRA, (2005). *Annual Report 2004/2005*. South African National Roads Agency, Pretoria, South Africa. p.24. Exchange rate US\$ 1.0 = R 6.0

6.3 Unsolicited bidding process

Many countries do not have any policy for considering unsolicited bids. Nevertheless, it is important to have proper procedures in place for handling such bids and reach fast, objective decisions on them. In order to take advantage of private sector funding, innovation, efficiency and skills (NRA, 2005, p.30), the South Africa government, in

addition to its existing conventional tendering process, has introduced a policy on unsolicited bidding. This policy allows the private sector to propose potentially viable road concession projects for the road agency's consideration.

The procedures of the South African National Road Agency (SANRA) in respect of unsolicited bids are follows (PWC, March 2004):

- The concessionaire identifies a road and assesses its suitability for a particular private sector participation (PSP) option.
- The concessionaire prepares a proposal and submits to SANRA agency for consideration.
- SANRA is under no obligation to accept the proposal, and is not responsible for its initial costs.
- If SANRA is interested in the proposal, the sponsor (or the concessionaire) will be designated the Scheme Developer. This is announced publicly.
- There will be a Scheme Developer Agreement between SANRA and the sponsor covering the scope of work, rights and responsibility of both parties, liabilities for costs and budgets up to the tender stage.
- SANRA is allowed to seek third party advice at its own cost whilst the scheme is being developed. The sponsor becomes liable for these costs only if he fails to complete the Scheme Development work
- The Scheme must be accepted by SANRA before it can proceed to the tender stage.
- The tender documents will normally be prepared by the sponsor
- The sponsor will be allowed to bid, but will not be given any preference in the evaluation of bids.
- Best and final bids will be invited from the two preferred bidders, plus the sponsor if he is not one of them.
- The sponsor will not be involved in the evaluation of bids, and will not be given access to information in any of the competing bids
- SANRA is under no obligation to award the contract to the original project sponsor
- If the sponsor is unsuccessful, Scheme Development costs (up to the budget) will be reimbursed by the successful tenderer
- If the project is aborted at any stage, the Scheme Development costs up to the budget will be reimbursed by SANRAL

The following proposed concession projects have been developed through the unsolicited bidding process.

Table 27 Proposed concession projects from unsolicited bids

Proposed concession projects	Costs (US\$ million)
The N1/N2 Windlands Toll Highway (142km)	983
The N2 Wild Coast Toll Highway (540km)	1 217
R300 Cape Town Ring Road (68km)	1 133

Source NRA (2005, p.30). *Declaration of Intent 2005-2008*. South African National Roads Agency, Pretoria, South Africa.

6.4 Evaluation of toll road projects

Traffic demand is the most important factor influencing the decision to toll a road or not. When proposed toll roads do not have sufficient traffic volume to ensure they are self-financing or financially viable, options have to be developed to take care of the financing deficits. Most South African toll roads under state or partial concession arrangement are not self-financing. This is because volumes of traffic and/or toll rates are not sufficient to cover required costs.

The approach that is used in assessing the financial viability of these roads for tolling is called “the loans supportable by revenues” concept. This concept is currently used in respect of state toll roads. The loan supportable by revenue (LSR) is the present value of the amount of loans that can be serviced and redeemed over the selected evaluation period at a selected interest rate. The approach involves the estimation of present value of toll revenue from the proposed toll rate and the expected traffic level on the toll road. The net revenue is determined by subtracting estimated operation and maintenance costs. The LSR, in the case of state toll roads, is determined by discounting the predicted net toll revenue of a project to present worth at a 4% per annum interest rate for a 20- or 30-year evaluation period.

“The net revenues are then used to float revenue bonds on the domestic capital market. The difference, if any, between the initial capital costs of the toll road and the value of these revenue bonds, is then provided by government in the form of a soft loan from the Treasury” (Heggie, 1998). The LSR concept, simply asks the question, how much loan can be supported by future revenue? By the definition of the LSR concept, a project that is viable may not necessary be self-financing. For a project to be self-financing, the LSR should be greater than the initial net capital cost.

To summarise the LSR concept,

- Estimate the annual toll revenue during the life of the project
- Determine the net annual toll revenue by subtracting the operation and maintenance costs from annual revenue

- Determine the NPV of the toll revenue over the project life
- Estimate the initial net capital cost of the project
- The LSR is then the difference between NPV of the toll revenue and the project's initial net capital costs (ICC).

What happens if the project is not self-financing, or in other words, what if the LSR is less than ICC? The government has to consider other sources of funding to take care of the deficit. The existing policy on tolling in South Africa allows for supplementary funding from the national road fund in the form of long-term loans. Since the inception of road tolling in South Africa road fund loans have contributed up to about 50% of toll road financing

6.5 The N3TC toll project

This section presents a case study on the performance of one of the South Africa's concession projects. It provides a brief overview of the nature of the concession, by discussing the roles and responsibilities of the concession parties, challenges during the first five years of the concession and some observed critical success factors. The data and issues raised and discussed were obtained from interviews with officials of NRA and N3TC in South Africa in August 2006. Apart from N3TC toll projects; there are two other concession projects in South Africa. These are the Bakwena (Platinum Corridor Concessionaire (Pty) Limited and the Trans Africa Concession (Ivins, 2005).

6.5.1 The concession

N3 Toll Concession (N3TC) is a single purpose company, with many stakeholders, which has entered into a concession agreement with NRA. The concession started in 1999 and is the first road concession project, which is privately financed and operated, in South Africa. The agreement allowed N3TC to design, construct, finance, toll and maintain the four-lane N3 Highway between Cedara, KwaZulu-Natal and Heidelberg, Gauteng in South Africa. N3TC was required to construct and maintain a safe and efficient world-class highway, suitable for all categories of road users, which will provide benefits that exceed alternative routes. The economic objectives of the N3 toll project are:

- to reduce the travelling time from KwaZulu Natal to Gauteng by one hour and to ensure a faster, safer and efficient transport link between the country's economic hub, Gauteng, and the KwaZulu Natal province

- to de-congest the N3 and hence ensure free-flow of freight and passenger traffic, and
- to reduce transport costs for freight and passengers. This will also lead to reduction in cost of goods and services.

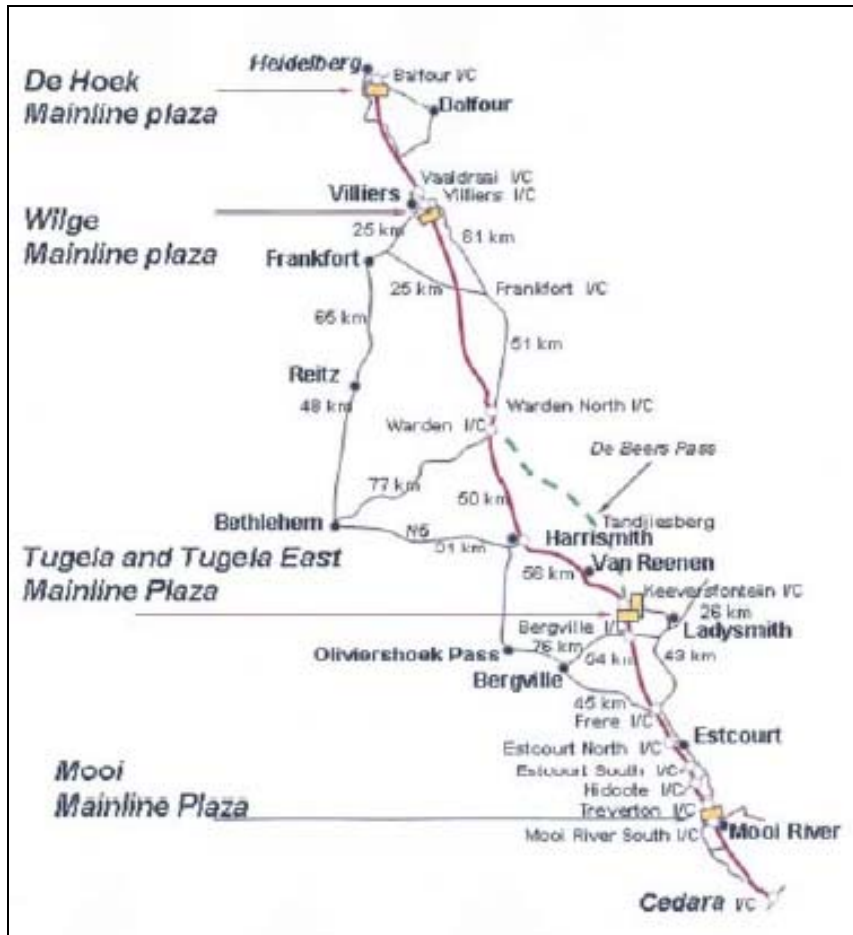


Figure 15 Map of N3 toll route

Source: Ivins, T., (2005). *The N3 Toll Concession: The 418km Challenge*. A presentation at IBTTA Transportation Summit, Nice, France.

This 30-year concession contract, involving 418km of N3 highway from Cedera to Heidelberg (see **Figure 15**), allowed N3TC to design, construct, operate, maintain and transfer the facility in a predefined condition to NRA after expiration of the concession period. The N3 bears an annual freight of about 30 million tons, “from sea level to 1600 m halfway along the route over the van Reenen Mountain pass” (Ivins, 2006, p.2).

6.5.2 Financing N3TC and current financial performance

At the inception of the N3TC project, the concessionaire was faced with the crucial challenge of how to finance the concession. First, the concessionaire had to liquidate

an existing debt owed by the South African government with respect to the existing highway. This debt had to be funded at the commencement of the concession. The R1.38 billion (US\$230 million) was equivalent to four and half times the annual toll revenue at the project commencement. To meet this debt payment required, N3TC was allowed to increase the initial toll rates by 29% at the commencement of the concession (Ivins, 2004, p.4). Considering the fact that toll rate had previously not been sufficient to redeem highway development debt, the next challenge for the N3TC was how to win public support and ensure that at least existing traffic levels were maintained despite the initial toll rate increase.

The initial construction works, expected to be completed between 30 to 36 months and at a predefined standard, cost R500 million- an amount equivalent to about one and a half annual revenue projection. Putting the projects initial debt, construction cost and other financing cost obligations together, an initial capital requirement of R 2.2 billion was required to get the concession off the drawing board. This total capital expenditure is equivalent to seven times the estimated annual revenue. Total project debt amounting to R1.9 billion was raised on a limited recourse⁹ basis. This brought the financing structure to 83% debt and 17% equity. N3TC then entered into various agreements involving pavement design and construction at fixed priced contract for a duration of 10 years. With the key adjudication criteria been toll rate, there was pressure on all bidders to have the lowest toll rate.

What was N3TC financing strategy to mitigate the effects of the above financial challenges? The company raised more than 60% of debt as inflation-linked bonds¹⁰ with favourably negotiated grace period (Ivins, 2004, p.7). The characteristic advantage of the inflation-linked bond is that it allows for adjustment in toll rates and other revenue parameters on the basis of the same consumer price index (CPI).

On the equity side, N3TC shareholders provided guarantees. The shareholders include, Murray and Roberts Limited, Grinader Construction Limited, Kobi-Infrastructure (Proprietary) Limited, Africon Infrastructure (Proprietary) Limited and John Muller and Associates cc. According to N3TC, 20% of the equity came from the institutional investors including the South African Infrastructure Fund, Old Mutual,

⁹ Unlike non-recourse project finance, limited-recourse project finance permits creditors and investors some recourse to the sponsors. This could take the form of a pre-completion guarantee during a project's construction period, or other assurances or some form of support for the project. Creditors and investors, however, still depend on the success of the project as their primary source of repayment.

¹⁰ Inflation-linked bonds (also called linkers) are bonds whose principals are indexed to inflation, hedging inflation risks

and Futuregrowth. The remainder came from loan commitments made by the Rand Merchant Bank (Lead financial Arrangers for N3TC), the Development Bank of Southern Africa, the BOE Bank Limited, the European Investment Bank and various CPI-linked lenders.

In addition, established contracting companies held 40% of the equity in N3TC with the remaining 40% held by various empowerment groups. In all, two types of instruments were issued to serve the interest of N3TC's shareholders. These were Convertible Redeemable Unsecured Loan stock units (CRUL's) and Subordinated Convertible Debentures (SCD's)¹¹. The SCD's constituted 15.2% of the equity contribution.

The financial performance of N3TC over the past seven years of operation is remarkable.

The Internal rate of return (IRR) was well in excess of forecast at financial close. The IRR increased by 2.2% or 220 base points to bring the current real equity IRR to 15.6%

*Debt Service*¹² and *Loan Life Coverage Ratios* (see **Table 32**) targets have largely been met.

Table 28 Current and target ratios for coverage ratios

Coverage ratio	Current ratio	Target ratio
Debt Service Coverage Ratio (DSCR)	1.1	1.3
Loan Life Coverage Ratio (LLCR)	1.2	1.5

Source Ivins, T., (2005). *The N3 Toll Concession: The 418km Challenge*. A presentation at IBTTA Transportation Summit, Nice, France.

Shareholder value: with higher traffic volume than initially anticipated and corresponding increase in toll revenues, shareholder value increased three-folds within five years; this development which encouraged shareholders to increase their share holding within the period.

¹¹ These forms of equity were utilised in order to make payments to shareholders earlier than would have been possible under the normal dividend distribution process, due to the accumulated deficit, resulting from the high early expenditure in the early years of the concession period (Ivins, 2005).

¹² Debt Service coverage ratio is the ratio of net operating income to debt payments on a piece of investment real estate. The higher this ratio is, the easier it is for a company to borrow more money from its lenders. Loan Life Coverage Ratio, on the other hand, is concerned with the vitality of the project for the time period of the loan life.

Refinancing: the current financial performance of N3TC has positively enhanced its credit rating. Within the past five years N3TC's crediting rating increased from A- to A. Project stability is however satisfactory for re-gearing thereby increasing the Debt: Equity ratio to release cash to shareholders (Ivins, 2004, p.9).

6.5.3 Traffic growth and revenue

Traffic growth is key parameter for revenue generation. The concessionaires' ability to fulfil debt obligations and to increase shareholder value is based on the projects ability to increase levels of traffic volume and corresponding revenue targets. N3TC public support was at its lowest level when it had to increase existing toll rates by 29% finance the existing infrastructure. As could be expected, increase in toll rate meant traffic attraction to the new toll road will be low.

Mitigation measures: in a move to address the concerns, and sometimes aggressive attitudes of interest groups, and to increase public support for the project, the company embarked on a massive education and awareness campaign. The first step was to repackage and market the project benefits to the public. The education involved informing the public that the benefits of the projects were worth the costs (or the increase in toll rates). Secondly, because the project used an open system, a measure that allows vehicles to enter or exit toll roads to non-toll roads without having to pass through a tollgate, the second step was to reduce the possibilities of traffic diversion. Other measures included improving the conditions of alternative, but less economic routes and also reducing delays resulting from road accidents.

Traffic and revenue performance: evaluation of the project performance between 1999 and 2005 shows a more than expected traffic and revenue growth. Project contract life revenue (R20.2 billion) is currently 21% higher than projection (24.4 billion) at financial close. The increase is attributed mainly to higher than expected growth in traffic volume of heavy vehicles in the traffic mix. The proportion of heavy vehicles in the traffic mix increased from 19% (1999) to 25% (2005). Currently 55% of total revenue comes from heavy vehicles. This increase in contribution from heavy vehicles is expected to be sustained for the entire project life. The attraction of N3 corridor traffic to the N3 toll road has improved from 88%, at the commencement of the concession, to 94%. A 6% improvement meant additional revenue of R32 million per annum (Ivins, 2004, p.8).

6.6 Perceived shortcomings in existing road concessioning schemes

Existing perceived inefficiencies with road concessioning in South Africa relate to both scheme design and implementation. Public concerns have been raised on two

major aspects of road concessioning in the country, namely; unsolicited bidding progress and the setting of tariffs.

6.6.1 Unsolicited bidding process

The existing tendering procedure in South Africa is competitive and notably free of corruption. Few large firms dominate the construction sector.

The shortcoming in the unsolicited bidding process is that the process allows oligopoly firms to form consortia and bid for almost all concession projects in the country. These phenomena create the perception that these firms control the entire national road assets. The high cost of preparing effective counterproposals often excludes many smaller firms from the bidding process. At the end of the day oligopoly firms win most of the projects, making the process appear less competitive (Leiman, n.d., p.2).

6.6.2 Toll setting format

It has been argued that existing toll rates in South Africa do not accurately take into account vehicles axle loading. Heavy vehicle pay proportionately less tolls compared to motorcars. This implies that existing tariff structure makes lighter vehicles subsidize heavy vehicles. Among the same class of vehicles there is no distinction between fully loaded and empty running vehicles. No matter the extent of loading, vehicles of the same class pay the same toll. It is believed that some truck companies, in their bid to save on toll payments, simply overload their vehicles in order to make fewer trips. There are currently no weighing bridges at the plazas so these overloading cannot be detected. The South African National Road Agency, the governmental institution responsible for the management of national roads and also for setting of toll rates for all vehicle classes appear to be aware of this problem. Toll rates for heavy vehicles have been purposefully sets low to encourage haulers to use the highways instead of secondary roads. The Agency believes the cost of damage cause by heavy vehicles using secondary roads far exceed the costs of cross-subsidies these vehicle received. But the efficiency question here is whether light vehicle drivers ought to bear the cost of these subsidies. One fundamental principle of road pricing is that road users pay only the cost attributable to their use of the road infrastructure and not more than that. If government for any reason decides to subsidize heavy vehicles, it is fair for the government to bear these costs and not to shift it to other road users.

6.6.3 Open system

There is currently no electronic tolling in place in South Africa. Tolls are collected at plazas located at various points along the toll roads. Because tolls are paid only when a car crosses a tollbooth, drivers are able to divert onto a secondary road and can avoid paying the tolls. The impacts of these are two folds. Apart from lose of revenue to the toll companies; this phenomenon often leads to urban congestion. Another problem is that these secondary roads are often not designed for heavy vehicles. Plying heavy vehicles on these secondary roads can reduce the life span of these roads. Until area tolling is implemented, traffic diversion will continue to be a major constraint to road tolling this country.

6.7 Lessons

The major lessons from the review of the South Africa road concessioning experience are:

1. Road concessioning schemes can be implemented in Africa, but the required conditions must be met. South Africa has a well-developed financial market, investor friendly business environment, experienced and well resourced world-class construction industry, stable political climate and an efficient legal system (PricewaterHouseCoopers, 2004, p.89).
2. Initial public opposition does not mean concession projects will not be acceptable in the long run. Experience show that when users begin to realise the benefits of toll roads e.g. time savings and reduction in vehicle operation costs, their support for the scheme increases.
3. A workable legal framework is a necessary prerequisite for a successful implementation of a road concession scheme. South Africa has a strong legal system and a very transparent adjudication process which is a necessary requirement for attracting private sector participation in financing long-term assets such as road infrastructure.

7 PREPARING A ROAD CONCESSION SCHEME FOR GHANA

7.1 Possible organisational options

There are various ways of designing concession schemes. The main difference between the schemes is the extent of private (and public) sector involvement. The most widely used organisation options in road concessioning are discussed in this section.

Build, Operate and Transfer (BOT): the main feature of this scheme is that the private sector agrees to build the road, operate the facility and return it to the government at the end of the agreed concession period – which is typically 30 years. The concessionaire carries not only traffic risks but also financing risks. The scheme is the most popular in the infrastructure-financing world, as it offers government the opportunity to develop expensive road projects off-balance sheet. Typically, the concessionaire will be responsible for arranging financing for the project, the initial construction of the facility, and collection of the revenue and take care of operation and maintenance of the facility until the end of the project life.

Rehabilitate, Operate and Transfer (ROT): this is similar to BOT. Here the concessionaire enters into an agreement with the host government to finance the rehabilitation of an existing road, toll the facility and return it to the government at the end of the concession period. The concessionaire carries all project risks.

Maintain, Operate and Transfer (MOT): under this option, the concessionaire enters into an agreement with the host government to finance the maintenance (usually routine and periodic), toll the facility and return it to the government at the end of the contract period.

Turnkey: in highway development, turnkey involves the government entering into contractual agreement with the private sector for the provision of a highway facility. The private sector is usually responsible for the design and construction (with associated risks) of the highway. The private sector must arrange financing on its own. Once the construction is completed the road is handed over to the government. The government then makes an agreed lump-sum payment to the private sector. The public sector bears the planning and traffic risks. Under turnkey, it is possible to have a follow-up agreement that allows the private sector to provide other services like testing, training and logistical support necessary for efficient operation of the facility. At the end of the construction period and facility handover, the turnkey contract may be extended (also called turnkey plus) to include management contract. This will often

occur when government is satisfied with the performance of the private sector and if the private sector is still interested in the project.

Maintenance management contracts (MMC): this contract scheme involves the concessionaire taking over the maintenance management of a state toll road for a given period. Here, the government is still responsible for ownership and investment decisions.

Corridor management: is a concession process “that applies access management principles to highway corridors in an attempt to balance the competing needs of traffic service, safety, and support for land development” (CTRE, 2004, p.1). The primary objectives of corridor management are to ensure mobility and safety of highways. A typical corridor management scheme includes the following measures (CTRE, 2004, p.2):

- The location and spacing of interchanges with other public roadways
- The location and spacing of at-grade intersections with other public roadways, including traffic signals and other traffic control devices
- The location and configuration of medians and median breaks
- The location and spacing of private driveways
- Alternative access ways, such as frontage and backage roads
- The location and design of dedicated left and right turning lanes
- Coordination of the transportation facility with surrounding land development, land use planning, zoning, and internal traffic circulation system

Corridor management aims at striking efficient balance between access management on the one hand and mobility and safety on the other hand.

After identifying the various PSP options the next step is to assess the suitability of each of the options. Common features of various private sector participation options are shown in *Table 29* below.

Table 29 Possible organisation options

Features	MMC	Turnkey	MOT	ROT	BOT	Corridor Management
Definition	Maintain	Design and build	Maintain and operate	Finance, rehabilitate, and operate	Finance, design, construct & operate	Finance, design, construct, maintain, operate
Direct cost recovery from users	No. Payment from govt. to operator	No Fixed payment from govt. to operator	Some degree of toll sharing with govt.	Concessionaire may pay govt. or vice versa	Govt. investment usually required. Ex-post subsidies not uncommon	Govt. contributes existing roads and other investment usually required
Scale of private investment	Very low	Considerable for very short term	Low	Medium	High	Medium /high
Private sector risks	Maintenance	Design Construction	Traffic and revenue levels Political Financial	Rehabilitation Traffic and revenue levels Political Financial	Design Construction Traffic and revenue Levels Political Financial	Design Construction Traffic and revenue Levels Political Financial
Public sector risks	Design Construction Traffic and revenue levels	Planning Traffic and revenue levels	Revenue Macro Some regulatory	Force Majeure Some regulatory	Planning Macro Some regulatory	Planning Force majeure Macro Some regulatory
Typical contract size (\$)	Small	Medium/high US\$50-\$800m	Small/medium	Medium/high	Very large US\$100m-\$1b	Medium/large US\$90-\$300m
Typical traffic volume (ADT)	<1 500		2 500 – 6 500	6 500 – 15 000	>15 000	
Minimum size concession required	Small/local construction firm	Small/local construction firm	Construction firm with management skills	Large construction firm with management skills	Consortium including major construction firms	Consortium often with construction firms
Typical duration	2-10 years	Defined construction	2-10 years	10-20 years	30years	30years

Source World Bank Institute (2000). Privatization and Regulation of Transport Infrastructure: Guidelines for Policymakers and Regulators. World Bank, Washington D.C.

7.2 Potential concession projects

The following traffic levels have been recommended for undertaking the respective schemes (Kerali, 2002):

BOT schemes: ADT of 15 000 and above

ROT schemes: 6 500 < ADT < 15 000

MOT schemes: 2 500 < ADT < 6 500

Toll Collection Only: ADT > 1 500

The Ghana Highway Authority acting through its Planning Division undertook a desk study, mobilized and conducted a field survey of traffic counts at thirteen (13) bridge and road toll sites. It intended to assess their suitability for privatisation (including various schemes like BOT, ROT and MOT) by considering revenue that could be expected from these toll sites. The traffic survey was also aimed at assisting the Board in its decision to review monthly remittances expected from the toll companies.

Table 30 Traffic survey on selected existing toll roads/bridges

No.	Site	Type	Region	ADT 2004	Remarks
1	Adiembra	Bridge	Ashanti	1 555	Adequate for tolling
2	Tabere	Road	Ashanti	4 486	::
3	Bechem	Road	Brong Ahafo	2 066	::
4	Kade	Bridge	Eastern	2 434	::
5	Adomi	Bridge	Eastern	4 015	::
6	Sogakape	Bridge	Volta	2 859	::
7	Asukawkaw	Bridge	Volta	57	Inadequate for tolling
8	Assin Praso	Bridge	Central	1 457	Adequate for tolling*
9	Ankobra	Bridge	Western	1 261	Adequate for tolling*
10	Jumoro	Bridge	Western	135	Inadequate for tolling
11	Aboaso	Road	Ashanti	4 789	Adequate for tolling
12	Kyeremfaso	Road	Ashanti	1 633	Adequate for tolling
13	Bamboi	Bridge	Northern	317	Inadequate for tolling

Source: GHA (2004, p.3). *Report on Traffic Studies on the 13 No. Road /Bridge Sites for the Ghana Road Fund*. Ghana Highway Authority.

Note *These roads have been accepted for tolling though their traffic volumes fall below the 1,500 threshold recommended by Kerali.

Based on the cost road of construction and maintenance, a tolling rate of 5 US cents per km for Light Vehicles and 12 US cents for Heavy Vehicles is considered minimum for the operation of the various schemes. The Road Fund Board's objective is to expand the current toll road network. Taking into consideration the existing traffic levels, the following road links are also been considered for tolling under various concession options.

Table 31 Selected roads for various tolling schemes

BOT (ADT>15,000)	ROT 6,500<ADT<15,000	MOT 2,500<ADT<6,500
Tetteh Quarshie-Mallam (ADT=27 000)	Mallam – Kasoa (ADT=8 200)	Tema – Akosombo (ADT=4 885)
Tetteh – Pantang (ADT=25 000)	Konongo – Kumasi (ADT=9 382)	Sunyani – Berekum (ADT=5 084)
Achimota – Nsawam (ADT=17 100)		Anwiankwanta – Kumasi (ADT=4 321)

Source: MRT (January 2004, p.3)

In the case of BOT and ROT investments, road improvement financed by the private investor might be required before concessioning can begin.

7.3 Road concession performance measurement criteria

The goal of the road administration or any road concessionaire is to ensure that toll roads meet certain minimum standards that can guarantee the achievement of requirement revenue targets.

In assessing the performance of toll projects some measurement tools are needed to verify whether or not initial projection or assumptions underlining the design of the concession have been fulfilled or achieved. Some of the key parameters include traffic volume, maintenance and operation costs and financing.

This subsection identifies some indicators for measuring the performance of future concession roads in Ghana. The key measurement parameters include concession profitability, debt repayment and returns to stakeholders. The following concession performance indicators have been identified and detailed descriptions of some of the indicators are provided in **Table 32**. The benchmarks are obtained mainly from a review of South Africa toll projects and other international road concession experiences.

- Working capital
- Debt service coverage
- Loan service coverage ratio
- Project life coverage ratio
- Internal rate of return
- Debt service projection
- Debt-equity ratio
- Debt-asset ratio
- Return on assets
- Return on equity
- Ratio of heavy and light weight vehicles
- Extent of overloading

Table 32 Performance indicators for toll roads

Performance Indicator	Description	Purpose	Source	Benchmark (target)
Debt service coverage ratio (DSCR)	The ratio of pre-finance cash flow after tax to the amount of interest payment and principal repayment for the period	To monitor the ability of project cash flow to pay (annual) project debt obligations	N3TC, South Africa	1.3
Project life coverage ratio (PLCR)	The ratio of the present value (PV) of cash available for debt service over the entire project lifetime to the outstanding debt	To monitor the ability of the project cash flow to pay it debt during the entire project life	GREENTIE (n.d.)	>1.5
Loan life coverage ratio (LLCR)	The ratio of the present value (PV) of cash available for debt service (during the repayment period) to the outstanding debt	To monitor the financial vitality of the project for the time period of the loan	N3TC, South Africa	1.5
Working capital (WC)	The difference between a companies current assets and short-term liability	To monitor a company's efficiency i.e. its ability to meet short-term debt payment obligations	Chilean Toll Roads	10%
Internal rate of return (IRR)	The interest rate at which discounted cash flows equal zero	To measure project financial viability IRR > cost of capital → project is viable	SANRAL, South Africa	>15

Performance Indicator	Description	Purpose	Source	Benchmark (target)
Debt ratio	The ratio of long term to short term debt	To measure project's short term debt payment obligation in comparison to long term debt	SANRAL, South Africa	80% long term, 20% short term
Equity ratio	The ratio of sponsor equity to non-sponsor equity contribution to the project	To measure the level of sponsor commitment to project. This is an important parameter for securing debt	SANRAL, South Africa	40% sponsors, 60% non-sponsors
Debt-equity ratio	A measure of a company's financial leverage calculated by dividing long-term debt by stockholder equity	To measure the volatility of project revenue resulting from interest payment.	SANRAL, South Africa	80% debt, 20% equity
Private sector investment index	Proportion of annual road expenditure secured from the private sector	To monitor the attraction of private sector investment	SANRAL, South Africa	0.85
Return on construction expenditure	The weighted internal rate of return of total construction expenditure per annum	To monitor the predicted economic benefits to the community from road agency capital programmes	SANRAL, South Africa	IRR > 15%
Expenditure efficiency index	The percentage of annual expenditure on overhead costs	To monitor the efficiency of road agency	SANRAL, South Africa	<5%
Asset preservation index	The ratio between expenditure and increase in pavement layer asset value	To monitor the efficiency of road agency	SANRAL, South Africa	

Performance Indicator	Description	Purpose	Source	Benchmark (target)
User satisfaction index	Index of users' qualitative evaluation of satisfaction with national road network	To provide a qualitative indication of users' perception of the national road network	SANRAL, South Africa	
Application of toll income	How will toll revenues be allocated?	For corporate financial planning purposes.	SANRAL, South Africa	70% debt service 30% operation & maintenance

7.4 Sector and cross-sector policies in favour of highway concession in Ghana

There are a numbers of sector and cross-sector issues that need to be addressed in road transportation in Ghana. The observation is that though the responsibility of road infrastructure provision lies with the Ministry of Roads and Transport, it is important that other sectors which are directly or indirectly affected by the road provision are not left out in road transport policy planning. These sectors include finance, environment, works and housing, industry, tourism, local government and rural development.

A good scenario demanding the need for an integrated approach to road transport planning is illustrated by lessons from the poor performance of the Hungary motorway projects. A review of the Hungary M1/M5 toll projects revealed that, traffic flow and revenues did not meet projections for two main reasons. First, the transport planners failed to access any possible correlation between spatial development and demand for intercity trips. With increasing level of urbanisation, goods and services were brought closer to the people, hence reducing demand for intercity travels. Secondly, national road pricing policies could not be applied to those motorways, which were later designated as European highways. All other relevant sectors need to be consulted and their views considered in developing a sustainable road concession policy.

Sector policies must also address the issue of integration of the different transportation modes in the country. Example, with the proposal to build an inland port in Kumasi (Ghana's second largest city after Accra) and the laying of oil pipelines from the Tema oil refinery to the Northern region, it would be important to access how these developments could affect general traffic flow and traffic redistribution within the country.

7.5 Reaching the urban poor with private road transport infrastructure

The urban poor generally have low willingness- and ability-to-pay for road infrastructure use. Considering the current economic situation of the country where nearly 40% of the population live below the poverty line, charging optimal toll (that which reflect the true cost of a trip) might exclude the urban poor from the use of road infrastructure. To attract needed public support, especially among pro-poor rights groups, it is important that the toll system be politically, socially and economically 'fair'. The notion of fairness here concerns the need for government to ensure that in

its bid to inject private participation in infrastructure provision, the right of citizens' access to basic infrastructure are not jeopardised.

There is therefore the need to strike a balance between equity (right of citizens to access basic infrastructure) and efficiency (the need to recover cost). There are various approaches through which government can meet this equity-efficiency objective in its bid to cater for the urban poor.

One, government must ensure that existing non-tolled roads are kept in good condition for use by those who might be tolled-off the toll roads. Pursuing such a policy would leave both those tolled and those not tolled all better off. Two, government could consider the policy of cross-subsidy to take care of the urban poor. An approach to ensure that the poor really benefits from this policy would have to be investigated and pursued. Since the urban poor mostly travel by mass public transport, an approach would be for government to subsidise tolls for high-occupancy public transports such as "trotro" and buses.

8 CONCLUSION AND RECOMMENDATIONS

Roads are indispensable catalysts for the socio-economic development of any country since they provide citizens with needed access to social services and economic opportunities. Despite these important functions roads play, the road sector in Ghana still remains grossly under funded -resulting in a large share of road networks in poor conditions. Under funding or deferred needed maintenance have severe future cost implications. Failing to provide needed maintenance at the appropriate time generally leads to expensive reconstruction costs. These additional costs are estimated to be 37% of the road network life cycle costs in Ghana.

This thesis has developed a cost-revenue model for assessing the extent to which existing revenues from user charges cover the estimated life cycle costs of the road network. Although road users' contribution forms a significant source of road budgets, they are still not sufficient to cover the expected total road costs. The current funding constraints are partly due to under allocation of funds to the road sector. Furthermore, only about one-half of what users contribute, in the form of road user related charges, is actually allocated to the road sector. This implies that nearly one-half of revenues generated from road user charges go to cross subsidize other sectors of the economy. This disparity between user contributions and allocated domestic funds lead to an underestimation of the extent to which road users are contributing to the road sector or the national economy.

How can we ensure adequate funding for the road sector? This thesis has reviewed the concept of road concessioning as a possible option of involving the private sector in the financing of needed road investments in Ghana. The findings indicate that a successful road concession scheme in Ghana will require public support, sound economic management, strengthening of the existing legal framework and serious measures to tackle corruption.

A public perception survey conducted as part of this thesis shows that there is consensus among road users on the important issues that affect the performance of road tolling in the country. The survey results show that road users are more likely to support the following measures: (1) unconditional tolling of both existing and new highways (2) charging of higher tolls on existing toll roads (4) public management of toll roads and (5) financing of highways using toll revenues. It is also anticipated that implementation of road concession scheme would address issues relating to urban congestion and road safety.

Traffic levels on most highways in Ghana are generally low, though some roads have high enough traffic volume for a possible concession scheme. It is there recommended

that concessioning be done on project-by-project basis starting the high traffic roads. Evaluation of selected highways in the country has identified some projects for possible Build-Operate-Transfer (BOT), Rehabilitate-Operate-Transfer (ROT) and Maintain-Operate-Transfer (MOT) concession schemes.

Overall, the focus of road transport infrastructure project financing in Ghana must not just be aimed at getting investment costs off government shoulders, but rather seen as a means of undertaking safe, efficient and competitive road projects and making road-users accept the payment of economic prices for the services provided instead of the tax payer. In the Ghanaian context, project finance makes a lot of sense because of declining donor support coupled with government's inability to generate and allocate sufficient funds to meet the nation's growing road infrastructure demand.

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APPENDIX A: PERSONS CONTACTED

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APPENDIX B: ROAD NETWORK LIFE CYCLE COSTS

Table 33 Detail calculation of annual road network life cycle costs

Road Class	Network Condition	Network Needs	Network Length [2003]		Cost of clearing backlog			Annual maintenance costs							Asset Replacement costs		Total Annual Costs
			km	%	US\$/km	US\$m	US\$/m/yr	Routine		Periodic			R+P		US\$/km	US\$/m/yr	US\$m
								US\$/km/yr	US\$/m/yr	US\$/km	US\$m	Years	US\$/m/yr	US\$/m/yr			
TRUNK ROADS			12 690	26%		1 271	127.1		13.3		425.0		61.8	75.0		137.6	339.7
Asphalt & PCC			1 600	13%		86	8.6		1.8		176.4		14.7	16.5		26.7	51.9
	Poor	Reconstruct	100	7%	500.000	52	5.2	1 150	0.1	110 000	11.5	12	1.0	1.1	500 000	1.7	8.0
	Fair	Overlay	310	19%	110.000	34	3.4	1 150	0.4	110 000	33.9	12	2.8	3.2	500 000	5.1	11.7
	Good	"Do nothing"	1 190	74%				1 150	1.4	110 000	131.1	12	10.9	12.3	500 000	19.9	32.2
Bituminous			4 730	37%		336	33.6		4.9		108.9		12.1	17.0		47.3	98.0
	Poor	Reconstruct	990	21%	300 000	298	29.8	1 040	1.0	23 000	22.9	9	2.5	3.6	300 000	9.9	43.3
	Fair	Resurface	1 660	35%	23 000	38	3.8	1 040	1.7	23 000	38.1	9	4.2	6.0	300 000	16.6	26.3
	Good	"Do nothing"	2 080	44%				1 040	2.2	23 000	47.9	9	5.3	7.5	300 000	20.8	28.3
Gravel			6 360	50%		848	84.8		6.5		139.9		35.0	41.5		63.6	189.9
	Poor	Reconstruct	4 040	64%	200 000	809	80.9	1 020	4.1	22 000	88.9	4	22.2	26.4	200 000	40.4	147.7
	Fair	Regravel	1 810	28%	22 000	40	4.0	1 020	1.8	22 000	39.7	4	9.9	11.8	200 000	18.0	33.8
	Good	"Do nothing"	510	8%				1 020	0.5	22 000	11.2	4	2.8	3.3	200 000	5.1	8.4
URBAN ROADS			4 060	8%		396	39.6		7.3		107.2		15.2	22.5		31.3	93.4
Asphalt & PCC			410	10%		62	6.2		0.8		34.5		2.9	3.7		5.6	15.5
	Poor	Reconstruct	130	32%	404 400	53	5.3	1 900	0.3	83 600	11.0	12	0.9	1.2	404 400	1.8	8.3
	Fair	Overlay	110	26%	83 600	9	0.9	1 900	0.2	83 600	9.0	12	0.7	1.0	404 400	1.5	3.3
	Good	"Do nothing"	170	42%				1 900	0.3	83 600	14.5	12	1.2	1.5	404 400	2.3	3.9
Bituminous			1 520	37%		122	12.2		2.9		42.0		4.7	7.6		11.5	31.3
	Poor	Reconstruct	490	32%	227 300	111	11.1	1 900	0.9	27 600	13.4	9	1.5	2.4	227 300	3.7	17.2
	Fair	Resurface	400	26%	27 600	11	1.1	1 900	0.8	27 600	10.9	9	1.2	2.0	227 300	3.0	6.1
	Good	"Do nothing"	640	42%				1 900	1.2	27 600	17.6	9	2.0	3.2	227 300	4.8	8.0
Gravel			2 130	52%		212	21.2		3.6		30.7		7.7	11.3		14.2	46.7
	Poor	Reconstruct	1 580	74%	133 000	210	21.0	1 700	2.7	14 400	22.7	4	5.7	8.4	133 000	10.5	39.8
	Fair	Regravel	190	9%	14 400	3	0.3	1 700	0.3	14 400	2.8	4	0.7	1.0	133 000	1.3	2.6
	Good	"Do nothing"	360	17%				1 700	0.6	14 400	5.2	4	1.3	1.9	133 000	2.4	4.3
FEEDER ROADS			32 610	66%		448	44.8		13.0		149.1		38.8	51.8		43.6	140.2
Bituminous			1 210	4%		45	4.5		0.6		19.7		2.2	2.8		5.7	13.0
	Poor	Reconstruction	290	24%	141 300	41	4.1	470	0.1	16 200	4.7	9	0.5	0.7	141 300	1.4	6.2
	Fair	Surface	230	19%	16 200	4	0.4	470	0.1	16 200	3.7	9	0.4	0.5	141 300	1.1	2.0
	Good	"Do nothing"	690	57%				470	0.3	16 200	11.2	9	1.2	1.6	141 300	3.3	4.8
Gravel			17 770	54%		311	31.1		8.4		112.4		28.1	36.4		26.6	94.2
	Poor	Reconstruction	9 240	52%	30 000	277	27.7	470	4.3	6 300	58.4	4	14.6	18.9	30 000	13.9	60.5
	Fair	Regravel	5 330	30%	6 300	34	3.4	470	2.5	6 300	33.7	4	8.4	10.9	30 000	8.0	22.3
	Good	"Do nothing"	3 200	18%				470	1.5	6 300	20.2	4	5.1	6.6	30 000	4.8	11.4
Earth			13 630	42%		93	9.3		4.1		17.0		8.5	12.6		11.2	33.1
	Poor	Reconstruct	7 090	52%	12 300	87	8.7	300	2.1	1 300	8.9	2	4.4	6.6	12 300	5.8	21.1
	Fair	Reshape	4 090	30%	1 300	5	0.5	300	1.2	1 300	5.1	2	2.6	3.8	12 300	3.4	7.7
	Good	"Do nothing"	2 450	18%				300	0.7	1 300	3.1	2	1.5	2.3	12.300	2.0	4.3
Total			49 370	100%		2 115	211.5		33.6		681.4		115.8	149.4		212.5	573.4
Adm. Costs (5%)						105.8	10.6		1.7		34.1		5.8	7.5		10.6	28.7
Total with adm.						2 221	222.1		35.3		715.5		121.6	156.8		223.1	602.0

APPENDIX C: ROAD FUND REVENUES AND USER CONTRIBUTION

Table 34 Annual road fund revenue

Notes Assumptions (1) cars, motorcycles consume premium and pick-ups, buses and trucks consume diesel. (2) Approximately all refined premium and

Vehicle population		Vehicle registration rev.			Vehicle inspection revenues			Road fund fuel levy revenues			International transit revenues			Toll revenues			Road fund
Vehicle type	No. of veh	Regd. veh.	Fee	Rev.	Vehicles inspected	Fee	Rev.	Road levy	Consumption	Rev.	Int. transits	Fee	Rev.	trips	Toll rate	Rev	Total
	[2005]		US\$	US\$m		US\$	US\$m	US\$/litre	Metric Tonnes	US\$m		US\$	US\$m		US\$	US\$m	US\$m
Motor Cycles	112 400	15 150	5.6	0.08	89 900	2.2	0.20	0.07	633 400	57.3				3 237 400	0.02	0.07	60.2
Cars	427 300	29 600	22.0	0.65	341 800	2.2	0.75				179 500	2.2	0.39	12 308 700	0.05	0.68	
Pickup /Light Bus	48 800	8 700	33.0	0.29	39 000	3.3	0.13	0.07	928 500	72.3	76 900	2.4	0.19	1 405 300	0.09	0.12	75.7
Heavy Bus	107 400	5 600	43.9	0.25	85 900	3.8	0.33				59 700	4.4	0.26	3 094 500	0.14	0.44	
Light Trucks	37 500	2 500	55.6	0.14	30 000	3.3	0.10				20 500	2.6	0.05	1 079 200	0.20	0.21	
Medium Trucks	16 600	960	72.2	0.07	13 300	4.4	0.06				9 200	4.4	0.04	479 300	0.20	0.09	
Heavy Trucks	13 700	1 380	131.8	0.18	11 000	11.0	0.12				7 200	5.5	0.04	395 600	0.44	0.17	
Total	763 700	63 870		1.66	610 900		1.69			129.7	353 000		0.98	22 000 000		1.80	135.8

diesel oils are consumed by vehicles. Exchange rate US\$ 1= GHC 9000.

Table 35 Annual total road user contributions

Vehicle population		Vehicle registration rev.			Vehicle inspection revenues			Road fund fuel levy revenues			International transit revenues			Toll revenues			Road fund
Vehicle type	No. of veh	Reg. veh.	Fee	Rev.	Vehicles inspected	Fee	Rev.	Road levy	Consumption	Rev.	No. int. transits	Fee	Rev.	No. of trips	Toll rate	Rev	Total
	[2005]		US\$	US\$m		US\$	US\$m	US\$/litre	Metric Tonnes	US\$m		US\$	US\$m		US\$	US\$m	US\$m
Motor Cycles	112 400	15 150	5.6	0.08	89 900	2.2	0.20	0.17	633 400	148.8				3 237 400	0.02	0.07	151.7
Cars	427 300	29 600	22.0	0.65	341 800	2.2	0.75				179 500	2.2	0.39	12 308 700	0.05	0.68	
Pickup /Light Bus	48 800	8 700	33.0	0.29	39 000	3.3	0.13	0.12	928 500	134.4	76 900	2.4	0.19	1 405 300	0.09	0.12	137.8
Heavy Bus	107 400	5 600	43.9	0.25	85 900	3.8	0.33				59 700	4.4	0.26	3 094 500	0.14	0.44	
Light Trucks	37 500	2 500	55.6	0.14	30 000	3.3	0.10				20 500	2.6	0.05	1 079 200	0.20	0.21	
Medium Trucks	16 600	960	72.2	0.07	13 300	4.4	0.06				9 200	4.4	0.04	479 300	0.20	0.09	
Heavy Trucks	13 700	1 380	131.8	0.18	11 000	11.0	0.12				7 200	5.5	0.04	395 600	0.44	0.17	
Total	763 700	63 870		1.66	610 900		1.69			283.3	353 000		0.98	22 000 000		1.80	289.4

Notes Assumptions (1) cars, motorcycles consume premium and pick-ups, buses and trucks consume diesel. (2) Approximately all refined premium and diesel oils are consumed by vehicles. Exchange rate US\$ 1= GHC 9000

APPENDIX D: QUESTIONNAIRES FOR TOLL ROAD USERS

Questionnaire number _____

Questionnaire administered by _____

Respondent's location _____

Date _____

1) Your Gender

Male Female

2) Age

Below 18 18-25 26-40 40-60

3) Household size

one or two three to five five to 10 more than 10

4) Number of vehicles in Household

one two three four five >five

5) Employment status

Student Employee Retired
 Unemployed Self-employer Other

6) Vehicle Type

motorbike car pickup/van small bus

7) Which of these toll roads do you often use? (*select only one*)

Tema-Accra Tema-Akosombo Ksi-Sunyani Ksi-Mampong-Ejura

8) Usual trip purpose

school work shopping visit religious Other (specify) _____

9) What is the average travel time (in hours) from origin to destination?

10) Number of return trips?

at least four return trip per week three return trips per week
 one return trip per week one return trip in two week
 two return trips per week one return trip per month

11) How would you describe the existing toll rate?

Very low low just ok high very high

12) Which of the following, in your opinion, is/are the primary cause(s) of accidents on this road?

- driver behaviour(e.g. over-speeding) road environment (no streetlights)
 road condition (e.g. potholes) broken-down vehicles on road
 vehicle condition (e.g. bad brakes) Other

13) Which of the following will most effectively control congestion on this road?

- increase number of booths introduce electronic tolling
 charge higher peak hour toll rates Other (specify)

14) Why do some drivers use unauthorised routes along this road? (*only for Tema-Accra Motorway users*)

- Avoid toll payment
 Short-cut to residence/workplace along route Indiscipline
 Avoid traffic congestion Other(specify)

15) Is there an alternative route to your destination if you decide not to use this toll-road?

- Yes No

16) What is the average travel time (in hours) to destination using the alternative route?

17) Please select the highest toll rate you will be willing to pay on the toll road? (Beyond this toll rate you might consider using a public transport or the non-tolled alternative route to your destination)

- 1,000 2,000 3,000 5,000
 1,500 2,500 4,000 Other

18) How much do spend per month on vehicle maintenance? (excluding cost of fuel)

- less than 200,000 500,000 to 1m 2 to 5million
 200,000 to 500,000 1 to 2million more than 5million

19) How should highway construction and maintenance be financed?

- Fuel tax Consolidated fund Other(specify)
 Tolls Donors

20) Who should manage highway toll projects?

- Public alone Public/Private partnership No preference

21) Which category of highways could be tolled?

- new highways existing highways both none
-

22) What is your monthly household income (in Cedis)?

- less than 0.5million
 0.5-1m
 1-2m
 2-5m
 5-10m
 10-15m
 15-20m
 more than 20m
-

23) Any suggestions for improvement in road tolling operations in Ghana?

APPENDIX E SUMMARY OF SURVEY DATA

SN	Age	House - hold size	Number of household vehicles	Employment status	Vehicle type	Trip purpose	Number of return trips	Causes of accidents	Congestion control measure	Use of unauthorised routes	Existence of alternative routes	Highest toll willing to pay	Time savings using toll road	Vehicle maintenance costs	How should highways be financed?	Who should manage toll roads?	Which highways should be tolled?	Household income
1	<18	> 10	3	retired	car	work	atleast four time a week	Road Condition	other	avoid traffic	yes	1000	No time savings	200 - 500	tolls	public	new	2 - 5
2	18 - 25	5 - 10	2	student	car	work	thrice a week	Road Environment	booths	other	no	500	NA	500 - 1000	tolls	public	both	< 0.5
3	26 - 40	5 - 10	2	unemployed	car	visit	thrice a week	Driver Behaviour	electronic	indiscipline	yes	5000	No time savings	200 - 500	tolls	public	both	2 - 5
4	26 - 40	5 - 10	5	self employed	car	work	atleast four time a week	Driver Behaviour	other	other	no	500	NA	500 - 1000	tolls	PPP	new	2 - 5
5	18 - 25	3 - 5	2	student	pick up	work	once a week	Driver Behaviour	booths	shortcut	yes	1000	No time savings	NA	tolls	public	both	5 - 10
6	40 - 60	3 - 5	1	self employed	car	work	atleast four time a week	Driver Behaviour	booths	other	no	500	NA	200 - 500	tolls	no pref	both	0.5 - 1
7	26 - 40	NA	3	self employed	small bus	work	once a week	Driver Behaviour	other	other	no	1000	NA	<200	tolls	public	existing	< 0.5
8	26 - 40	> 10	3	self employed	car	work	once a week	Driver Behaviour	booths	shortcut	no	500	NA	500 - 1000	Consolidated funds	public	new	< 0.5
9	18 - 25	3 - 5	1	self employed	car	work	atleast four time a week	Driver Behaviour	peak toll	avoid traffic	no	1500	NA	500 - 1000	Consolidated funds	PPP	both	2 - 5
10	26 - 40	> 10	2	self employed	car	work	thrice a week	Driver Behaviour	other	shortcut	no	500	NA	500 - 1000	tolls	public	both	2 - 5
11	26 - 40	3 - 5	1	Employee	car	other	atleast once a month	Driver Behaviour	other	avoid traffic	no	1000	NA	">5000"	Consolidated funds	public	existing	2 - 5
12	18 - 25	5 - 10	1	unemployed	car	work	atleast four time a week	Road Condition	booths	avoid traffic	no	500	NA	">5000"	tolls	PPP	both	1 - 2
13	40 - 60	3 - 5	2	self employed	car	work	once a week	Driver Behaviour	electronic	shortcut	yes	1000	upto 50% time savings	500 - 1000	all	no pref	both	5 - 10
14	26 - 40	> 10	3	self employed	car	work	atleast four time a week	Road Condition	booths	shortcut	no	1000	NA	200 - 500	tolls	public	both	0.5 - 1
15	26 - 40	3 - 5	1	self employed	car	work	twice a week	Driver Behaviour	other	avoid traffic	no	1000	NA	500 - 1000	tolls	public	new	2 - 5
16	40 - 60	> 10	1	retired	car	work	atleast four time a week	Driver Behaviour	booths	shortcut	no	500	NA	500 - 1000	tolls	public	both	5 - 10
17	26 - 40	> 10	1	self employed	car	work	atleast four time a week	Driver Behaviour	other	shortcut	no	1000	NA	500 - 1000	tolls	public	none	2 - 5
18	18 - 25	5 - 10	1	self employed	car	work	thrice a week	Driver Behaviour	booths	indiscipline	yes	500	upto 100% time savings	200 - 500	tolls	public	both	2 - 5
19	26 - 40	> 10	1	self employed	car	work	twice a week	Road Condition	other	other	yes	1000	upto 50% time savings	1000 - 2000	tolls	public	new	2 - 5
20	26 - 40	5 - 10	1	retired	car	work	once a week	Road Condition	booths	other	yes	1000	No time savings	NA	Consolidated funds	PPP	existing	0.5 - 1
21	26 - 40	> 10	2	self employed	car	work	twice a week	Driver Behaviour	electronic	shortcut	yes	2000	upto 50% time savings	500 - 1000	Consolidated funds	public	both	1 - 2
22	26 - 40	5 - 10	2	self employed	car	work	once a week	Driver Behaviour	electronic	avoid traffic	yes	1000	more than 100% time savings	500 - 1000	tolls	PPP	both	2 - 5
23	18 - 25	5 - 10	1	Employee	cargo	work	atleast once a month	Driver Behaviour	electronic	shortcut	yes	1500	No time savings	200 - 500	Fuel tax	public	existing	1 - 2
24	40 - 60	5 - 10	1	retired	pick up	work	atleast four time a week	Vehicle Condition	NA	indiscipline	yes	1000	NA	500 - 1000	tolls	public	new	< 0.5
25	26 - 40	3 - 5	1	self employed	car	work	once a week	Vehicle Condition	other	avoid traffic	no	1000	NA	500 - 1000	tolls	PPP	both	1 - 2
26	40 - 60	3 - 5	2	self employed	pick up	work	thrice a week	Driver Behaviour	electronic	avoid traffic	no	1500	NA	200 - 500	Fuel tax	PPP	new	1 - 2
27	40 - 60	5 - 10	1	Employee	pick up	work	twice a week	Vehicle Condition	electronic	avoid traffic	no	2000	NA	1000 - 2000	Fuel tax	PPP	new	1 - 2
28	18 - 25	3 - 5	3	Employee	cargo	work	thrice a week	Vehicle Condition	electronic	indiscipline	no	6000	NA	">5000"	Fuel tax	public	new	1 - 2
29	26 - 40	1- 2	1	Employee	car	work	twice a week	Driver Behaviour	electronic	indiscipline	yes	500	upto 50% time savings	500 - 1000	Fuel tax	PPP	new	0.5 - 1
30	40 - 60	3 - 5	1	unemployed	car	shopping	atleast four time a week	Vehicle Condition	electronic	indiscipline	yes	1000	upto 50% time savings	200 - 500	Fuel tax	public	new	NA

SN	Age	House - hold size	Number of household vehicles	Employment status	Vehicle type	Trip purpose	Number of return trips	Causes of accidents	Congestion control measure	Use of unauthorised routes	Existence of alternative routes	Highest toll willing to pay	Time savings using toll road	Vehicle maintenance costs	How should highways be financed?	Who should manage toll roads?	Which highways should be tolled?	Household income
31	26 - 40	5 - 10	1	Employee	pick up	work	atleast four time a week	Vehicle Condition	other	shortcut	no	1000	NA	200 - 500	tolls	PPP	existing	< 0.5
32	26 - 40	3 - 5	NA	unemployed	cargo	work	atleast four time a week	Driver Behaviour	booths	shortcut	yes	NA	upto 50% time savings	200 - 500	tolls	public	both	NA
33	26 - 40	3 - 5	1	self employed	pick up	work	atleast four time a week	Driver Behaviour	booths	shortcut	no	NA	NA	200 - 500	tolls	public	both	< 0.5
34	40 - 60	5 - 10	2	self employed	cargo	work	once a week	Driver Behaviour	electronic	shortcut	yes	4000	No time savings	1000 - 2000	tolls	no pref	both	NA
35	26 - 40	3 - 5	2	self employed	small bus	work	atleast four time a week	Driver Behaviour	booths	shortcut	no	1000	NA	500 - 1000	tolls	public	both	0.5 - 1
36	26 - 40	3 - 5	2	Employee	big bus	work	atleast four time a week	Driver Behaviour	booths	shortcut	yes	1500	more than 100% time savings	500 - 1000	Donors	PPP	both	0.5 - 1
37	40 - 60	5 - 10	1	Employee	small bus	work	atleast four time a week	Vehicle Condition	booths	avoid traffic	no	1000	NA	200 - 500	tolls	PPP	new	0.5 - 1
38	40 - 60	5 - 10	2	self employed	small bus	work	atleast four time a week	Driver Behaviour	booths	avoid traffic	yes	1000	NA	200 - 500	Fuel tax	public	existing	< 0.5
39	26 - 40	3 - 5	1	Employee	small bus	work	atleast four time a week	Vehicle Condition	booths	avoid traffic	yes	1000	upto 50% time savings	200 - 500	tolls	public	both	0.5 - 1
40	40 - 60	3 - 5	NA	Employee	small bus	work	atleast four time a week	Driver Behaviour	peak toll	shortcut	yes	1500	upto 50% time savings	200 - 500	tolls	public	existing	0.5 - 1
41	26 - 40	> 10	3	Employee	car	work	atleast once a month	Driver Behaviour	booths	avoid traffic	yes	500	upto 50% time savings	<200	tolls	public	existing	< 0.5
42	26 - 40	5 - 10	1	self employed	car	shopping	once a week	Driver Behaviour	NA	indiscipline	yes	500	upto 100% time savings	200 - 500	tolls	public	existing	2 - 5
43	26 - 40	1- 2	1	self employed	car	work	atleast four time a week	Vehicle Condition	other	avoid traffic	yes	1000	NA	NA	tolls	public	new	NA
44	18 - 25	1- 2	1	Employee	car	work	once a week	Driver Behaviour	booths	avoid traffic	yes	2000	upto 100% time savings	200 - 500	Others	PPP	both	< 0.5
45	26 - 40	3 - 5	1	Employee	car	visit	thrice a week	Driver Behaviour	electronic	indiscipline	yes	500	upto 50% time savings	200 - 500	tolls	public	both	5 - 10
46	40 - 60	5 - 10	2	self employed	car	work	once a week	Vehicle Condition	booths	avoid traffic	yes	500	NA	500 - 1000	tolls	public	both	0.5 - 1
47	26 - 40	3 - 5	1	Employee	car	visit	once a week	Road Environment	booths	other	yes	500	NA	1000 - 2000	tolls	public	both	5 - 10
48	26 - 40	3 - 5	1	Employee	pick up	work	once a week	Driver Behaviour	electronic	avoid traffic	yes	4000	NA	"2000-5000"	tolls	PPP	both	1 - 2
49	40 - 60	3 - 5	1	Employee	car	work	once a week	Driver Behaviour	electronic	other	yes	1000	upto 100% time savings	"2000-5000"	Fuel tax	public	both	2 - 5
50	26 - 40	> 10	1	Employee	car	work	twice a week	Driver Behaviour	booths	shortcut	NA	1000	NA	NA	Others	no pref	NA	NA
51	26 - 40	3 - 5	2	self employed	car	work	twice a week	Driver Behaviour	electronic	shortcut	yes	NA	upto 100% time savings	1000 - 2000	Fuel tax	PPP	both	5 - 10
52	26 - 40	3 - 5	2	Employee	pick up	work	once a week	Driver Behaviour	booths	NA	no	4000	NA	">5000"	Consolidated funds	public	both	0.5 - 1
53	40 - 60	5 - 10	2	self employed	car	work	thrice a week	Driver Behaviour	booths	indiscipline	yes	1000	NA	200 - 500	tolls	public	both	2 - 5
54	26 - 40	3 - 5	1	Employee	car	work	atleast four time a week	Driver Behaviour	booths	shortcut	yes	1000	upto 100% time savings	500 - 1000	Fuel tax	no pref	both	5 - 10
55	26 - 40	1- 2	NA	Employee	pick up	work	twice a week	Driver Behaviour	NA	avoid traffic	no	1000	NA	NA	tolls	no pref	both	0.5 - 1
56	40 - 60	3 - 5	1	Employee	small bus	work	atleast four time a week	Driver Behaviour	NA	NA	yes	5000	more than 100% time savings	500 - 1000	tolls	public	both	2 - 5
57	18 - 25	NA	4	Employee	cargo	work	thrice a week	Vehicle Condition	NA	indiscipline	no	5000	NA	"2000-5000"	tolls	public	both	0.5 - 1
58	40 - 60	5 - 10	2	Employee	car	work	atleast four time a week	Driver Behaviour	booths	indiscipline	yes	1000	upto 50% time savings	1000 - 2000	tolls	public	NA	2 - 5
59	40 - 60	5 - 10	2	Employee	car	shopping	atleast once a month	Driver Behaviour	electronic	indiscipline	yes	1000	upto 100% time savings	200 - 500	tolls	public	both	2 - 5
60	18 - 25	3 - 5	2	student	car	school	atleast four time a week	Driver Behaviour	electronic	indiscipline	no	1000	NA	500 - 1000	Donors	public	both	0.5 - 1
61	40 - 60	1- 2	1	self employed	pick up	work	atleast four time a week	Driver Behaviour	electronic	avoid traffic	no	1000	NA	200 - 500	tolls	no pref	new	1 - 2

SN	Age	House - hold size	Number of household vehicles	Employment status	Vehicle type	Trip purpose	Number of return trips	Causes of accidents	Congestion control measure	Use of unauthorised routes	Existence of alternative routes	Highest toll willing to pay	Time savings using toll road	Vehicle maintenance costs	How should highways be financed?	Who should manage toll roads?	Which highways should be tolled?	Household income
62	26 - 40	3 - 5	1	Employee	car	work	once a week	Driver Behaviour	NA	NA	NA	NA	NA	NA	Others	no pref	NA	NA
63	40 - 60	5 - 10	3	Employee	car	work	atleast four time a week	Driver Behaviour	booths	indiscipline	yes	1500	No time savings	<200	Donors	public	both	0.5 - 1
64	26 - 40	1- 2	3	Employee	car	shopping	twice a week	Vehicle Condition	NA	avoid traffic	no	5000	NA	<200	Fuel tax	public	both	0.5 - 1
65	18 - 25	5 - 10	4	retired	car	work	atleast four time a week	Driver Behaviour	NA	indiscipline	yes	5000	NA	200 - 500	Others	no pref	both	NA
66	40 - 60	3 - 5	1	Employee	car	work	atleast four time a week	Driver Behaviour	electronic	shortcut	yes	1000	upto 50% time savings	"2000-5000"	tolls	no pref	both	2 - 5
67	18 - 25	1- 2	3	self employed	car	school	twice a week	Driver Behaviour	electronic	indiscipline	yes	5000	more than 100% time savings	1000 - 2000	tolls	public	new	1 - 2
68	40 - 60	5 - 10	3	self employed	car	work	twice a week	Vehicle Condition	booths	avoid traffic	yes	5000	No time savings	200 - 500	tolls	public	both	1 - 2
69	26 - 40	3 - 5	2	Employee	big bus	work	atleast once a month	Driver Behaviour	booths	indiscipline	no	1000	NA	NA	tolls	no pref	NA	< 0.5
70	26 - 40	> 10	4	Employee	car	work	once a week	Driver Behaviour	other	avoid traffic	yes	1000	upto 100% time savings	"2000-5000"	tolls	public	both	0.5 - 1
71	40 - 60	> 10	4	Employee	car	work	atleast four time a week	Driver Behaviour	booths	shortcut	no	1000	NA	<200	tolls	PPP	both	0.5 - 1
72	26 - 40	3 - 5	NA	Employee	car	work	atleast four time a week	Driver Behaviour	booths	avoid traffic	no	1000	NA	<200	tolls	public	both	0.5 - 1
73	18 - 25	1- 2	1	Employee	car	work	atleast four time a week	Driver Behaviour	NA	other	no	NA	NA	200 - 500	tolls	PPP	new	0.5 - 1
74	26 - 40	> 10	2	Employee	car	work	atleast four time a week	Driver Behaviour	electronic	avoid traffic	no	1000	NA	200 - 500	Fuel tax	PPP	both	1 - 2
75	40 - 60	5 - 10	4	Employee	car	work	atleast four time a week	Driver Behaviour	electronic	shortcut	no	NA	NA	200 - 500	Others	PPP	new	0.5 - 1
76	26 - 40	> 10	3	self employed	car	work	atleast four time a week	Driver Behaviour	other	avoid traffic	no	1000	NA	200 - 500	Others	PPP	both	1 - 2
77	18 - 25	3 - 5	3	Employee	car	work	atleast four time a week	Driver Behaviour	booths	avoid traffic	no	1000	NA	500 - 1000	Consolidated funds	public	existing	1 - 2
78	40 - 60	3 - 5	1	self employed	car	work	atleast four time a week	Driver Behaviour	electronic	indiscipline	no	1000	NA	<200	tolls	public	both	1 - 2
79	40 - 60	> 10	2	self employed	car	work	atleast four time a week	Driver Behaviour	electronic	shortcut	no	1000	NA	500 - 1000	tolls	PPP	both	2 - 5
80	40 - 60	> 10	1	Employee	car	work	once a week	Driver Behaviour	booths	indiscipline	no	1000	NA	<200	Consolidated funds	PPP	new	1 - 2
81	26 - 40	> 10	1	self employed	car	work	atleast four time a week	Driver Behaviour	other	shortcut	no	1000	NA	<200	Fuel tax	public	both	1 - 2
82	26 - 40	> 10	5	Employee	car	work	twice a week	Driver Behaviour	booths	indiscipline	no	1000	NA	<200	Fuel tax	public	new	0.5 - 1
83	18 - 25	> 10	1	Employee	car	work	once a week	Driver Behaviour	electronic	indiscipline	no	1000	NA	<200	tolls	PPP	new	0.5 - 1
84	18 - 25	> 10	1	Employee	car	work	twice a week	Driver Behaviour	electronic	avoid traffic	no	1000	NA	<200	tolls	no pref	both	0.5 - 1
85	26 - 40	3 - 5	3	self employed	car	work	thrice a week	Driver Behaviour	electronic	avoid traffic	no	1000	NA	<200	tolls	PPP	new	0.5 - 1
86	26 - 40	> 10	4	self employed	car	work	atleast four time a week	Driver Behaviour	other	avoid traffic	no	1000	NA	<200	tolls	PPP	both	2 - 5
87	26 - 40	> 10	6	Employee	car	work	twice a week	Driver Behaviour	electronic	shortcut	no	1000	NA	<200	tolls	PPP	new	0.5 - 1
88	40 - 60	3 - 5	2	self employed	car	work	atleast four time a week	Driver Behaviour	electronic	shortcut	no	500	NA	200 - 500	tolls	public	both	2 - 5
89	40 - 60	3 - 5	1	self employed	car	work	atleast four time a week	Driver Behaviour	booths	shortcut	no	1000	NA	200 - 500	tolls	public	both	NA
90	26 - 40	5 - 10	4	Employee	car	work	thrice a week	Driver Behaviour	booths	shortcut	yes	500	upto 50% time savings	500 - 1000	tolls	PPP	both	< 0.5
91	40 - 60	5 - 10	2	self employed	car	work	twice a week	Driver Behaviour	booths	avoid traffic	no	500	NA	500 - 1000	tolls	PPP	new	1 - 2
92	40 - 60	5 - 10	1	self employed	car	work	atleast four time a week	Driver Behaviour	booths	shortcut	no	500	NA	500 - 1000	tolls	public	new	0.5 - 1

SN	Age	House - hold size	Number of household vehicles	Employment status	Vehicle type	Trip purpose	Number of return trips	Causes of accidents	Congestion control measure	Use of unauthorised routes	Existence of alternative routes	Highest toll willing to pay	Time savings using toll road	Vehicle maintenance costs	How should highways be financed?	Who should manage toll roads?	Which highways should be tolled?	Household income
93	40 - 60	3 - 5	2	self employed	car	work	thrice a week	Driver Behaviour	electronic	shortcut	no	1000	NA	200 - 500	tolls	public	both	1 - 2
94	26 - 40	3 - 5	2	self employed	car	work	atleast four time a week	Driver Behaviour	electronic	shortcut	yes	500	upto 100% time savings	">5000"	Fuel tax	no pref	new	NA
95	26 - 40	5 - 10	2	Employee	pick up	work	atleast once a month	Driver Behaviour	other	other	yes	1000	upto 50% time savings	"2000-5000"	tolls	no pref	existing	NA
96	> 60	1 - 2	1	Employee	small bus	work	atleast four time a week	Driver Behaviour	electronic	other	yes	1000	upto 50% time savings	"2000-5000"	tolls	PPP	existing	< 0.5
97	26 - 40	5 - 10	1	Employee	small bus	work	atleast four time a week	Driver Behaviour	booths	indiscipline	yes	1000	upto 50% time savings	"2000-5000"	tolls	PPP	NA	1 - 2
98	26 - 40	> 10	1	Employee	pick up	work	atleast four time a week	Driver Behaviour	electronic	NA	yes	1000	NA	"2000-5000"	tolls	PPP	existing	NA
99	NA	1 - 2	1	Employee	small bus	work	atleast four time a week	Driver Behaviour	booths	other	yes	1000	more than 100% time savings	500 - 1000	tolls	PPP	existing	0.5 - 1
100	26 - 40	3 - 5	2	Employee	small bus	work	atleast four time a week	Driver Behaviour	electronic	other	yes	1000	more than 100% time savings	500 - 1000	tolls	public	existing	0.5 - 1
101	26 - 40	1 - 2	6	Employee	small bus	work	atleast four time a week	Driver Behaviour	booths	other	yes	500	NA	1000 - 2000	tolls	PPP	existing	NA
102	26 - 40	3 - 5	4	Employee	small bus	work	atleast four time a week	Driver Behaviour	booths	other	yes	1000	upto 50% time savings	1000 - 2000	tolls	PPP	existing	0.5 - 1
103	26 - 40	1 - 2	4	Employee	small bus	work	atleast four time a week	Vehicle Condition	NA	other	yes	1000	upto 50% time savings	200 - 500	tolls	PPP	existing	< 0.5
104	26 - 40	1 - 2	1	Employee	small bus	work	atleast four time a week	Driver Behaviour	other	NA	yes	500	NA	500 - 1000	tolls	PPP	existing	NA
105	26 - 40	1 - 2	NA	retired	small bus	work	atleast four time a week	Driver Behaviour	electronic	other	yes	1000	upto 50% time savings	1000 - 2000	tolls	PPP	existing	0.5 - 1
106	18 - 25	3 - 5	3	Employee	car	work	atleast four time a week	Driver Behaviour	booths	other	yes	1000	No time savings	1000 - 2000	tolls	PPP	existing	NA
107	26 - 40	1 - 2	2	Employee	car	work	atleast four time a week	Vehicle Condition	electronic	avoid traffic	yes	500	No time savings	1000 - 2000	tolls	PPP	existing	NA
108	NA	3 - 5	2	Employee	small bus	work	atleast four time a week	Vehicle Condition	booths	other	yes	1000	more than 100% time savings	500 - 1000	tolls	PPP	existing	NA
109	26 - 40	5 - 10	1	Employee	small bus	work	atleast four time a week	Road Condition	booths	other	yes	1000	upto 50% time savings	"2000-5000"	tolls	PPP	existing	< 0.5
110	40 - 60	3 - 5	3	Employee	car	work	atleast four time a week	Driver Behaviour	booths	NA	yes	1000	NA	1000 - 2000	Fuel tax	PPP	existing	NA
111	26 - 40	1 - 2	1	Employee	small bus	work	atleast four time a week	Driver Behaviour	booths	other	yes	1000	upto 50% time savings	200 - 500	tolls	PPP	existing	NA
112	26 - 40	1 - 2	4	Employee	small bus	work	atleast four time a week	Driver Behaviour	other	other	yes	1000	upto 50% time savings	500 - 1000	tolls	public	existing	NA
113	26 - 40	1 - 2	1	Employee	small bus	work	atleast four time a week	Driver Behaviour	other	shortcut	yes	1000	upto 50% time savings	1000 - 2000	tolls	PPP	existing	NA
114	40 - 60	5 - 10	3	Employee	car	work	atleast four time a week	Driver Behaviour	other	other	yes	500	upto 100% time savings	200 - 500	tolls	PPP	existing	NA
115	26 - 40	5 - 10	2	Employee	car	work	atleast four time a week	Road Condition	booths	other	yes	1000	NA	1000 - 2000	tolls	PPP	existing	NA

APPENDIX F: SUMMARY OF SURVEY DATA

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	111	96,5	96,5	96,5
	Female	4	3,5	3,5	100,0
	Total	115	100,0	100,0	

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<18	1	,9	,9	,9
	18 - 25	17	14,8	15,0	15,9
	26 - 40	61	53,0	54,0	69,9
	40 - 60	33	28,7	29,2	99,1
	> 60	1	,9	,9	100,0
	Total	113	98,3	100,0	
Missing	System	2	1,7		
Total		115	100,0		

Household size

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1- 2	18	15,7	15,9	15,9
	3 - 5	41	35,7	36,3	52,2
	5 - 10	31	27,0	27,4	79,6
	> 10	23	20,0	20,4	100,0
	Total	113	98,3	100,0	
Missing	System	2	1,7		
Total		115	100,0		

Number of household vehicles

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	49	42,6	44,5	44,5
	2	31	27,0	28,2	72,7
	3	16	13,9	14,5	87,3
	4	10	8,7	9,1	96,4
	5	2	1,7	1,8	98,2
	6	2	1,7	1,8	100,0
	Total	110	95,7	100,0	
Missing	System	5	4,3		
Total		115	100,0		

Employment status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	student	3	2,6	2,6	2,6
	unemployed	4	3,5	3,5	6,1
	self employed	40	34,8	34,8	40,9
	Employee	62	53,9	53,9	94,8
	retired	6	5,2	5,2	100,0
	Total	115	100,0	100,0	

Vehicle type

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	car	75	65,2	65,2	65,2
	pick up	12	10,4	10,4	75,7
	small bus	21	18,3	18,3	93,9
	big bus	2	1,7	1,7	95,7
	cargo	5	4,3	4,3	100,0
	Total	115	100,0	100,0	

Trip purpose

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	work	105	91,3	91,3	91,3
	shopping	4	3,5	3,5	94,8
	visit	3	2,6	2,6	97,4
	school	2	1,7	1,7	99,1
	other	1	,9	,9	100,0
	Total	115	100,0	100,0	

Number of return trips

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	once a week	19	16,5	16,5	16,5
	twice a week	15	13,0	13,0	29,6
	thrice a week	12	10,4	10,4	40,0
	atleast four time a week	63	54,8	54,8	94,8
	atleast once a month	6	5,2	5,2	100,0
	Total	115	100,0	100,0	

Causes of accidents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Road Condition	7	6,1	6,1	6,1
	Road Environment	2	1,7	1,7	7,8
	Driver Behaviour	90	78,3	78,3	86,1
	Vehicle Condition	16	13,9	13,9	100,0
	Total	115	100,0	100,0	

Congestion control measure

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	booths	47	40,9	44,8	44,8
	electronic	36	31,3	34,3	79,0
	peak toll	2	1,7	1,9	81,0
	other	20	17,4	19,0	100,0
	Total	105	91,3	100,0	
Missing	System	10	8,7		
Total		115	100,0		

Use of unauthorised routes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	avoid traffic	31	27,0	28,4	28,4
	indiscipline	22	19,1	20,2	48,6
	shortcut	32	27,8	29,4	78,0
	other	24	20,9	22,0	100,0
	Total	109	94,8	100,0	
Missing	System	6	5,2		
Total		115	100,0		

Existence of alternative routes

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	63	54,8	55,8	55,8
	no	50	43,5	44,2	100,0
	Total	113	98,3	100,0	
Missing	System	2	1,7		
Total		115	100,0		

Highest toll willing to pay

GHC		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	500	23	20,0	21,1	21,1
	1000	66	57,4	60,6	81,7
	1500	6	5,2	5,5	87,2
	2000	3	2,6	2,8	89,9
	4000	3	2,6	2,8	92,7
	5000	7	6,1	6,4	99,1
	6000	1	,9	,9	100,0
	Total	109	94,8	100,0	
Missing	System	6	5,2		
Total		115	100,0		

Time savings using toll road

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No time savings	10	8,7	20,0	20,0
	upto 50% time savings	23	20,0	46,0	66,0
	upto 100% time savings	10	8,7	20,0	86,0
	more than 100% time savings	7	6,1	14,0	100,0
	Total	50	43,5	100,0	
Missing	System	65	56,5		
Total		115	100,0		

Vehicle maintenance costs

GHC (million)		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<0.2	15	13,0	13,9	13,9
	0.2- 0.5	33	28,7	30,6	44,4
	0.5 - 1.0	30	26,1	27,8	72,2
	1.0 - 2.0	15	13,0	13,9	86,1
	2.0 - 5.0	10	8,7	9,3	95,4
	>5.0	5	4,3	4,6	100,0
	Total	108	93,9	100,0	
Missing	System	7	6,1		
Total		115	100,0		

How should highways be financed?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid tolls	81	70,4	70,4	70,4
Consolidated funds	8	7,0	7,0	77,4
Fuel tax	16	13,9	13,9	91,3
all	1	,9	,9	92,2
Donors	3	2,6	2,6	94,8
Others	6	5,2	5,2	100,0
Total	115	100,0	100,0	

Who should manage toll roads?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid public	55	47,8	47,8	47,8
PPP	46	40,0	40,0	87,8
no pref	14	12,2	12,2	100,0
Total	115	100,0	100,0	

Which highways could be tolled?

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid none	1	,9	,9	,9
new	25	21,7	22,7	23,6
existing	30	26,1	27,3	50,9
both	54	47,0	49,1	100,0
Total	110	95,7	100,0	
Missing System	5	4,3		
Total	115	100,0		

Household income

GHC (million)	Frequency	Percent	Valid Percent	Cumulative Percent
Valid < 0.5	14	12,2	15,1	15,1
0.5 - 1	31	27,0	33,3	48,4
1 - 2	20	17,4	21,5	69,9
2 - 5	21	18,3	22,6	92,5
5 - 10	7	6,1	7,5	100,0
Total	93	80,9	100,0	
Missing System	22	19,1		
Total	115	100,0		