ADDIS ABABA UNIVERSITY

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COMMERCIALIZATION OF ROADS IN ETHIOPIA

A CASE STUDY OF ADDIS ABABA – ADAMA ROAD

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ACRONYMS

AADT	Average Annual Daily Traffic
AC	Asphalt Concrete
ADB	African Development Bank
BADEA	Bank of Arab for Economic Development in Africa
BOO	Build Own Operate
BOOT	Build Own Operate Transfer
BOT	Build, Own, Transfer
DBFO	Design, Build, Finance and Operate
DBOM	Design Build Operate Maintain
ERA	Ethiopian Roads Authority
ESA	Equivalent Standard Axel
ETB	Ethiopian Birr
EU	European Union
IDA	International Development Association
IRI	International Roughness Index
IRR	Internal Rate of Return
LS	Lump Sum
NPV	Net Present Value
PCE	Passenger Car Equivalent
PPP	Public-Private Partnership
RFA	Road Fund Administration
ROW	Right of Way
USD	United States Dollar
VOC	Vehicle Operating Cost

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ABSTRACT

Road transport is the dominant mode of transport in developing countries like Ethiopia, carrying over 90 percent of the passenger and freight transport, and providing the only access to rural communities where over 85 percent of the population lives. Ethiopia's transport system is one of the lowest in the world and is inadequate to support an efficient production and distribution system. Much of the problem of road construction and maintenance is rooted to the institutional aspects of agencies responsible for roads and the absence of a system ensuring adequate financing for road conservation. Traditionally, the Government has been the great provider of roads, constructing the road network and putting it at the disposition of all citizens. The use of roads has been largely free of charge. Unlike most other types of infrastructure, roads are neither built nor maintained by those who use them to market output or services.

The objective of this study is to review the current road administration and financing system in Ethiopia, compare with international experiences of commercialization of roads and examine its application in Ethiopia. Based on the case study made on Addis Ababa – Adama Trunk road, results show that building a new toll road parallel to the existing road will be feasible and will make sustainable financial flow to preserve the road in good condition so that the vehicles operating costs will be reduced which will contribute to the national economy by saving extra expenses of imported items like fuel, tyre and spare parts, and saving the idle time wasted by travel delay due to traffic congestion and deteriorated road. It is also observed that as construction of new toll road requires huge fund-raising, the public-private partnership will ensure reliable initial fund and efficient management.

1 INTRODUCTION

1.1 Background

Roads make a crucial contribution to economic development and growth and bring important social benefits. Road transport is the dominant mode of transport in developing countries like Ethiopia, carrying over 90 percent of the passenger and freight transport, and providing the only access to rural communities where over 85 percent of the population lives.

According to the World Bank, poverty assessments from Sub-Saharan African countries point to the pivotal role of access as an enabling condition for development in all sectors. Inadequate road transport infrastructure and lack of mobility pose important constraints to development in developing countries (Hamilton, 1996).

It is not only the low road network which hinders the mobility but also the condition of the roads would worsen or contribute more for the difficulty of transport system. Poorly maintained roads constrain mobility, significantly raise vehicle operating costs, increase accident rates and their associated human and property costs, and aggravate isolation, poverty, poor health, and illiteracy in rural communities. Due to this low coverage and poor state of road network, and low vehicle fleets, large part of the country is far from the reach of modern transport.

The failure to maintain roads is tantamount to an act of disinvestment, for it implies the sacrifice of past investments in roads. According to the study carried out by The World Bank in the eighty-five developing countries an estimated $45 billion worth of road infrastructure has been lost over the past two decades owing to inadequate maintenance. This loss could have been averted with preventive maintenance costing less than $12 billion. (Harral & Faiz, 1988)

The loss of physical infrastructure is only part of the picture. Bad roads seldom deter users or curb the volume of traffic. Instead, they raise the cost of road transport−the dominant mode of transport for both people and freight in most countries. A dollar reduction in road maintenance expenditures can increase the cost of vehicle operation by two to three dollars. (Heggie I. , 1995).

Insufficient spending for maintenance thus exacts hidden costs several times the cost of maintaining and restoring roads. Road users bear the burden of these additional costs, which dwarf the savings to a road agency from deferring or neglecting maintenance.

Ethiopia has one of the lowest road densities in Africa (Ethiopian Roads Authority, 2007). According to the data obtained from ERA, the classified road network consists of only about 42,429 km of roads, comprising 5,452 km of paved and 36,977 km of unpaved roads. With a total land area of over 1.1 million sq. km and a population of about 79 million[1], Ethiopia's road density is 40.3 km/1000 sq.km or about 0.56 km per 1000 population, a road network of the lowest density when compared with the Africa's average of over 50 Km/1000 sq. Km. It is estimated that, only about 32 percent of the population is within 5 km of all weather roads. Table 1-1 below summarizes the scope of classified road network in 2007.

Table 1-1: Classified Road Network (2007)

Class of Road	**Length in km**		
	Paved	**Unpaved**	**Total**
Federal Roads	5,452	14,628	20,080
Regional Roads	-	22,349	22,349
Total	**5,452**	**36,977**	**42,429**

Road infrastructure in Ethiopia had reached such a level of deterioration by the early 1990s that it had become a serious hindrance to the Government's efforts in reviving the economy. It was estimated that only about 14% of the Federal roads and 25% of the regional roads were in good condition in 1997 (Ethiopian Roads Authority, 2003).

As part of the effort to overcome this problem, the Government of the Federal Democratic Republic of Ethiopia has launched a Road Sector Development Program (RSDP) to be implemented in different phases. The first and second of which are extending from 1997 - 2002 and from 2002 - 2007 respectively, and the third phase which is extending from 2007 - 2010 is under implementation. The first phase focuses on the

[1] According to 2008 estimates, Ethiopian Central Statistics Office

rehabilitation, upgrading and backlog clearance of maintenance of the existing road network with external financial assistance from multilateral and bilateral sources and the second phase focuses on expansion of network and routine maintenance.

After all these efforts and huge amount of money is invested, the conditions of the roads are still not satisfactorily improved at the end of 2007 except in the Trunk Roads[2]. Even these Trunk Roads which have been rehabilitated and/or upgraded to a good condition have started to deteriorate even before the completion of the programme. At the end of RSDP-II (2007), it is estimated that only about 50% of the Federal roads and 46% of the Regional roads are in good condition. (Ethiopian Roads Authority, 2007)

Much of the problem of road construction and maintenance is rooted to the institutional aspects of agencies responsible for roads and the absence of a system ensuring adequate financing for road conservation. Traditionally, the Government has been the great provider of roads, constructing the road network and putting it at the disposition of all citizens. The use of roads has been largely free of charge. Unlike most other types of infrastructure, roads are neither built nor maintained by those who use them to market output or services. Here roads differ from the other components of the transport infrastructure, such as ports and railways, where it has always been necessary to pay explicitly every time they are used.

1.2 Purpose of the Thesis

The purpose of this Thesis is to review the management system and the funding of road construction and maintenance in Ethiopia, and to consider how the funding may be improved so that user charges can more accurately and fairly reflect the costs of road investment and maintenance that can be attributed to different classes of road users. The study considers the main advantages and disadvantages of current institutional aspects of road administering agencies, the source of funds for road infrastructure and their allocation strategy, and compare with different alternatives of the role of private sector in the road management and finance.

[2] According to ERA road functional classification 2002, Trunk Roads are main highways linking the capital, Addis Ababa, to center of international importance and terminating at international boundaries.

The operation of the road fund has been analyzed together with the incidence of vehicle, spare parts and fuel taxation on government revenues and expenditure. Detailed analysis of road user charges is carried out, for different vehicle types and for the different road networks, with the objective of covering total routine and periodic road maintenance in Ethiopia.

In addition case study has been carried out on Addis Ababa – Adama road in such a way that the existing condition of the road, year of construction and design life, its cost, frequency and type of maintenance, current traffic and forecast, and other similar features were studied. Problems in the service of the road have been identified. The option for private financing to the maintenance has been analyzed through questionnaires to different road users. The application of other alternatives such as toll road or privatization is tested.

Finally, the current Ethiopian condition of management and financing of road construction and maintenance has been compared with the international experience for countries in transition and for developing countries, and recommendation in institutional setup and financing for road construction and maintenance is given.

1.3 Statement of Problem

The road network of Ethiopia is the lowest compared to developing countries in Africa. The funds from general taxes allocated by the Government cannot expand the road network as required nor can sufficiently preserve the existing low network through proper maintenance, which is a bottleneck for development. The road users don't directly pay the road costs, the road management has not been considered as a business and the private sector does not participate in the investment of road infrastructure, which jeopardize the development of road network and lacks sustainable source of funds, rather road is considered as a free service to be supplied by the Government and managed by public agency.

1.4 Research Question

The study has raised the following questions:

- Does the existing management and financing of roads in Ethiopia contribute for the low road network and poor condition? Can commercialization of roads through tolling alleviate the low road network and poor condition of roads in Ethiopia?
- Can we learn from developing countries implementing the commercialization of roads through tolling?

2 LITERATURE REVIEW

The literature review began with a search for any resources that had the potential for further review. International experiences on privatizing road infrastructures had been studied and studies about toll roads, especially those conducted by the World Bank for different developed, developing or transition countries in Asia and Latin America, and Sub-Saharan African Countries have been reviewed. Studies and experiences of establishment of road funds for different countries have also been reviewed. The literature review and sources of data focused primarily on the World Bank practice and experience.

2.1 Introduction

According to a study made by the World Bank for Asian Toll Road Development (Kuranami, Winston, Sriver, Iwasaki, & Shigeru, 1999), many developed and developing countries throughout the world have accumulated a wide variety of institutional, regulatory, and financial experience in building and operating toll road systems. The study stated that around the world there's an increase in toll roads because tax financing is not producing good enough highways and taxpayers don't accept tax increment because they don't get highway value for the tax they pay. They are frustrated by congestion on inadequate overloaded roads & tie-ups which cost much in wasted fuel, missed meetings, downtime from work, and unnecessary pollution and accidents.

Toll road operation is a business that involves constructing regionally indispensable roads more rapidly than would otherwise be possible, using loans to prevent road construction from being retarded due to financial difficulties in the public works budget. The operator borrows the capital needed to construct and operate the road, and the funds should be repaid with income from users' tolls over a definite period -- though exceptionally, there are also cases of permanent toll roads (Kuramani et al., 1999).

In many developing countries, financial difficulties in public works are an inevitable fact of life. Especially in the motorway field, demand for main road construction tends to be intensely concentrated in a short period prior to the people's attainment of a substantial level of income. The degree of financing difficulty in these cases can be acute.

Traditional financing approaches have depended on an all-inclusive system backed by the credibility of the government. As the limits of this approach have become apparent, more and more countries have seen the advantages of converting to new financing systems, where the all-inclusive credit guarantee offered by the state treasury is replaced with limited credit guarantees where investors from the private and public sectors are invited to contribute on the basis of the credit-worthiness of each project. A growing number of countries are seeking to reform their entire system of public finance by using these new approaches that aim to activate private-sector vitality (Fisher & Babbar, 1998).

Accordingly, toll roads are an important means to fill the gap between the demand for construction of trunk roads in a given region and the financial ability to meet that demand.

2.2 Toll Roads

Tolling is a way to build and rebuild roads without having to resort to taxes. Toll roads dip into the capital markets for their funds, not into taxpayers' pockets. It's the fairest system and the most efficient and variable toll rates will allow flexible and responsive pricing of a commodity that is especially scarce in certain times and places. Modern electronics now allow tolls to be collected at highway speed, which is cheaper, cleaner and more convenient than stopping at an old-style toll plaza (Kuramani et al., 1999).

From the very day a road is opened for traffic, its pavement begins deteriorating from the stresses of the weather and the pounding of vehicles. Cracks need filling, surfaces painted, signs and lighting maintained, debris removed, grass mowed, drains unclogged, policing conducted - all the time. Hence, the road users need to pay for the cost. Tolls are not taxes but the price for a service. Now that service may be well or poorly provided. It may, or may not, be considered value for money. But the user-pays principle of tolls - that those who benefit from a road pay directly for its use - is good (Heggie & Vickers, 1998).

On the contrary, roads in the past have been paid for different ways. Highway infrastructure traditionally has been funded through general government budgets and dedicated taxes and fees rather than tolls. In most industrial countries 90 percent or more of highway kilometers are publicly funded; in developing countries governments often bear the entire cost (Poole & Samuel, 2006).

However, the limited resources available through traditional government funding sources has led to increasing interest in private toll roads as an alternative way of meeting highway needs. Several additional factors have contributed to the renewed interest in private tolling, including a worldwide trend towards commercialization and privatization of state-owned enterprises; the success of public toll roads in raising capital; and advances in tolling technology, making tolling more efficient and convenient.

2.2.1 History

Private toll roads have a long history in the United States and Europe. In the United States the concept of private toll roads is gaining renewed interest after decades of inactivity. In the first half of the nineteenth century private toll roads outnumbered public roads in the United States. By the mid-nineteenth century more than 10,000 miles of private toll roads were in operation. The public sector provided support through land grants and subsidies, and public roads were built primarily to support the network of private roads.

During the late nineteenth and early twentieth centuries the growth of rail transport and problems with toll evasion caused a decline in private toll roads. In the 1930s, however, some states began developing public toll road programs in response to the growing needs of commerce, the dramatic growth in automobile ownership, and the absence of a major federal highway program (Fisher & Babbar, 1998).

2.2.2 Functions of Toll Roads

Toll roads can be classified as congestion relievers, intercity arteries, or development roads (Estache, Romero, & Strong, 2000). A facility's function is a major determinant of its physical characteristics and cost, as well as its market demand and revenue potential.

Congestion relievers are relatively short roads that are constructed to relieve heavy traffic congestion on existing urban routes. Congestion relievers are generally inexpensive to build relative to their revenue potential because they tend to be short and to serve heavy traffic demand.

Intercity arteries are built to improve access between major metropolitan areas. Intercity arteries are generally expensive to construct because they are often long, high-capacity roads. However, they may benefit from heavy traffic in certain corridors.

Development roads link relatively remote areas targeted for economic development with urban centers or major transportation routes. Development roads can provide a significant economic stimulus to the regions they serve. However, they often require future economic development to generate sufficient traffic in order to be economically viable. Thus development roads are often speculative from an economic standpoint.

2.2.3 Advantages and Disadvantages of Tolling

Richard Robinson has put the advantages and disadvantages of tolling roads as follows (Robinson, 2008):

Advantages:

- ***Road Pricing:*** Costs are charged to users specifically in relation to the use made of a particular facility, and charges can reflect use by different types of vehicle, carrying different loads, at different time of the day. Thus, each class of road user pays in relation to the costs they impose on the road network.
- ***Cost-recovery:*** It is possible to set a toll to enable not only the recovery of all road costs, including financial costs, but also generate a revenue surplus that can be re-invested in the network.
- ***Quality Management:*** Potential users of the toll road will pay the toll in addition to all the other taxes and levies that are included in road user charges, but only so long as they consider that improvement in service quality warrants the added expense.
- ***Administration of Toll Roads:*** Toll facilities may be administered either by public or private sector administrations and agencies.

Disadvantages:

- ***Double-Taxation:*** The presence of a toll road alongside those that are ‘free’ implies an element of double taxation. If tolls are imposed without any reduction in the real value of general road users charges, this is tantamount to imposing an additional general revenue taxation on transport.
- ***Regulation:*** Where there are no ‘free’ substitutes for the toll road, an effective monopoly may exist that should be subject to regulation. A similar

issue may arise if non-tolled roads are allowed to deteriorate, resulting in higher costs to road users. This will then strengthen artificially the position of toll road operators.

- ***Efficiency of revenue collection:*** Tolling is a relatively inefficient method of revenue collection from the public finance point of view. The application of tolls may also result in cost increase to the road sub-sector. In any case, tolling is only likely feasible on a very small portion of the road network.

2.3 Commercialization of Roads

Governments are facing dramatic growth in highway needs, both for new facilities and for maintenance and rehabilitation of existing facilities. This demand is particularly strong in congested urban areas and regions experiencing rapid economic and population growth (Fisher & Babbar, 1998).

There is much, and growing, interest in many parts of the world in the use of private capital for the provision and operation of transport facilities. According to the World Bank, there are two main reasons for this (Heggie & Vickers, 1998).

First, changes in fiscal policy are placing increasing constraints on the funds available for investment by the public sector. With taxation revenues constrained by political, economic and social considerations, there has been, and will continue to be, a reduction in public sector expenditure. Many countries are seeking to limit public expenditure, and some are required to do so under support agreements with the International Monetary Fund, the IMF. In many parts of the developing world, the costs of servicing debts have come to account for a major part of national expenditure, leaving little finance available to support new capital investment in infrastructure. Yet there is a continuing need to invest in roads, particularly in those countries enjoying strong economic growth or those with a need to improve accessibility in order to encourage economic growth, and thereby welfare improvements. The use of private finance is seen as an effective way of satisfying both these needs - limiting public sector expenditure while continuing to invest in improved and new roads.

The second reason is a view that the private sector can be more efficient, and innovative, in managing the design, construction and operation of roads, thereby reducing the costs of their provision.

Most government departments do not have a commercial orientation, and general budget financing is a failure for commercial undertakings. Government budgets were not designed to finance a major business. Roads are big business and should be managed like a business. They should be brought into the marketplace and put on a fee-for-service basis. In other words, the road sector should be commercialized. This involves creating an arm's-length agency to manage at least the main road network on a commercial basis, introducing an explicit road tariff, making sure that road users pay for extra spending on roads, depositing the proceeds from the road tariff into a road fund, appointing a representative public-private board to oversee management of the road fund, establishing a small secretariat to manage the day-to-day affairs of the road fund, and ensuring that all works financed from the road fund are subject to rigorous technical and financial auditing (Heggie I. , 1995).

2.3.1 The Four Basic Building Blocks

According to the World Bank Study (Heggie & Vickers, 1998) commercialization requires complementary reforms in four important areas, usually called the Four Basic Building Blocks. The key concept behind the reform agenda is commercialization: bring roads into the market place, put them on a fee-for-service basis, and manage them as a business. But since roads are a public monopoly and their ownership is likely to remain in government hands for some time, commercialization requires complementary reforms in four other important areas, referred to as the four basic building blocks. They focus on:

- Establishing *responsibility* for managing roads by clearly assigning roles.
- Creating *ownership* of roads by involving users of roads in their management to encourage better management and to win public support for more road funding, while constraining road spending to what is affordable.
- Stabilizing road *finance* by securing an adequate, continual flow of funds.
- Strengthening *management* of roads by introducing sound business practices and enforcing managerial accountability.

The four basic building blocks are the core of reform. They are interdependent and should be implemented together. If not, reform will be only partly successful. The management and financing of roads cannot be reformed without establishing who is responsible for what. The financing problem cannot be solved without the strong support of road users. The support of road users cannot be won without taking steps to ensure that resources are used efficiently. And resource use cannot be improved without controlling monopoly power, constraining road spending, and enforcing managerial accountability. The reforms can be introduced in different ways, that is, the content of each building block can differ, depending on country circumstances. They can move sequentially or in parallel, and both the sequencing and the pace of reform can vary. But in the end all four building blocks should be in place to ensure that the reform agenda is sustainable and does not drift back to the status quo ante. (Heggie & Vickers, 1998) further describe the four building blocks as indicated in the following sections, Section 2.3.2. - 2.3.5.

2.3.2 Assigning Responsibility

The first building block concentrates on creating a coherent organizational structure for managing different parts of the road network. This requires clearly assigning responsibility among different government departments, different levels of government, and individual road agencies. The arrangement must be based on an accurate road inventory, functional classification of roads, designation of appropriate road agencies, formal assignment of responsibility to each road agency, and clarification of the relationship between the road agency and the owner or parent ministry. Responsibilities to be assigned include those for operating, maintaining, improving, and developing the road network; for traffic management; for handling general accidents and incidents; for road accidents caused by the road agency's own negligence; and for adverse environmental impacts associated with roads and road traffic.

2.3.3 Creating Ownership

The second building block is concerned with the concept of ownership—building constituencies with a strong vested interest in sound road management. Major policy reforms in the road sector cannot succeed without the active support of a large and vocal constituency willing to argue for better road management and additional, affordable road financing.

The obvious constituents are the stakeholders: road users themselves, together with the business community, farmers, and other people dependent on a well-functioning road network. Given that current financial allocations for roads are erratic and well below the levels needed to keep the road network in stable condition over the long term, strong stakeholder support for more road funding must be built up if reform is to succeed. The usual mechanism for winning their support is by involving them in road management. Stakeholders agree to work in partnership with the government to strengthen road management and financing in return for a seat at the table where decisions are made about how roads are to be managed and how funds are to be spent.

2.3.4 Ensuring Secure and Stable Financing

The third building block concentrates on establishing an adequate and stable flow of funds. Without ensuring secure and stable financing, none of the above reforms will be sustainable. It is obvious that governments in developing and transition economies are seriously short of fiscal revenues. Budget allocations for road maintenance are much below the optimum requirements, and agreed allocations are often cut with little notice in response to short-term fiscal crises. Funds for road improvement are likewise in extremely short supply, particularly in countries in need of extensive road modernization.

Given these fiscal conditions, governments cannot meet financing needs by allocating additional revenues from the consolidated fund. Additional funds must come from heightened revenue mobilization. But if road-user charges are raised, there is no guarantee that the additional revenues will be allocated to roads, nor that they will generate a stable flow of funds. Furthermore, traditional earmarking is not a viable solution. It adversely affects management of the government's overall budget and is rarely sustainable.

An added concern is that existing financing mechanisms do little to strengthen market discipline either by managing demand or by improving the efficiency of the road agency. Solving the financing problem calls for a radically new approach, the concept of commercialization. With strong stakeholder support roads can be put on a fee-for-service basis to generate the added revenues needed to support operation, maintenance, and improvement and to separate road financing from the vagaries of the government’s budget.

2.3.5 Introducing Sound Business Practices

The fourth building block focuses on creating a commercially oriented road agency. Road users involved in the management of roads generally press for the introduction of sound business practices to ensure that their constituents get value-for-money from road spending. Road users expect clear management objectives, an effective management structure, competitive terms and conditions of employment, consolidated budgets, commercial costing systems, and effective management information systems. Introducing sound business practices changes managerial incentives. It brings pressure to dispose of in-house plant and equipment (or to use it more efficiently), to arrange for more work to be done under contract, to control vehicle overloading, and to improve road safety. These issues have become systemic sources of inefficiency in the road sector because current management procedures in most countries provide little incentive to do anything about them.

2.4 Private Finance for Roads

In many countries, there has been considerable interest in recent years in the private finance of road infrastructure. The expectation is that involvement of the private sector, on a competitive basis, in the financing and management of roads will bring increased effectiveness and efficiency, resulting in greater value for money (Robinson, 2008).

Private financing includes private concessions, public toll roads, private public partnership, and community fund raising by targeting local taxation. The issue of private financing in the road sector is normally related to concessions. A concession is the award of a right or a license to build, own and operate a public service for a given period. In financial terms, concession financing is the design, arrangement and implementation of a financial package for a major project, in which the developers will consider the future cash-flow of the project (Farrell, 1994).

2.4.1 BOOT, BOT, BOO and BTO

There are various structures under which the private sector can participate, as a concessionaire, in the provision and operation of highways. Many different terms are used for private financed road projects as described below (Fisher & Babbar, 1998).

BOT (build, own and transfer or build, operate and transfer) is the most common acronym for the typical approach, in which the private sector finances, designs, builds, maintains and operates a facility for a fixed term before transferring it to the owner (host government).

BOOT (*Build, Own, Operate and Transfer)* scheme is the most common, where a company is awarded a concession to build a scheme for which it obtains the necessary finance, and which it owns, operates and maintains for a finite period. At the end of that period it transfers ownership to a public agency, usually the Principal.

Although BOOT schemes are often referred as BOT, strictly BOT (*Build, Operate, Transfer*) schemes are those in which the private sector has a concession to operate without necessarily fully owning the scheme, possibly because the land is acquired by and remains under the ownership of a public authority.

Under a *Build, Own Operate*, BOO, scheme, the facility remains in the ownership of the concession company, forever.

A further variant is the *Build, Transfer, Operate*, BTO, scheme under which the private sector transfers ownership on completion of the scheme but has a continuing right to operate. The primary reason for such schemes is to protect the concessionaire against some potential liabilities, which can be a particular problem in the USA.

Central to BOOT, BOT and BTO schemes is the principle that the private sector takes its reward through direct user charges, tolls in the case of roads. A second key principle is that at some time the project reverts to the public sector. Although there is no reason why private highway schemes should not remain private in perpetuity, few do; this is in contrast to other utilities or some rail projects. There are a number of triggers for the return. Some relate to financial performance, in such a way that it will revert when all outstanding debt has been repaid. Others revert at a particular point in time - providing, for example, a thirty year concession. Many concession agreements allow for the project to revert to public ownership should the concession company fail.

The key difference with regards to funding, between a BOT scheme and the more traditional government funded approach, is the means by which revenue is raised. A BOT scheme obtains its initial investment through two routes: equity investments (typically between 10% and 30% of project costs) which are raised through shareholder agreements, and debt financing (typically between 70% and 90% of project costs) from commercial sources, which are usually backed by export credit guarantee agencies, and bilateral and multilateral lenders. The return on this investment is made by charging road users a toll during the term of operation. In some cases where tolling might be unacceptable, such as the UK DBFO schemes, a 'shadow' toll approach is used, in which the government pays the project company a rate for each vehicle which uses the road. (Ethiopian Roads Authority, 2003)

With regards to planning, the key difference between a BOT scheme and the more traditional government funded approach is the types of analyses used to justify the project. Government funded schemes will normally use an economic analysis which assesses the project contribution to government development objectives for the whole economy. In order to ensure financial viability privately financed schemes will tend to emphasize financial rather than economic issues, will place a higher emphasis on risks and the cost consequences of failure. A higher discount rate will also be used in the assessment of a private financed scheme to reflect the increased cost of non-government borrowing. When a new high standard toll road is built the economic return of a road project will, in general, be far higher than the commercial rate of return generated from tolls. This is because the economic rate of return will fully capture benefits on the toll road as well as any benefits resulting from reduced congestion on other roads. In contrast the financial analysis resulting from tolling can only capture part of the benefits from the toll road (tolls have to be set lower than the perceived user benefits otherwise the road will not be used) and there will be no financial benefits collected from reduced congestion on the other non-toll roads.

Most of the private finance used in the road sector in developing countries has been for the provision of very heavily trafficked toll roads (above 10,000 vehicles per day), generally located in the more industrialised countries such as Indonesia, Malaysia and Mexico. It is now recognised that the wider involvement of the private sector in this area may be constrained by a number of factors including the complexity of setting up a BOT arrangement, the perceived risks to the private company and the costs of raising finance. The financial viability of a BOT project over its life must be sufficient to service the project debt and to provide a return on the equity that is commensurate with the long term risks of the equity investors. For externally financed toll road projects the arrangements to increase toll rates with inflation and to deal with the exchange rate risk are of critical importance. (Ethiopian Roads Authority, 2003)

2.4.2 DBFO, DBOM

There are two "Design Build" concepts under which the public sector seeks to benefit from private sector efficiencies. The first is the *Design Build Finance Operate*, DBFO, system adopted in the UK, under which the concessionaire has obligations and rights for a fixed period, while ownership is retained by the public authority. As applied in the UK, the DBFO system allows the concessionaire to be paid through shadow tolls and requires him to take the major traffic risks.

An alternative arrangement is the *Design Build Operate Maintain*, DBOM, system. The concessionaire takes responsibility for designing, building and maintaining the highway, just as with a DBFO. His reward is usually through a rent, which would be related to the service provided, rather than as a shadow toll. Crucially, relative to the UK DBFO system, the concessionaire does not take the traffic risk (other, possibly, than as it affects maintenance requirements).

2.4.3 Public Private Partnership

Diminishing general budgetary resources have provided the impetus for governments to explore “off–balance sheet” methods to raise financing for infrastructure projects, including private toll roads. Before pursuing a private toll road program, however, the advantages and disadvantages of private tolling relative to public funding or public toll roads should be carefully weighed. Assessing the appropriateness of private toll roads is a complex, project-specific process involving numerous economic, policy, and political considerations (Planning Commission, Government of India, 2006).

The primary economic benefits of tolling, public or private, are the user-based funds generated to support road development and the ability to influence road use and traffic patterns through road pricing. Although certain traditional sources of public funding, such as gas taxes and registration fees, are also user-based, they are not collected at the point of use and therefore are less effective in managing traffic.

The primary economic disadvantages of tolling are the time and cost required to implement toll systems and the potential delays and excessive traffic diversions associated with toll collection. On purely economic grounds, therefore, tolls should be used when the benefits of toll revenues and traffic management exceed the costs of implementation and any delays and excessive diversions caused by the system.

The difference between private toll concessions and public tolling is best illustrated by considering the “value chain” for toll road development. Links in the value chain include project design, construction, maintenance, toll collection, and financing. The biggest difference between public and private tolling is in the financing arrangement, since all the other links in the value chain can be contracted to private parties under either a public or a private tolling scheme.

The primary economic advantage private tolling has over public tolling is the strong incentive for financial success created by the use of private debt and equity to fund the project. In addition, in some countries a public entity may be unable to attract capital to a project that a private consortium can finance because of the government’s weak reputation among investors. The economic disadvantage of private over public tolling is the potentially higher cost of developing, implementing, and administering a private concession program relative to a public tolling scheme. On purely economic grounds, therefore, private tolling should be used whenever the value of the private sector’s financial incentive exceeds the additional costs associated with the private concession process. It is important to note that if investors assume similar project risks, the cost of capital for a specific project should be similar whether it is tolled publicly or privately. Any financing advantage that a public entity may have is due to greater government risk assumption or distortive tax policies, not to an inherent ability of the public sector to access lower-cost capital.

In addition to the economic considerations discussed above, policymakers must consider numerous noneconomic issues when evaluating toll road programs. These include public acceptance of tolling, the equity of charging tolls for road use, and the impact on the government’s flexibility in future road development. In particular, public acceptance is one of the overriding issues in toll road development and may be the greatest impediment to tolling. Noneconomic issues tend to be greater impediments to private than to public toll road development. After taking these important noneconomic issues into consideration, policy-makers may make different decisions than those indicated by a purely economic assessment.

In general, private tolling is preferable for projects that are able to fund most, if not all, of their capital requirements through toll revenues. Private tolling is preferable to public tolling because of the tremendous financial incentives and accountability created by private debt and equity investment.

When the toll-backed portion of total project capital falls below a threshold amount, the benefits of private tolling may be diluted to the point that they no longer exceed the costs. In that case public tolling may be preferable. Public tolling also may be preferable if noneconomic policy considerations make private tolling unattractive. Public tolling is preferable to general government funding in these cases because of the additional funds generated from the direct beneficiaries of the project and the ability to use tolls to manage traffic. Projects that are unable to generate sufficient revenues to justify the cost of a tolling system and any delays or excessive diversions created by toll collection should be funded by traditional government sources.

2.5 Planning and Institutional Issues

Planning and institutional issues are the basic frameworks for the establishment of toll road system in a country. The following points can be discussed under this issue (Kuramani et al., 1999).

i. Need for Strategic Network Planning Framework.

A strategic planning framework incorporating network analysis is important to optimize the benefits and minimize the costs of toll road development. Components of such planning should include: (i) refining the strategic road network and the most appropriate alignments of the key links; (ii) firming up the appropriate timing of construction of individual links based on corridor studies; and (iii) establishing clear economic and financial viability.

ii. Cross-Subsidies for Network Expansion.

Private sectors may not be interested in expanding toll roads in rural areas where the return would not be recoverable or in areas where the road construction would be costly. The Government should set a goal to build a nationwide network expansion that included routes running through rural areas and/or areas with terrain upon which road construction would be costly. To pursue this goal, cross-subsidies were required given a requirement to recover costs with toll revenues. Toll revenue pooling has been utilized for regional toll roads and urban expressways that constitute an integral network. The rationale underlying the system has involved several issues, however, including equity among users, economic inefficiencies that might arise from insensitivity to route or segment profitability, and the determination of routes to be included in the system.

The critical issue raised by such cross-subsidies is whether the social and economic advantages of having an extensive network of high-performance highways rather than a smaller network in which each individual segment is self-supporting justifies the loss of financial discipline and the possible misallocation of scarce resources through the use of such subsidies. In this case, a ceiling is applied to reduce inefficiency; i.e., cross-subsidization for a loss-making routes is limited to a maximum of a portion of the total construction cost of the route. The balance must be covered by the toll revenue of the loss-making route or by subsidies from the government.

iii. Alternative Form of Operating Entities.

Toll roads may be developed and operated by:

- a government agency,
- a public corporation,
- a private sector concession, or
- a public-private partnership.

Each approach presents certain advantages and disadvantages.

Government Agency*:* A government agency would be established as for the purpose of designing, constructing, and maintaining toll expressways, and collecting tolls from road users. Although there may be theoretical merit to direct execution by government, particularly with respect to planning for network expansion, competing demands for government funds and the difficulty in providing incentives to improve cost effectiveness and operational efficiency have been major issues. There might be also overlapping of responsibilities in charge of regulatory and supervisory functions over the operations of toll road concessions.

Public Corporation*:* Arguments made in favor of public corporations relate to: (i) their greater effectiveness relative to private companies in pursuing goals set by the government; (ii) the inconsistency of management by private firms with desired intensive control by government when a large amount of subsidy is provided; and (iii) their ease of accepting cross subsidies among routes in a network. On the other hand, it is often argued that public corporations lack incentives for cost reduction and generally tend to be less efficient than their private counterparts. Due to tight control by the government, public corporations tend to be less effective in responding to market conditions that change over time and differ across regions.

Private Sector Concessions*:* Dating back at least to the 19th century in the United States, private sector concessions have often been favored over government agencies because of their efficiency and market responsiveness. The experience of France suggests that private companies can build highways more efficiently than can public companies. However, private firms may not be able to assume all the risks associated with toll road development, which entails a long-term and large-scale investment. Budgetary dependence on the Government may be substantially reduced in this approach toward toll road development, but a problem with development by the private sector relates to “moral hazard,” since national toll roads, like banks, are too big and important to let fail.

Public-Private Partnership (PPP) Approach*:* The PPP approach refers to a commercial company in which both the private and public sectors hold stakes, with managerial control in the hands of the private sector. A PPP may be distinguished from a private-sector concession in that (i) both private and public interests typically hold equity in a PPP, and (ii) it is more flexible regarding project implementation.

The World Bank assisted Toll Road Concession project has adopted a PPP approach, instead of a purely governmental approach, (Kuramani et al., 1999) in order to:

- bring additional resources to the project and complete it in a shorter time, freeing scarce governmental resources for other investments; and
- increase the efficiency in construction and project operation, through market discipline, assuring that the project is completed on schedule and within the budget.

2.6 Legal and Regulatory Framework

Legal and regulatory frameworks are one of the least visible aspects of toll road development, but are nevertheless vitally important elements (Kuramani et al., 1999) and the following issues are generally included under this category:

i. General Need for Well-Drafted Laws and Regulations.

Irrespective of institutional option, well-drafted laws and regulations have proven necessary for successful toll road development.

When the private sector is to be involved in toll road development, concession laws need to be well drafted. The host government must provide the basic legislative and regulatory authority for a given infrastructure project to be built and operated by the private sector; this includes designation of the individual ministries, government agencies, or local governments authorized to grant concessions. The enabling legislation may be general and enable different types of concessions to be granted, or alternatively, it may be specific and provide for a particular concession; either approach should be acceptable provided that, among other things, the right agency is designated as concession grantor and the permitted term of the concession is sufficiently long so that the concessionaire will be able to build and operate the toll road in accordance with its business requirements.

ii. Bidding and Selection Procedures.

Formalized, transparent procedures for dealing with investors prior to and during the bidding process are required. Bidding should be competitive to minimize the level of government support and reduce residual risk bearing by the government. A clear bidding and negotiation process requires that:

- the need for project requirements to be specified closely, to ensure evaluation is of like-for-like;
- clearly defined government support measures in the bidding documents, where necessary as a maximum—rather than held back for negotiation; and
- simple evaluation criteria—for example, bidding at defined tariffs (to meet government policy objectives) to minimize the level of government investment required.

iii. Security Legislation.

The lack of provisions for the protection and enforcement of security arrangements (e.g., mortgages) in a country's legal system makes bankers extremely reluctant to lend to BOT projects.

iv. Regulations of Foreign Direct Investment.

General laws and regulations concerning foreign investment may provide incentives or disincentives to foreign investment in toll road concessions. Some countries, in pursuit of equity objectives have adopted a National Development Policy with the aim of securing significant portion of the ownership of by local companies. This policy effectively precludes foreign direct investment, but on the other hand has helped to develop domestic private sector.

v. Currency Issues.

The currency used for the pricing of tolls and the ease of its convertibility to foreign currency affect the interest of international investors in toll road projects. To minimize the risk of hard currency investments, some of the toll rate formulas include variables that reflect exchange rate movements. The ability of a foreign-invested highway project to secure adequate foreign exchange payments is therefore subject to risks relating to exchange rates and access and availability of foreign currency.

vi. Dispute Resolution.

Although no one hopes for disputes on a BOT project, the regulatory framework must provide for adequate dispute resolution procedures in event that such disputes occur.

Where there is a contract to which a foreign party is a signatory is a “foreign economic contract,” and it should be clearly stated whether the parties to such a contract can stipulate arbitration either inside or outside the country. While there have been difficulties in enforcing foreign arbital awards rendered in the country in practice, foreign investors require the country is bound under international treaty to enforce foreign arbital awards rendered in other jurisdictions. In general the dispute resolution clauses should clearly spell out procedures for arbitration and dispute resolution in accordance with international law.

vii. Land Acquisition Law.

The law related to land acquisition and resettlement may affect the implementation of toll road projects. While it is possible that government agencies and public corporations may be authorized to expropriate land under the relevant laws, it is difficult to provide such right to the private sector; this could lead to an increased cost of toll road development.

2.7 Concession Contracts

Concession contracts between a grantor and a concessionaire should be unambiguous with respect to the risks involved. Preferably, a model concession contract should be prepared to enhance fairness and the clarity of negotiations between the parties involved, and to improve the efficiency of negotiation by clarifying a starting point of discussion. Sub-issues within this issue category relate to:

i. Grants of Concession

The concessionaire should be granted exclusive use of the toll road right of way, including the right to develop ancillary businesses (e.g., food, service stations), which must be clearly defined by legislation.

ii. Toll Rate Setting and Adjustment.

The concession contract must provide a clear framework for toll setting and adjustment covering topics such as operating cost fluctuations, currency devaluation, and minimum debt service ratios. Such matters are particularly important when revenue guarantees are not in place and the concessionaire bears construction, traffic, and toll collection risks.

iii. Conditions for Contract Termination

In the event that a concession is terminated, whether as a consequence of a default by the concessionaire or the grantor, or as a result of the occurrence of a force majeure event, then the grantor, or a new entity appointed by the grantor, would take over all ownership rights to the toll road, including the right to collect tolls. The issue as to whether there should be compensation payable by the grantor to the concessionaire and how the project lenders are to be repaid in this situation will need to be addressed. The way that this issue is addressed is usually quite complicated and depends on the stage of the project when the termination event occurs and the cause of the termination event.

iv. Changes in Law.

One of the most difficult concession contract negotiation issues relates to changes in law, the occurrence of acts of government interference, force majeure, and other events or circumstances outside the control of the concessionaire that reduce returns for the sponsors or result in the concessionaire’s becoming unable to pay the project lenders. In most concession contracts, unless a deficiency guarantee or subsidy is provided such events or circumstances will expressly exclude insufficient traffic or a downturn in usage.

There are two stages in the negotiation of this issue. First, from the concessionaire’s perspective, the types of such acts, events, or circumstances should, to the extent possible, be well defined or capable of objective determination (with perhaps recourse to a court or independent arbitrators if there is a disagreement). The second stage is to determine the consequences; the ideal position for the concessionaire upon the occurrence of certain circumstances (e.g., a politically motivated strike or the failure by the grantor or a governmental agency to provide related infrastructure) that lead to a reduction in operating revenue would be for the grantor to agree that tariffs could be increased, or the concession period extended. Although rare, in some cases the grantor may agree to pay compensation to the concessionaire.

2.8 Government Support

There are a variety of government support measures that can be provided to public corporations or private toll road concessionaires. The degree of support that should be provided to particular toll road operators, however, depends on the political and economic situations of the countries. It is also important for the government to assess critically the possibility of large contingent liability in the case of guarantees such as foreign exchange guarantees, loan/bond guarantees, or equity guarantees.

The Government can support the toll road operator in the following areas:

i. Land Acquisition.

In most private toll road projects, largely for strategic reasons, the land is acquired and held in the name of the grantor or another governmental authority. The private sector typically would like to avoid the following two situations: (i) large acquisition cost and capital cost during early years of a project when no particular revenue is expected; and (ii) ownership of land that may not be converted into other uses, while various taxes and duties may be imposed on the acquisition and the ownership of the land.

ii. Extension of Concession Period.

Extension of the concession period is a supplemental measure for compensating the loss of profit caused for a variety of reasons. However, cash flow increases in the distant future may not improve a project’s immediate profitability and may reduce the residual value of the project. Therefore, governments should be careful in extending concessions when asset valuation and payments to the concessionaire are required with the transfer of the project. Extension of the concession period, a common practice in toll road BOT projects in many countries, may also be granted when a force majeure event causes cessation of toll road operation for a certain period due to the occurrence of war, earthquake, riots, or other events that have been defined in the concession contract.

iii. Construction of Related Facilities.

In addition to land acquisition, the construction of related facilities (e.g., access roads) can be a critical element for a toll road operation. There are three kinds of risk involved in this support: (i) delay in acquiring the necessary land, (ii) delay in construction, and (iii) potential facility defects. The risk of potential defects is generally assumed by the government, but in case of Design, Build, Finance, and Operate (DBFO) projects in United Kingdom, the consortia participating in the bid are obliged to submit a proposal regarding the magnitude and the methodology of the potential defect risk that they are ready to assume.

iv. Shadow Tolls

Shadow tolling is an experiment for introducing the BOT model in the toll road sector, whereby a private sector consortium agrees to finance the construction or upgrade of a stretch of road and, for a concession period such as 30 years, is entitled to operate and maintain the road and receive "shadow" toll revenue based on actual levels of traffic. The concept was created for DBFO (Design, Build, Finance and Operate) roads in the *United Kingdom*. The shadow toll is paid to the concessionaire by the government, not charged to motorists. The shadow toll usually consists of two components: an availability payment and a performance/usage payment where the former is paid based on the availability of required capacity (number of lanes) whereas the latter is paid on the basis of vehicle-kilometers achieved.

Sponsors of the shadow toll concept argue that because they are paid over time they may be less of a burden to the government than an up-front grant. Shadow tolls may also have the benefit of mitigating market risk to be assumed by the private sector when the motorists' willingness to pay is unknown. However, before introduction of the mechanism, the long-term ability of the government to pay shadow tolls, which may increase in amount as the mechanism proliferates, should be closely scrutinized.

v. Foreign Exchange Guarantees

Under an exchange guarantee the government compensates the concessionaire for increases in the local cost of debt service due to exchange rate fluctuations. Because such fluctuations can constitute a significant project risk when foreign capital is involved, government guarantees can have a substantial impact on a project's ability to raise financing with perhaps a lower interest rate. With currency devaluation, the indexation of foreign exchange rate fluctuations to a toll formula would not mean much to concessionaires, because currency devaluation of such magnitude profoundly damages the entire economy of a country and has considerable impact on domestic interest rates; the impact of the “foreign exchange portion” of the project is only one of many elements that must be negotiated with the government.

vi. Loan (Bond) Issue Guarantee.

Under this approach the government provides a full guarantee of cash-flow deficiency guarantee for repayment of loans. As with an equity guarantee, a loan guarantee entails no public cost as long as the project generates sufficient cash flow to service debt.

2.9 Traffic Forecasting

Traffic forecasting, which involves a great deal of uncertainty, is not an exact science (Kuramani et al., 1999). Factors such as planned land development, population growth along the route, and various economic indicators in forecasting models have inherent uncertainties that affect traffic forecasts. Since project viability is directly related to expected traffic volumes, toll road operators, grantors, concessionaires, financiers, and investors are all concerned with estimated traffic volumes. There are many cases where consultants have used parameters calibrated elsewhere without evaluating their transferability to the country for which the forecasts were prepared. These problems are partly due to a lack of expertise and budgetary constraints, which relates to the institutional issue.

Forecasts of use of existing highway routes are usually more accurate as compared to those for “greenfield” toll road projects. Although accuracy can be improved by refining forecasting methodology, improving the accuracy of estimates of exogenous parameters such as socioeconomic indices, and refining traffic diversion equations, traffic forecasts should be cross-checked by at least one independent consultant or institution.

i. Problem of Less-than-Forecast Traffic

Over-estimation of traffic has commonly occurred with respect to toll road projects in developing or transitioning countries. The demographic and economic conditions and trends influencing travel demand are typically not well identified. In several cases, traffic growth rate assumptions were unrealistic and often data from the Ministry of

Communications and Transport might be inadequate or unavailable. These traffic study shortcomings are generally attributed to a lack of expertise on the part of the concessionaires, financiers, and their consultants.

ii. Need for Independent Audits of Traffic Forecasts

Due to possible conflicts of interest or simply poor capability, independent audits of traffic forecasts are advisable. The forecasts which are prepared by the firms involved in the concession company, is a practice that should be avoided as these firms' traffic forecasts are usually too high. To avoid such problem, an independent evaluation of traffic and financial forecasts is a critical factor explaining the eventual difficulties experienced by the concession companies, with consequent cost to the Government.

iii. Conflicts of Interest in Contractor-Driven Projects

Since contractors benefit more from the construction of toll roads than from their operation, consortia led or otherwise driven by contractors may produce overly optimistic traffic forecasts. Where construction companies would involve in concessions, inherent conflicts of interest may lead to overestimation of traffic volumes (and under-estimation of construction costs).

iv. Sensitivity Analysis

It is important to conduct sensitivity analyses—with respect to traffic and traffic diversion as well as other key variables (e.g., toll rates, project costs, implementation period, and a combination of these factors)—in order to assess the effects on the rate of return of variations.

2.10 Setting and Adjusting Toll Rates

The profitability of a toll road project, especially in inflationary environments, will depend much on the toll level, or increases achievable by the operators. Accumulated world experience suggests a number of general guidelines for setting and adjusting toll rates, and two issues, general guidelines for toll setting and toll adjustment procedures, are discussed here.

i. General Guidelines for Toll Setting

General principles suggested by one World Bank report (Kuramani et al., 1999) indicate that (i) tolling is appropriate only when traffic levels exceed 4,000-5,000 vehicles per day; (ii) toll rate levels should not result in excessive traffic diversion—with an upper limit of acceptability considered to be in the range of 10-15 percent; and (iii) under certain conditions, toll rates can be set higher where there is no feasible alternative. It is important to base project revenues on affordable toll rates.

a. Uniform Toll Rate Issue

An important issue is whether toll rates should be set by individual route or set uniformly across the network. The use of uniform toll rates was primarily to cross-subsidize less profitable routes with revenues from more profitable ones. Financial viability is thus to be achieved for the entire network, not by route or by segment. Although cross-subsidization may not necessarily require toll rates to be uniform, different levels of rates across routes or segments within an integral network would create confusion among users, and charging equal levels of rates would be more politically acceptable.

b. Differential Toll Rate by Vehicle Categories

Toll rate setting also involves an issue of specifying the number of vehicle categories to be charged different toll rates and the rate differences across categories. Experience suggests that a larger number of categories tends to enhance the sense of fairness and thus is more politically acceptable.

There are, however, cases where a smaller number of vehicle categories would be desirable, primarily to minimize time and queue length for toll collection.

There is no simple equation or a universal theory to determine rate differences across vehicle types. It is often argued in developed countries that commercial vehicles including trucks and buses are favored in terms of the toll levels, compared with the capital and maintenance costs incurred by these vehicles. Some countries, on the other hand, introduced a lower rate for buses as part of a transport policy to support public transport operators and to encourage bus use.

c. Fixed or Distance-Based Toll Rate

Another issue on toll rate setting relates to the choice of distance-based or fixed toll rates. Although a distance-based toll rate system is generally more reasonable as it better reflects the cost of service, it involves two major problems: requirements for large capacity at exits and leakage in toll collection. Since payments in a distance-based system should be made at exits, land and staff requirements could be large. Distance-dependent tolls also create opportunities for users to abuse the system; it may be possible for users running in opposite directions to exchange their tickets on the way and pay less than the actual rates at exits. It is expected that these shortcomings of distance-based toll rates will be eliminated by the introduction of an electronic toll collection (ETC) system.

ii. Toll Adjustment Procedures

One issue is whether toll rate adjustments should be left to a governmental authority's discretion or based on a formula, usually linked to price index changes. In any case, there is a need to follow specified toll adjustment procedures once they have been set; uncertainty creates problems for toll road operators.

If the actual traffic level is more than the forecast level at a specified time, the Government could request either the deferral of a toll rate increase or a lowering of the level of toll rate increase. But if the actual traffic is less than forecast, the concessionaire could request to bring forward the timing of toll rate increases.

2.11 Financing Structure and Sources

Issues on financing structure and sources are closely related to Government Support issues described above. Sub-issues relate to:

i. Equity Financing

It is relatively easy to attract domestic capital of both debt and equity for smaller projects, say when the capital cost is less than US$100 million. Moreover, it is very beneficial for a toll road project to obtain domestic financing to avoid the exchange rate risk between local currency toll revenues and foreign currency debt. However, in many developing countries, local capital markets are not sufficiently developed to provide the long-term capital required for toll road projects (Kuramani et al., 1999).

ii. Institutional Investors/Infrastructure Investment Funds

Institutional investors like insurance companies and pension funds can be a good source of financing for toll road projects since the long-term maturity of their funds matches the duration of a toll road concession. However, since institutional investors in developing countries are not active in the infrastructure sector in general, foreign institutional investors from developed countries can play an important role in filling the gap. Institutional investors, especially insurance companies and pension funds in the United States, have been actively pursuing investment opportunities in privately financed infrastructure projects in Latin America and Asia. They have invested in toll road projects directly, through various investment funds, and have purchased debt securities such as 144a [3] bonds in private placement.

iii. Asset Securitization

One innovative approach is the leveraging of existing highway assets to raise new funds in capital markets. This approach can be attractive to private investors, since they need assume only limited construction/completion risks and the transactions offer the prospect of high returns. The approach is also attractive to governments, since it permits them to obtain additional financing with relative ease, including for financially less attractive but still economically desirable projects.

However, there are some concerns with the asset securitization approach such as the possibility of over-leveraging the asset at the expense of the obligation to repay the original loan. Another problem using the capital markets is that the timing and the volume of fund raising is inherently affected to a great extent by prevailing market sentiment. Investors are very sensitive to the political risk as well as the features of alternative investment opportunities such as the coupon rate for various bonds, the profitability of

[3] This is a kind of global bond that is regulated under [the United States] Securities and Exchange Commission Rule 144a. The procedure for issuance and underwriting was simplified in 1990 and limited only to investors termed "Qualified Institutional Buyers (QIB)," who are professional institutional investors such as insurance companies and pension funds.

stock markets, and ups and downs of real estate markets. Therefore, financing capital-market financing should not be relied upon as a perpetual, stable source of funds.

2.12 Public Acceptance

Public acceptance is an important element in successful toll road projects (Kuramani et al., 1999) as discussed below:

i. Relocation and Resettlement

An important issue regarding the public acceptance of toll road development relates to land acquisition and resettlement. Certain countries could benefit from upgraded institutional capacity and compensation to address the resettlement planning issue. Also worth noting here, risks related to land acquisition are best borne by the Government, not the developer.

ii. Noise, Air Pollution, and Ecology

Mitigation of the adverse environmental impacts of toll roads must be an integral part of the planning process.

iii. Community Severance Impacts

With the opening of a toll road which crosses through a heavily residential area, there would be an impact on communities being disconnected and severed. Access needs for both pedestrian and local vehicular traffic should be given high priority. There is often a disparity between the access needs of the roadside communities and the needs of the generally longer-distance through traffic when it comes to the design of express highways. As most highway privatization projects have based their economic and financial viability on their ability to increase the speed and lower the journey time of commuting motorists, their emphasis has generally been on ensuring “uninterrupted flow” for through traffic and less so on the conflicting needs of neighboring residents for access and community interaction.

iv. Public Relations Campaigns

Effective public relations can foster public acceptance of well-conceived toll road projects. Environmental and community issues must be addressed from the start. This process may involve issues that are most appropriately addressed between the government and its citizens, well before the private sector is introduced. The process often involves achieving consensus on long-range goals and plans for the community—including the overall role of highways in the future transportation and land development plan most desired by local residents. However, the timing for the release of project information to the private sector should be carefully managed, because of resistance from resident groups related to environmental issues may stall the project.

Issues that should adequately be addressed include public perceptions relating to:

- the relationship between toll levels and local standards and ability to pay;
- the perceived “unfairness” of charging tolls on formerly non-tolled facilities, improvements notwithstanding;
- the impact of diversions to non-tolled local roads; and
- profits earned by investors.

3 RESEARCH METHODOLOGY

3.1 Methodology

To determine whether implementation of toll road in Ethiopia is feasible or not, the following methodology is adopted in the study.

First, the history of roads in Ethiopia and the current condition is reviewed. The experience of road funding for the construction and maintenance of roads is thoroughly investigated and reviewed. The role and responsibilities of different road agencies like the Ethiopian Roads Authority, Regional Roads Authorities, and the Road Fund Administration have been reviewed and compared with international experiences. The mandates and power of these road agencies have been studied for further review.

Then the Economic analysis of toll road project is conducted based on international experience. The costs and benefits are identified and compared to check the feasibility of a sample road selected for case study.

In the case study of Addis Ababa – Adama road different alternative approaches have been examined in such a way that converting the existing road to a toll road or constructing another toll road parallel to the existing road; operating the toll road through a public agency or private sector or public-private partnership has been discussed and analysed.

In order to forecast the traffic volume of the toll road to be implemented, the diverted traffic from the current traffic is estimated based on the diversion factor estimated by considering the savings in travel time, savings in vehicle operation costs (VOC) and reduction of accident costs. The saving in travel time is estimated through interviewing drivers using the road for different categories of vehicles. To estimate the savings in VOC first the total VOC is calculated assuming the toll free road will continue with the current condition which is in FAIR condition. Then the saving in VOC for different categories of vehicles is calculated using an index formulated by the World Bank through a research made in developing country by comparing the VOC between different road conditions based on International Roughness Index (IRI).

The stakeholders view has been collected through interviews made to concerned officials of the selected stakeholders and the information is analyzed and used in determining the way how to implement the toll road system and included in recommendations. The public perception has also been collected through interview for different group of people using the existing road to determine the acceptance of the new toll road system by the general public and its impact on the diversion of the existing traffic.

The cost of the new toll road is estimated based on current practices of different similar projects by ERA and AACRA. Other related costs like land acquisition costs, maintenance and operation costs are also calculated to determine the total annual costs of the new facility.

Then the total annual revenue is estimated for the forecasted traffic volume and the proposed initial toll rate. Sensitivity analysis assuming the decrease in traffic volume and increase in traffic costs has also been made.

Finally conclusions are drawn based on the analysis made for the case study and recommendations are also forwarded at the end.

3.2 Limitations of the Study

3.2.1 Literature Review

The Literature review is mainly focuses on the studies made by the World Bank for the development of toll road projects.

3.2.2 Data Collection

The traffic data collected for the purpose of traffic forecasting is based on the data available from the Ethiopian Roads Authority, and there was a limitation to conduct the actual traffic survey.

4 ROAD MANAGEMENT IN ETHIOPIA

Roads in Ethiopia are administered by different level of organizations as described below.

4.1 Ethiopian Roads Authority

In 1951, when the Ethiopian Roads Authority was established, the total road network amounted to 6,400 km. This network was built mainly during Italian invasion. By 1997 the road network had grown to 26,550 km, of which 3,708 km were paved. As a result of investments under RSDP I and RSDP II the current length of the network has reached 42,429 km, of which 5,452 km (12.8%) are paved and the remaining 36,977 km (87.2%) are unpaved. Of the present classified road network, about 20,080 km are considered as the main road network administered by the Federal Government (Ethiopian Roads Authority) and the remaining 22,349 km of "low level" roads, generally categorized as "rural roads" under the Regional Rural Roads Authorities (Ethiopian Roads Authority, 2003).

The Ethiopian Roads Authority is responsible for the planning, construction, maintenance and administration of Federal Roads. For the last 10 years (1997 – 2007) with RSDP I and RSDP II programs, the Ethiopian Roads Authority invested more than ETB 20 billion for the construction and maintenance of federal roads. In terms of funding by category of financiers, a little more than 63% has come from internal sources (the Government, the Road Fund and the Community) while the remaining amount of funds (37%) has been pooled from the international community. Specifically, the share of the Government of Ethiopia is the highest (45.8%), followed by IDA (18%), the Road Fund (14%) and EU (8.8%). See Figure 4-1 below for detail on contribution by financiers. (Ethiopian Roads Authority, 2007).

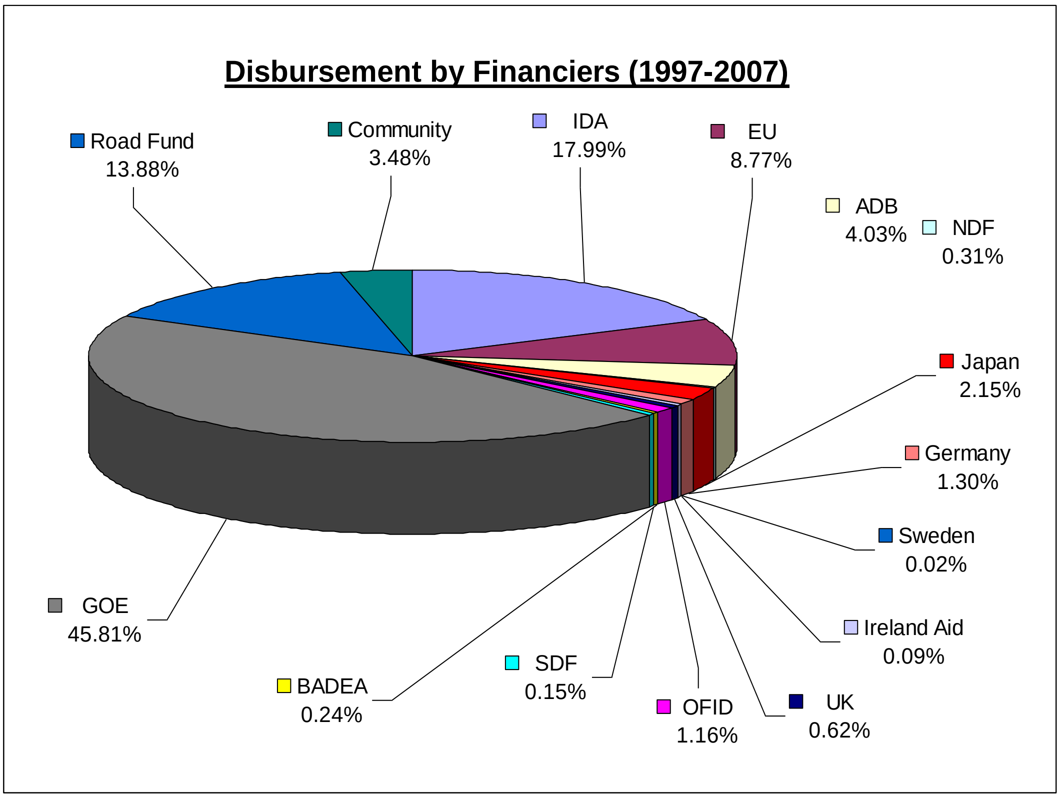

Figure 4-1: Financial Disbursement of Roads by Financers (1997 – 2007)

As it can be seen from the above Figure 4-1 the source of finance for ERA is almost the government fund either from domestic source or foreign loan. There is no system for private sector to finance for road works.

According to the information obtained from the Planning and Programming Division of the Ethiopian Roads Authority, ERA has contracted out the construction of all road projects to international and local contractors through competitive bidding. ERA has been carrying out the maintenance of roads by the district maintenance contractors, which is recently established as a separate enterprise but still accountable to the General Manager of ERA.

4.2 Regional Roads Authorities

Following the political reforms of the 1990s, the responsibility for the administration and management of the rural road networks was transferred to the Regional Rural Road Authorities (RRAs) while ERA maintained responsibility for the Federal Road Networks.

Regional Road Authorities are organized under semi-autonomous Authorities headed by Board, which is accountable to the Region's council to administer rural/regional roads. They are directly responsible for planning, management and implementation of the development and maintenance of the regional roads networks. ERA’s support to the regions has been mainly through overall rural roads network planning and programming, provision and coordination of training and technical assistance.

Most of the RRAs are carrying out the construction and maintenance of road works by the force account units except some regions are contracting out the construction of few road projects to private contractors. The Oromia Roads Authority, for example, has carried out the construction of 35 projects by force account and only 3 projects are carried out by private contractor in the 2008/09 fiscal year. The maintenance of roads is entirely carried out by force account.[4]

The source of budget for the construction of regional roads is entirely from the Regional Government’s treasury, while the Office of Road Fund Administration is funding for the maintenance of regional roads. Similar to the Federal Roads Authority, there is no system at region level for private sector to participate in the financing and administration of regional roads.

4.3 Road Fund Administration

In the early 1990s it was recognized that the limited extent and poor state of the road network had become a major constraint on measures taken to revive Ethiopia’s economy. In 1995, only 11 per cent of paved roads and 19 per cent of unpaved roads were in an acceptable condition. Major trunk roads accessing ports and economically important areas were in disrepair. To tackle these problems in 1997 the Government launched a 10 year Road Sector Development Program (RSDP). The program attracted a great deal of donor support and involved a major program of investment.

As part of the RSDP it was recognized that road maintenance funding had to be improved. In line with the World Bank sponsored Road Maintenance Initiative (RMI) a road fund was established in Ethiopia in 1997 through proclamation by parliament. The

[4] Data obtained from the Oromia Roads Authority, Planning and Programming Department.

Road Fund Board is chaired by the Minister of Works and Urban Development. Other members of the board include three Vice Ministers, six Regional Presidents or representatives, the general manager of the Ethiopian Roads Authority, four representatives of road transport owners and the general manager of the Office of the Road Fund Administration. Membership of the Board is for two years.

The fund was established with the objective to finance road maintenance and road safety activities through a dedicated road user payment fund. Revenue sources of the fund were identified as:

- The government budget
- A fuel levy
- A vehicle licence renewal fee based on vehicle axle weight and configuration
- Overloading fines
- Other road tariffs that may be fixed as necessary

The Board is empowered to issue directives to define collection and disbursement procedures of the Fund (including the recommendation of additional sources and levels of tariffs required to finance road maintenance) and ensure the timely collection and deposit of revenues. It must review the annual road maintenance programs of the road agencies and submit to the government proposals for works to be financed by the Fund. It should ensure the transparency and accountability of disbursements, receive and review management reports from Road Agencies, initiate financial and technical audits of road maintenance and road safety measures.

In order to receive road fund revenues each road agency has to have a separate Road Fund account purely for road maintenance. Deposited money can be used on a rolling basis from year to year. This is unlike Ministry of Finance budget accounts which must be used within each budget year. The separate accounts help prevent the mixing of funds for maintenance with other activities. Likewise it helps road fund auditing to take place separately from other accounts.

By special directive of the council, pre-determined proceeds from the fuel levy were deposited in the fuel levy account for the year 1996/97. This enabled the Road Fund to have some financial strength from the beginning. So far over 99% of Road Fund revenues have come from fuel based collections, the balance has come from transit fees on the Djibouti corridor. Around 14% is from a fuel levy on petrol and diesel (at 9.5 and 8.0 cents a litre respectively in 2007/08), 86% is from a sales tax (15% value added tax) on petrol, diesel and fuel oil, and 6% from a municipality tax on petrol and diesel. So far no revenue has come from vehicle based license or overloading fees (Ethiopian Roads Authority, 2003).

The build-up of fuel prices is shown in Table 4-1. The excise tax on petrol and diesel goes to government general revenue. The Road Fund is derived from Valued Added Tax, Municipality Tax and the Road Fund Levy on Petrol and Diesel.

Table 4-1: Build up of Fuel Prices (2007/08)

Description	Price per 100 litre in ETB	
	Petrol	Diesel
1. Price at Djibouti	411.93	420.18
2. Transport to Ghalafi	7.66	7.66
3. CIF Value	419.59	427.84
4. Excise tax (30% on 3.)	125.88	-
5. VAT (15% on 3+4)	81.82	64.18
6. Municipality tax	2.00	2.00
7. Road Fund Levy	9.50	8.00
8. Stabilization fund	95.15	0.38
9. EPE Margin	5.51	5.11
10. EPE Invoice (1+4+5+6+7+8+9)	731.79	499.85
11. Distributors margin	24.21	44.15
12. Addis Ababa retail price	756.00	544.00
13. Addis Ababa retail price per litre	7.56	5.44

Source: Ethiopian Petroleum Enterprise (EPE), 2007/08.

Table 4-2 below provides data on the revenue collection, allocation and disbursement of funds from the road fund.

Table 4-2: Road Fund Revenues, Allocation and Disbursements and Physical Work

	1990 (1997/98)	1991 (1998/99)	1992 (1999/00)	1993 (2000/01)	1994 (2001/02)	1995 (2002/03)	1996 (2003/04)	1997 (2004/05)	1998 (2005/06)	1999 (2006/07)	2000 (2007/08)	Total
Revenues (‘million Birr)												
Fuel Levy	328.9*	181.9	217.0	355.6	344.9	341.1	515.3	525.7	340.7	1,120.8	1,092.8	5,364.7
Transit fees				0.05	0.2	0.2	0.2	0.1	0.6	0.3	0.3	2.0
Interest		0.9	3.8	0.15	1.3	0.6	1.1	9.2	9.0	0.6	1.3	280.0
Total	**328.9**	**182.8**	**220.8**	**355.8**	**346.4**	**341.9**	**516.6**	**535.0**	**350.3**	**1,121.7**	**1,094.4**	**5,394.6**
Budget for maintenance (‘million Birr)												
Allocation	163.0	212.2	254.2	242.5	255.0	255.0	297.5	332.5	568.3	948.9	1,326.3	4,855.4
Disbursements	158.9	117.5	236.4	162.5	233.6	246.0	286.3	424.0	557.9	909.0	1,077.7	4,409.8
Percent (%)	**97.5%**	**55.4%**	**93.0%**	**67.0%**	**91.6%**	**96.5%**	**96.2%**	**127.5%**	**98.2%**	**95.8%**	**81.3%**	**90.8%**

* - Includes collections from 1996/97

Source: Road Fund Administration – November 2008.

Table 4-2 shows that there have been some major shortfalls in the rate of disbursement. This particularly happened in 1998/99 and 2000/2001. Overall 91 % of the allocated budget for the eleven year period has been disbursed, and about 95% of the planned physical work has been achieved.

The basic allocation of funds has been on the basis of 70% to the Federal Roads (i.e. for the Ethiopian Roads Authority), 20% is allocated to the regions and 10% to selected municipalities. The regional allocation has been divided on the basis of a weighted average ratio with an 80% weight to road length (in categories RR30 and RR50) and a 20% weight to population. The remaining money is distributed to the municipalities on the basis of population size and “regional centrality”, with Addis Ababa accounting for half the allocation.

As of the year 2007, almost 49% of the total classified road network (20,790 km) is in good condition and 22% are registered as being in fair condition. This represents quiet an improvement over the situation in 1997 when it is estimated that less than 50% of the road network was in good and fair condition.

The condition of the road network in 1997 (which is the year of commencement of RSDP I) and 2007 is compared as follows in Table 4-3: (Ethiopian Roads Authority, 2007)

Table 4-3: Condition of Road Network, 1997 and 2007

Year	**Road Condition**		
	Good	**Fair**	**Poor**
1997	22%	26%	52%
2007	49%	22%	29%

4.3.1 Fuel Levy Collected from Non-road Users

When significant amounts of gasoline or diesel are used for non-transport purposes and the fuel levy is perceived to be high, efforts must be made to ensure that non-transport users do not have to pay the fuel levy.

As per an estimation made by the Ethiopian Roads Authority, the contribution of fuel levy and taxes on diesel used for non transport purpose in the year 2000/01 is indicated below in Table 4-4. According to this estimation about 15% (54 mil out of 356 mil) of the Road Fund was collected from fuel levy, municipality tax and VAT on diesel used by non transport users. In 2007/2008 about 14% of the Road Fund is collected from fuel levy and the remaining 86% from VAT. Hence, about ETB 164 mil (15% X 1.1 billion) is collected in 2007/08 from non transport users as fuel levy and taxes.

Table 4-4: An Estimate of Fuel Contribution to Road Fund (2000/01)

No.	Description	Import Value [Million Birr]	To Road Fund [Million Birr]
1	Petrol	343	78
2	Diesel used in transport	1,008	153
	Sub-Total	**1,351**	**231**
3	Diesel used for non transport	355	54
4	Other fuels and oil	380	71
	Sub-Total	**735**	**125**
	Total	**2,086**	**356**

In principle non transport users should have not paid fuel levy and municipality taxes. There are different ways in which different countries attempt to ensure that non-road users do not have to pay the fuel levy destined for the road fund (Heggie I. G., 1998) as discussed below:

i. Replacing the diesel levy with weight-distance charges

The basic principle is that all diesel vehicles must buy a license graduated according to axle configuration and gross vehicle weight. The charges are administered through sealed hub odometers or other certified distance meters. The charge is lower for vehicles with multiple axles and increases with gross vehicle weight.

ii. Offering exemptions

Under this arrangement, non-road users of diesel fuel obtain the fuel without having to pay the fuel levy that goes into the road fund. Diesel fuel is made available to non-road users either tax-free or at a reduced rate of taxation. The system is generally applied only to large users of diesel (e.g., power generation).

iii. Coloring un-taxed diesel

Some countries color untaxed diesel fuel and road vehicles are then periodically inspected for use of untaxed fuel. Road vehicles are prohibited from having dyed diesel in their fuel tanks, with substantial penalties for non-compliance.

iv. Reimbursing non-road users who have already paid the diesel levy (i.e., rebate systems)

Some countries have chosen to make everyone pay the diesel levy and to permit non-road users to apply for subsequent reimbursement. The non-road user therefore pays the fuel levy and then submits a request for a refund, together with the receipt to which the refund applies.

v. Compensating non road users

Instead of offering exemptions or rebates – which are difficult to administer – some countries compensate selected non-transport users of diesel for having to pay the diesel levy. Here it is estimated how much diesel is consumed by each main non road user group and relates this to the output of each group (e.g., number of liters of diesel used to cultivate one hectare of land, land one tone of fish, etc.). The group is then compensated on the basis of their output and the average number of liters of diesel fuel consumed per unit of output. Mozambique, for example, uses an even simpler method to compensate farmers. Twenty percent of the diesel levy is paid into a special fund which provides financial support for agriculture (Heggie I. G., 1998).

4.4 Road Sector Development Program (RSDP)

The Road Sector Development Programme (RSDP) is the Ethiopian Government's strategy for achieving its policy objectives in the road sector. This programme, prepared by the Ethiopian Roads Authority (ERA), includes not only investment in physical infrastructure and expenditure on maintenance of existing and new infrastructure, but also investment in institutional strengthening and capacity building in order to improve road sector management. The programme is jointly funded by the government and its development partners.

The first phase of the RSDP (1997-2002), which has been concluded in 2002, has been evaluated as satisfactory, yielding improvements in accessibility and network quality, stronger road administration and management capacities, and more sustainable road maintenance financing. While generally successful, RSDP I fell short of its physical targets in some areas, notably rehabilitation and upgrading of trunk roads and periodic maintenance, and this can in some part be attributed to capacity constraints in the implementing organisation, ERA.

Recognising this, the second phase of RSDP (RSDP II) and subsequent programmes has given renewed emphasis to capacity building as well as to the reform of institutional arrangements in the sector. The RSDP II, inter alia, addresses a number of policy and institutional support studies such as network planning, road corridor development plan, poverty impact of transport operations, rural transport and a variety of social issues including road safety, environmental protection and HIV/AIDS prevention and mitigation. The Program was completed successfully in 2007.

The third phase of RSDP (RSDP III), which has been started in July 2007, is under implementation which lasts for three years up to July 2010. The Three Years Plan is based on the assumption that commitments by the Government and donor partners will be realized. While every effort has been made to ensure that the information included herein is both accurate and reliable, it is expected that some changes will occur over time, especially for projects in the later years of the Program. For a variety of reasons, projects may be delayed, expedited or the scope of a project may be altered in the coming years.

The overall accomplishment of the RSDP in two phases and the plan for third phase (RSDP III) in detailed in Table 4-5 – Table 4-8 below (Ethiopian Roads Authority, 2007).

Table 4-5: Physical and Financial Plan and Accomplishment of RSDP I (1997-2002)

Item No.	Project	Physical [Km]			Financial [‘mil Birr]		
		Plan	Accomp.	%	Budget	Disbu.	%
I.	**Federal Roads**						
1.1	Rehabilitation of Trunk Roads	1,326.0	975.0	73.5	3,161.4	2,543.3	80.4
1.2	Upgrading of Trunk Roads	822.0	540.0	65.7	1,332.9	894.0	67.1
1.3	Upgrading of Link Roads	0.0	9.0		200.1	176.7	88.3
1.4	Construction of Link Roads	930.0	928.0	99.8	768.8	878.1	114.2
1.5	Periodic Maintenance	766.0	257.0	33.6	313.8	92.1	29.3
1.6	Routine Maintenance	--	--	--	701.0	676.2	96.5
1.7	Others (including Institutional Support)	--	--	--	539.4	264.5	49
	Sub-Total	3,844.0	2,709.0	70.5	7,017.4	5,524.9	78.7
II.	Regional Roads						
2.1	Construction	5,131.0	6,000.0	117	2,588.7	1,500.0	57.9
2.2	Emergency and Routine Maintenance				206.7	170	82.2
	Sub Total				**2,795.4**	**1,670.0**	**140.1**
III.	Community Roads				0.1	2.7	2,700
IV.	Urban Roads				0.0	87.0	
	Total	**8,975**	**8,709**	**97**	**9,813.0**	**7,284.6**	**74.2**

Table 4-6: Physical and Financial Plan and Accomplishment of RSDP II (2002-2007)

Item No.	Project	Physical [Km]			Financial [‘mil Birr]		
		Plan	Accomp.	%	Budget	Disbu.	%
I.	**Federal Roads**						
1.1	Rehabilitation of Trunk Roads	860.0	988.0	115.0	2,221.5	3,924.1	176.6
1.2	Upgrading of Trunk Roads	1,258.0	1,469.0	117.0	3,726.1	4,474.1	120.1

1.3	Upgrading of Link Roads	308.0	290.0	94.0	1,363.1	1,312.9	96.3
1.4	Construction of Link Roads	732.0	529.0	72.0	2,294.7	1,921.2	83.7
1.5	Periodic Maintenance	2,514.0	4,198.0	167.0	831.4	1,398.6	168.2
1.6	Routine Maintenance				606.1	848.3	140.0
1.7	Others (including Institutional Support)				666.0	808.7	121.4
	Sub-Total				9,487.4	10,763.8	113.5
II.	Regional Roads						
2.1	Construction	2,877.0	4,106.0	142.7	1,808.4	1,174.1	64.9
2.2	Emergency and Routine Maintenance	234.0	417.0	178.2	454.8	513.4	112.9
2.3	Others				203.0	115.4	56.8
	Sub Total				2,466.2	1,802.9	234.6
III.	Community Roads	22,773	57,764	253.7	1,708.1	1,426.0	83.5
IV.	Urban Roads				102.7	196.0	190.8
	Total	**31,556**	**69,761**	**221.0**	**15,985.9**	**18,112.5**	**113.7**

Table 4-7: Summary of Planned Civil Works under RSDP III (in Km)

	2007/08	**2008/09**	**2009/10**	**Total**	**Average**
Federal Roads					
Rehabilitation of Trunk	235	130	188	483	161
Upgrading of Trunk	533	531	484	1,548	516
Upgrading of Link	415	750	775	1,880	627
Construction	470	758	855	2,083	694
Periodic Maintenance	1,881	2,014	1,921	5,816	1,939
Regional Roads					
Construction	1,910	1,910	1,910	5,730	1,910
Periodic Maintenance	2,000	2,000	2,000	6,000	2,000
Community Roads					
Construction	9,182	9,182	9,184	27,548	9,183

Table 4-8: Summary of Planned Finance under RSDP III (in million Birr)

	2007/08	2008/09	2009/10	Total	Average
Federal Roads					
Rehabilitation of Trunk	935.7	1,276.7	1,430.9	3,643.3	1,214.4
Upgrading of Trunk	1,964.7	2,045.5	2,212.4	6,222.6	2,074.2
Upgrading of Link	1,526.2	2,910.8	3,638.1	8,075.1	2,691.7
Construction	1,340.6	2,791.1	3,972.9	8,104.7	2,702.0
Periodic Maintenance	785.9	873.1	915.7	2,574.7	858.0
Routine Maintenance	220.0	250.0	280.0	750.0	250.0
Regional Roads					
Construction	955.0	955.0	955.0	2865.0	955.0
Periodic Maintenance	400.0	400.0	400.0	1200.0	400.0
Routine Maintenance	103.9	112.3	123.8	340.0	113.3
Community Roads					
Construction	116.9	114.8	114.8	346.5	115.5
Routine Maintenance	10.5	15.0	15.0	40.0	13.3
Total	**8,359.4**	**11,744.3**	**14,058.6**	**34,161.9**	**11,387.3**

4.5 Current Road Condition

The total road network of the country at the beginning of RSDP was about 26,550 km with a road density of 0.46 per thousand population and 24.14 per thousand square km. Due to the construction of new gravel and regional roads during RSDP I and RSDP II, the total road network has increased to 42,429 km in the year 2007 with an average annual growth of 5% per annum. With a total land area of 1.1 million sq. km and a road network of 42,429 km, the road density in the year 2007 is 38.6 km per 1000 sq. km and 0.55 km per 1000 population.

The overall change of road network during the implementation of RSDP I and RSDP II (1997 – 2007) has shown a significant increment as shown in the following Table 4-9.

Table 4-9: Change in Road Network and Road Density (1997 – 2007)

Year	Road network in km				Growth Rate (%)	Road Density /1000 popn.	Road density /1000sq. km
	Asphalt	Gravel	Rural	Total			
1997	3708	12,162	10,680	26,550	--	0.46	24.14
1998	3760	12,240	11,737	27,237	4.5	0.46	25.22
1999	3812	12,250	12,600	28,662	3.3	0.47	26.06
2000	3824	12,250	15,480	31,554	10.1	0.50	28.69
2001	3924	12,467	16,480	32,871	4.2	0.50	29.88
2002	4053	12,564	16,680	33,297	1.3	0.49	30.27
2003	4362	12,340	17,154	33,856	1.7	0.49	30.78
2004	4635	13,905	17,956	36,496	7.8	0.51	33.18
2005	4972	13,640	18,406	37,018	1.4	0.51	33.60
2006	5002	14,311	20,164	39,477	6.6	0.53	35.89
2007	5452	14,628	22,349	42,429	7.5	0.55	38.60

Source: ERA: RSDP III First Year Assessment Report

The condition of roads has shown significant improvement during this period as shown in Table 4-3 above, where roads in good condition increased from 22% in 1997 to 49% in 2007.

The total financial disbursement during this 10 year period was about ETB 25.4 billion. Yet, after all this effort has been made, the road density is still very minimum even when compared to the African average (38.60 Km per 1000 sq. Km. compared with 50Km per 1000 sq. Km for Africa). The proportion of area more than 5 Km from all weather roads is still 68% and some areas of the country are further than 100 Km from the nearest all weather road (Ethiopian Raods Authority, 2008).

As it can be seen above the Ethiopian Roads Authority is responsible for the planning, administration, construction and maintenance of federal roads, while the Regional Roads Authorities are responsible for 'low class' roads in their regions. The only source of finance for the construction, rehabilitation and upgrading of roads is the fund allocated by the government from taxes or loans. There is no system for the private sector will participate either in financing or administration of roads.

5 ECONOMIC ANALYSIS OF TOLL ROADS

Economic feasibility studies analyze the relation between the costs and benefits of the project based on units of economic cost. Expenditure comprises construction costs, right-of-way acquisition costs, maintenance and operating costs, fund-raising costs and interest. Benefits may include reduced driving time, reduced driving costs, fewer accidents, and environmental improvements. Most benefits are estimated in terms of the traffic volume diverting from existing roads to new roads. It is naturally assumed that diverted traffic is able to enjoy the full value of benefits, which are calculated in cash terms by subtracting the cost of new roads from that of existing roads (Economic Evaluation Manual, 2007).

The project economics of a toll road are determined by a number of factors, including the toll road's function, physical characteristics, and market demand. The predictability of market demand is a particularly sensitive variable for toll road economics because of the difficulty of forecasting traffic and revenues on previously untolled highways.

In the economic analysis of toll road projects the total cost of the toll road is estimated and compared against the revenue collected mainly from toll.

5.1 The Economic Advantages of Toll Road

The benefits of toll roads can be expressed in many ways. From the national economic point of view, benefits of toll roads include reducing travel time, reducing vehicle operating costs, reducing accidents and in general reducing the transport costs. Likewise, from the operator of the toll road point of view, benefits mainly includes the revenue of toll collection from the road users with other subsidiary benefits of road side business opportunities like food and supermarket, fuel station, advertisements, telephone, parking and other facilities (Economic Evaluation Manual, 2007).

In the view of many economists and transportation experts, toll roads, and pricing roads more generally, offer important advantages in transportation (Munroe & Schmidt, 2006). According to Munroe & Schmidt, at present most road agencies realize some of the benefits of road pricing by raising funds to pay for construction and using some peak period pricing to manage congestion, and stated the economic advantages of toll roads as follows:

- **Efficiency**: Toll roads, when used to reduce congestion through charges that reflect current utilization, send signals to consumers about the full cost of using the road. This includes not only wear-and-tear costs, but the costs imposed by an additional driver on the travel speed of all other drivers. Toll pricing allows for rational decisions on the part of consumers – they can choose to avoid unnecessary trips and to time-shift trips to less congested times.
- **Building the Right Facilities**: Without proper price signals (including lack of any direct charges), building expensive new urban roadways leads to continually increasing congestion. With pricing, however, the over-use of a facility is kept in check, and if congestion rises, prices rise.
- **Providing Funding:** If congestion rises, prices rise and provide the mechanism (and signal) to fund the project. Bond financing can be raised to pay for the project, with the future toll collections used as collateral.
- **Reducing Sprawl:** Urban sprawl is the direct result of under-pricing roadways. If drivers were required to pay the true cost of using a roadway, there would be less incentive to keep moving further away from job centers.
- **Fairness:** Users pay for their use in proportion to their use. Where congestion charges (or time-of-day pricing) can be implemented, they pay for the cost they impose on each other through congestion.
- **Greater Safety:** According to studies (Samuel, Tollroads: Reducing Accident, 2000), the accident rate on toll roads – where the flow of traffic is more even – is lower.
- **Matching Costs and Benefits:** Most roadways are funded through general taxes. These taxes do not measure costs imposed by driving – they fail to address differences in fuel economy and the maintenance cost imposed by different vehicle weights. A toll system charges for use directly.

5.2 The Cost of a Toll Road

The cost of toll road depends on many factors among which a project's physical characteristics are the primary determinants of its costs. Important aspects include whether the project is a new facility or an expansion of an existing road, the length, capacity and design, geographic and geologic aspects, and toll collection mechanisms. New facilities are more costly per kilometer than expansions or rehabilitations of existing facilities. Rehabilitation and expansion typically require less construction work than new facilities (Estache, Romero, & Strong, 2000).

The width of a road (number of lanes), the thickness of the pavement and construction technique or pavement type, and the type of geography traversed are key determinants of project costs. As a result, project costs include the following costs (Economic Evaluation Manual, 2007):

- The cost of construction;
- Land acquisition costs;
- Costs of compensation for removal of properties along the Right of Way;
- The cost of maintenance;
- The cost of rehabilitation or upgrading;
- The cost of toll collection facility;
- Operational and management costs; and
- Financial costs or interests on loans.

5.3 The Demand for a Specific Toll Road

The other crucial component of the economic picture of a toll road is determined by demand considerations. Market demand can be measured in terms of actual or expected traffic levels, predictability of expected traffic, and the willingness to pay tolls. Each of these measures is critical to the design of toll road projects because they determine whether there is a revenue stream large enough and predictable enough to obtain financing. The markets served, the number and quality of competitive alternative routes, and the toll road's links to the rest of the transport network also affect traffic levels (Estache, Romero, & Strong, 2000).

Predicting traffic levels is especially difficult for two reasons. New projects are unable to rely on existing traffic volumes as the basis for demand forecasts. As a result, they must turn to other methods of demand estimation, such as stated preference models, which may be less reliable. Judgments must be made about the new road's ability to draw traffic from existing alternatives and to generate new traffic. The second reason is that in cases where projects are to be stand-alone, the level of tolls required to cover costs and provide required financial returns may be far above existing toll levels, if tolls are levied at all. In these cases, estimates of price sensitivity and willingness to pay for new facilities become very hard (Estache, Romero, & Strong, 2000).

5.4 The Willingness Vs. The Ability to Pay for a Road

Road investment must take into account the need to serve different user groups, including very poor users in rural areas that may not be able to afford the toll levels that are required to allow operators to recover their investments. For a toll road project, an accurate estimate of the amount that the potential users are ready to pay - **the willingness to pay -** is in theory a prerequisite of toll level setting. In practice, this parameter is very difficult to assess, in particular in countries where the experience of toll networks is limited or simply does not exist. In transition or developing countries, the quick changes occurring in income distribution and overall wealth make willingness to pay even more difficult to estimate over the periods usually considered for economic appraisal. Users' willingness to pay tolls is largely a function of their wealth, – **the ability to pay** - the value they assign to time savings and other toll road benefits, and the cost and quality of competitive alternatives (Galvez & Jara-Diaz, 1998).

Many countries can now count on useful results on the value of time and the willingness to pay for various types of transport service users. These are relevant indications when pricing new services to be provided by private operators. It makes sense to compare the tolls or tariffs calculated from the cost side with these rough estimates of the willingness to pay for some services.

More generally, the standard assumptions that toll road users are willing to pay high tolls to compensate for reductions in travel time and savings in vehicle operating costs are not as realistic as many academics would like them to be. This is a major problem since the tolls that users are willing to pay for may not be sufficiently high to attract private equity.

5.5 Vehicle Operating Costs (VOC)

Vehicle Operating Costs are the costs of operation of a vehicle such as the cost of purchase of the vehicle, its depreciation costs, maintenance costs, fuel and lubricant consumption costs, tyre replacement costs etc, when used under a range of operating conditions. The estimation of VOC can range from complex models, requiring a wide range of input parameters, to simple models needing very few input data (Institute for Transport Studies, University of Leeds, 2009).

According to a study by the World Bank (Chesher & Harrison, 1987), the reduction or increase in the VOC will mainly depend on the condition of the road, including the following parameters:

- Surface type – Paved or unpaved;
- Roughness - which is defined as the deviations of a surface from a true planar surface with characteristics that affect vehicle dynamics, ride quality, dynamic loads and drainage;
- Vertical profile - Rise and fall;
- Horizontal profile - Degree of curvature;
- Altitude of terrain - to determine the air resistance to the vehicle motion;

The World Bank's HDM-VOC model takes into account the above parameters of road conditions and other vehicle properties including vehicle gross weight which is the sum of tare weight and payload, maximum used driving power, maximum used braking power, age of vehicle, to determine the vehicle operating costs.

The road condition parameters usually affect the vehicle's speed which has a direct impact on the rate of fuel consumption. The roughness with the potholes damages the vehicle whereby increasing the maintenance and repair costs, tyre replacement costs and depreciation costs.

According to a study done by the World Bank, when a road is not maintained and is allowed to deteriorate from good to poor condition each dollar *saved* on road maintenance *increases* VOCs by $2 to $3. This reflects that a deteriorated road will have 200% to 300% of VOC than road in good condition (Heggie I. , 1995). The study also concludes that road maintenance is shown to be highly cost-effective, with benefit/cost ratios varying from 3.4 to 22.1.

The International Roughness Index (IRI) measures road roughness on a scale from 0 IRI typically rising up to say 30 IRI where the road is so rough it is barely drivable. A new asphalt concrete road can have roughness value as low as 2 IRI. A newly constructed gravel road of good materials can have a roughness value of under 5 IRI. Weather and cumulative axle loading are the main factors in the deterioration of paved roads which increase the roughness values over time (Chesher & Harrison, 1987).

A study made by INARSA for the Ethiopian Roads Authority to determine the conditions of paved roads based on Pavement Management System (PMS) road roughness surveys categorizes the road condition with a corresponding IRI values as follows (Ethiopian Roads Authority, 2003):

- Good - < 4.5,
- Fair - 4.6 – 6.0,
- Poor - 6.0 – 9.0, and
- Bad - > 9.0

Hence, a paved road deteriorated from good condition (IRI < 4.5) to a poor condition (IRI about 9.0) increases the VOC by 200% - 300%.

The above estimation, though based on the roughness of the road pavement, does not fully reflect pothole damage. Most vehicles are not designed to deal with the sharp and repeated shocks caused by potholes. Potholes cause immense damage to vehicles.

On a road with bad potholes, a driver can either pursue a defensive strategy or ignore the potholes and carry on as usual. If he follows a defensive strategy, he first slows down and changes gears. He then has to negotiate the loaded truck and trailer, weighing between 44 and 50 tons, through the potholes. This causes extra stress on the tires, wheel bearings, spring assemblies, spring hangers, chassis, cross-members, engine mountings, gear box mountings, brakes, steering assemblies, and shock absorbers. Having negotiated the potholes, he accelerates and changes gears again. On the other hand, if he ignores the potholes, he will drive through them at his regular speed, resulting in more damage to the vehicle and tires and increasing the risk of accidents. The axle pressure now increases by at least three times.

The effect of potholes on vehicle and associated additional costs on its operation can be better understood with the study made by one trucking association in Zambia (Heggie I. , 1995). The Federation of Zambian Road Hauliers interviewed truckers to compare the running costs of a truck and trailer combination on a road with potholes with those on a road without potholes.

The extra annual expenditures over the normal running expenditures due to the potholes, as obtained from the survey, are indicated in Table 5-1 below. It ignores extra fuel consumption, damage to goods, down-time of trucks under repair, and accidents caused by potholes and sharp pavement edges.

Table 5-1: Example of Extra VOC due to Potholes

Quantity	**Item**	**Unit price (dollars)**	**Annual cost (dollars)**
10	Extra tires and tubes	595	5,952
1	Extra clutch and pressure plate	1,071	1,071
4	Extra wheel bearing	201	803
1	Extra set of brake shoes	1,050	1,050
1	Extra set of springs	1,667	1,667
4	Extra spring hangers and bushes	113	452
-	Welding, electrodes/oxyacetylene for: body, chassis and cross member damage engine, gearbox, and cabin mountings	952	952
1	Extra steering assembly	1,874	1,874
4	Extra shock absorbers	128	510
	Total annual costs attributable to potholes		**14,333**

(*Source:* Federation of Zambian Road Hauliers Ltd., February, 1992.)

On the assumption that each truck travels 70,000 km per year, these expenses raise VOCs by over $0.20 per veh-km. Since the average cost of operating a large articulated truck on a good road is about $1.20 per veh-km, potholes thus increase VOCs by at least 17 percent, since the additional costs of fuel, down-time, and damage to goods are not included. Furthermore, with virtually all the needed spare parts imported from abroad, the extra costs must be entirely foreign exchange. It is no wonder road transport associations keep pressing for better road maintenance and express a willingness to pay for it.

5.6 Road Users Charge

'*Road user taxes'* can be simply classified as any tax imposed on the acquisition and operation of road vehicles, including taxes and fees on vehicles, parts and fuel. It is more difficult to define '*road user charges'*. The term 'charge' implies a fee for use or a charge levied to cover the cost imposed by vehicle use on the rest of society. In many instances road user *charges* will be a component of road user *taxes*. However this is not always the case. Where a specific road fund has been set up then the charges are not considered as part of taxation. Similarly a road toll for using specific facility will also not be considered as a tax (Kenneth, Gwilliam, & Shalizi, 1997).

Road user charges have been calculated to cover a wide variety of costs. The following items are sometimes included in the analysis and discussion of road user charges:

- Traffic management
- Policing
- Accidents
- The control of international traffic
- Environmental damage costs
- Congestion costs
- Routine and periodic road maintenance costs
- Road rehabilitation
- New road construction

The World Bank's Road User Charges Model (RUCM) is a useful tool to help estimate road user charges. In using RUCM, the overall objective is broadly to allocate variable charges to each traffic component in relation to the incremental road maintenance costs that each category generates and to allocate fixed cost in relation to each vehicle's ability to pay. The purpose of the approach is to help identify appropriate charges for the road fund. It was felt that other road taxation objectives, e.g. fuel conservation or to address inequality could be handled, as now, via different transport taxes that go to fund general government revenues.

To estimate the variable and fixed routine and periodic maintenance costs a series of runs of HDM4 can be undertaken and the sensitivity to traffic loading interpreted. For bitumen paved roads equivalent standard axle loads (ESAs) will be used as the sole basis for allocating variable costs. However it is recognized that traffic volume also plays a part in paved road deterioration. For unpaved roads the number of axles per vehicle combined with traffic volume would be used. To allocate fixed costs, for most of the road network, relative vehicle import value, modified by expected vehicle life was used. The actual allocation to different vehicles also depends upon the vehicle distance run. The rational for the approach is that vehicle value represents the easiest proxy to identify the “ability to pay”. To allocate fixed costs to the urban paved network a measure of congestion is used (passenger car equivalent units, PCEs).

For each vehicle type variable and fixed costs is calculated. This is then compared with revenues generated from specifying a standing vehicle charge and a fuel levy. Different combinations of standing charges and fuel levies could then be compared to see which combination gives the lowest difference for each vehicle type whilst at the same time covering maintenance costs.

6 CASE STUDY: ADDIS ABABA – ADAMA ROAD

6.1 Background

Addis Ababa is the capital city of Ethiopia with its own autonomous administration. The population of Addis Ababa is about 2.7 mil[5]. Adama is located at about 90Km east of the capital, Addis Ababa, and is the capital of East Shoa Zone of Oromia Region.

The Addis Ababa – Adama Trunk road is part of the road linking the main road connecting Ethiopia and Djibouti, the highest trafficked road in the country. The road section from Addis – Modjo, which is about 63Km, was rehabilitated and upgraded in the year 2001 as part of Addis – Modjo – Awassa. The section from Modjo – Adama, which is about 17Km, was rehabilitated and upgraded in the year 2003 as part of Adama – Awash Road Rehabilitation Project funded by the EU.

The road has a total length of 80Km starting from Kaliti Ring Road Junction, and can be categorized in to three sections based on the road and traffic condition.

6.1.1 Section 1: Kaliti Junction – Akaki

This section is usually considered as inter-urban section though it is administered by the Ethiopian Roads Authority. It starts at Kaliti Round About around Driver's Training Center and passes through congested urban areas. It has approximately about 13Km. The traffic condition is higher than that of the other section as more traffic flows in intercity between the center of the city and southern part of the City.

6.1.2 Section 2: Akaki – Modjo

This section is the second most trafficked road as it is the main access to the southern part of the country in addition to the eastern part. The road starts at the outskirt of Akaki Town, and crosses well developed industrialized areas of newly established Gelan Town, Dukem, up to Bishoftu Town and relatively rural areas between Bishoftu and Modjo Towns of Oromia Region.

[5] AS per the 2006 population census.

The road length is approximately about 50Km. This section has less traffic volume than Section 1, but obviously has higher traffic volume than Section 3 as significant traffic from southern part of the country joins the route at Modjo Town.

6.1.3 Section 3: Modjo - Adama

This section is relatively has lower traffic volume than the other sections. It starts at Modjo Town passing through rural areas up to Adama City, and has an approximate length of about 17Km.

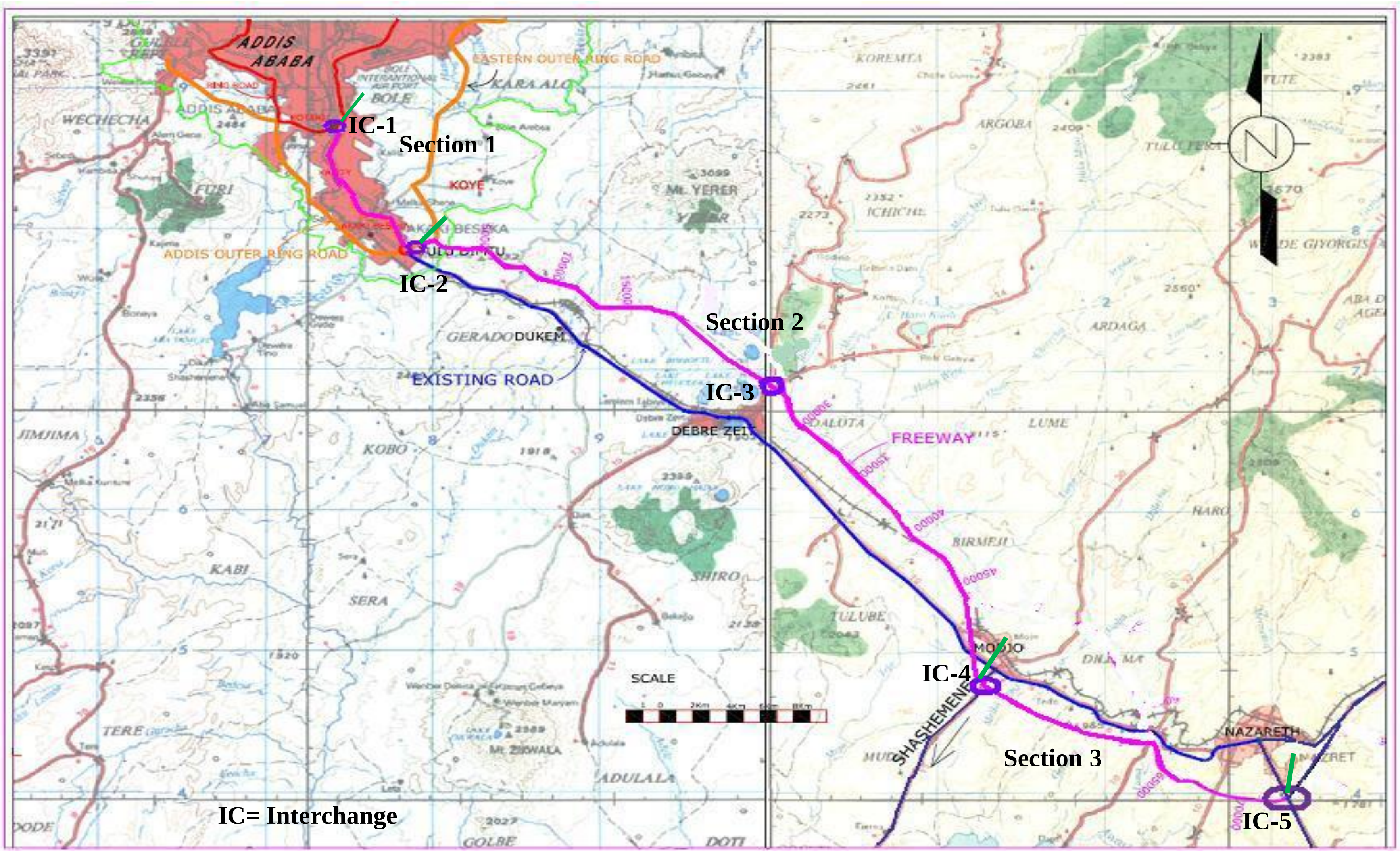

Figure 6-1: Location Map for Addis Ababa – Adama Trunk Road

6.2 Alternative Service Approaches

Different alternative scenarios can be approached to be implemented, among which the following are analyzed in this study.

6.2.1 Toll Road Network

There can be two alternative scenarios in implementing the toll road network — converting the existing main road to a toll road OR constructing a new toll road parallel to the existing road. Both alternatives have their own advantages and disadvantages as discussed below.

i. Converting the Existing Road to Toll Road

Maintain and/or upgrade the existing Addis Ababa – Adama Trunk Road to a better condition, and operate it through collecting tolls from road users. In this case the value of current road asset will be estimated and considered as a loan to the operators. In addition a long-term loan used to maintain, upgrade and administer the toll road will be facilitated from local Banks or International/Foreign Banks.

Advantages:

- The cost of maintenance or upgrading the existing road is minimum and easily attracts investor/concessionaire;
- There is no much right-of-way problem and less opposition from the local community;

Disadvantages:

- No alternative free road and may not be easily accepted by the general public and can have political consequences;
- Neither fair service nor fair price can be guaranteed as there will be no free competition; the operator can fix the price by itself as the road users have no option to abandon using the toll road if they feel the price is high or the service is not satisfactory which means the road is not in good condition;

The cost of removal of properties within the right of way can be higher because if expansion will be considered it will destruct highly developed buildings and utilities parallel to either sides of the existing road.

ii. Construction of New Toll Road

Constructing another toll road parallel to the existing trunk road and operate the road through collecting tolls from road users. In this case the toll road should be in a better condition with satisfactory service to attract users prefer the toll road to free parallel road.

Advantages:

- There is no public rejection as there is an alternative free road at least in fair condition for those who don’t want to pay out-of-pocket prices;
- Free market can be implemented by itself without external control or government interference because if the price doesn’t match the value of service the users have option to abandon using it, so the operator will balance the price and the service to attract more users;

Disadvantages:

- The cost of initial investment is too high and potential investor may not be available, which means the business may not be feasible;
- More land will be required and may displace more settlers. The resettlement activity cannot be simple and not easily accepted by the local community affected by the implementation of the project;

6.2.2 Management

i. Management of the Toll Roads directly by Government Body or Public Corporation

Operate by establishing a Public Toll Road Corporation which will take over the existing Addis – Adama Trunk Road from the ERA, maintain and/or upgrade the road to a better condition, and operate it through collecting tolls from road users. In this case the value of current road asset will be estimated and considered as a loan to the newly established corporation. In addition a long term loan used to maintain, upgrade and administer the toll road will be facilitated from local Banks or International/Foreign Banks;

This is the basic pattern of management, and management structures close to this pattern are common in some countries. It should be mentioned, however, that there are variations on this pattern. In some cases, toll revenue is planned to cover the entire cost of construction and maintenance during the entire period for which tolls are levied. In other cases, only part of those costs is earmarked to be met from toll income, with the public purse bearing the rest of the costs. The operators are not permitted to make a profit.

ii. Concession to a Private Sector

Transfer the existing road to a private sector fully or partially, and operate by this party through collecting tolls from road users after maintaining and/or upgrading the road to a better condition. The case indicated above will apply for this alternative;

The basic pattern of toll road management entails a private-sector body raising funds, building the road, collecting tolls from users, managing the road, and then handing the road over to the public sector gratis once costs have been recouped in full or in part.

iii. Private-Public Partnership

This kind of arrangement often entails a private-sector company being granted a concession by the public sector to run toll roads. Financing of the huge construction cost has been supported by the public sector in various ways: capital investment from public corporations and local authorities; interest-free loans from road funds or other government sources; and the issuance of government-guaranteed bonds. The combination of private-sector business dynamism backed by the massive resources of the public sector proved most effective.

6.3 Traffic Volume Forecasting

Traffic volume forecasts are the most fundamental data in the financial analysis of roads from the planning stage onward. They will influence the fundamental decision on whether the road should be a toll road, and later on they will also influence decisions on the setting and adjusting of toll levels and collection period (Kuramani et al., 1999).

When a new toll road is constructed parallel to an existing toll-free road, the traffic forecast will base on the diverted traffic from the current traffic volume. There might be generated traffic due to the construction of better standard and improve road, but the magnitude is insignificant and hence, only the diverted traffic is considered in the analysis.

There are many factors affecting the amount of diverted traffic among which the toll level, savings in vehicle operation costs (VOC), saving in travel time and reduction of accident costs by using the new toll road are the major ones. The future condition of the existing toll-free road will also influence the amount of diverted traffic to the new toll road. In addition the public perception of implementing new system in tolling the road, the ability to pay and willingness to pay are also affecting the diverted traffic proportion.

6.3.1 Existing Traffic Condition

The current traffic volume of the road for each segment for the last 5 years, has been collected from the Ethiopian Roads Authority, as indicated in the following tables, Table 6-1 – Table 6-3, by vehicle category. The percentage of yearly increase in AADT and the average increase for five (5) years is also indicated below in Table 6-4 – Table 6-6.

Table 6-1: Traffic Volume of Addis Ababa – Akaki Section

Vehicle Type	2004	2005	2006	2007	2008
Car	2,098	2,362	3,359	4,029	4,176
Station Wagon	2,565	2,886	4,106	4,844	4,984
Small Bus	3,027	3,315	4,456	5,300	5,523
Large Bus	1,491	1,633	2,195	2,440	2,819
Small Truck	1,818	2,590	2,767	3,445	3,797
Medium Truck	2,182	3,108	3,320	4,020	4,691
Heavy Truck	2,060	2,935	3,135	3,699	4,278
Truck Trailer	1,894	2,965	3,266	3,998	4,852
Total	**17,135**	**21,794**	**26,604**	**31,775**	**35,120**

Table 6-2: Traffic Volume of Akaki – Modjo Section

Vehicle Type	2004	2005	2006	2007	2008
Car	1346	1436	1437	1902	1737
Station Wagon	1583	1690	1690	2193	1979
Small Bus	935	1223	1421	2014	2146
Large Bus	819	1071	1245	1428	1520
Small Truck	537	679	755	997	1686
Medium Truck	1381	1747	1942	2070	1933
Heavy Truck	925	1170	1301	1586	1904
Truck Trailer	1215	1682	1688	2472	2366
Total	**8741**	**10698**	**11479**	**14662**	**15271**

Table 6-3: Traffic Volume of Modjo – Adama Section

Vehicle Type	2004	2005	2006	2007	2008
Car	1,023	1,092	1,092	1,430	1,342
Station Wagon	1,177	1,256	1,257	1,646	1,543
Small Bus	903	1,181	1,373	1,794	1,907
Large Bus	508	665	773	1,009	1,072
Small Truck	753	953	1,059	1,255	1,269
Medium Truck	935	1,183	1,315	1,557	1,576
Heavy Truck	909	1,150	1,278	1,514	1,532
Truck Trailer	994	1,376	1,381	2,022	1,993
Total	**7,203**	**8,856**	**9,528**	**12,227**	**12,234**

Table 6-4: Increasing Rate of Traffic Volume of Addis Ababa – Akaki Section

Vehicle Type	2004-05	2005-06	2006-07	2007-08	Average (2004-08)
Car	13%	42%	20%	4%	20%
Station Wagon	13%	42%	18%	3%	19%

Vehicle Type	2004-05	2005-06	2006-07	2007-08	Average (2004-08)
Small Bus	10%	34%	19%	4%	17%
Large Bus	10%	34%	11%	16%	18%
Small Truck	42%	7%	25%	10%	21%
Medium Truck	42%	7%	21%	17%	22%
Heavy Truck	42%	7%	18%	16%	21%
Truck Trailer	57%	10%	22%	21%	28%
Total	**27%**	**22%**	**19%**	**11%**	**20%**

Table 6-5: Increasing Rate of Traffic Volume of Akaki – Modjo Section

Vehicle Type	2004-05	2005-06	2006-07	2007-08	Average (2004-08)
Car	7%	0%	32%	-9%	8%
Station Wagon	7%	0%	30%	-10%	7%
Small Bus	31%	16%	42%	7%	24%
Large Bus	31%	16%	15%	6%	17%
Small Truck	26%	11%	32%	69%	35%
Medium Truck	27%	11%	7%	-7%	9%
Heavy Truck	26%	11%	22%	20%	20%
Truck Trailer	38%	0%	46%	-4%	20%
Total	**22%**	**7%**	**28%**	**4%**	**15%**

Table 6-6: Increasing Rate of Traffic Volume of Modjo – Adama Section

Vehicle Type	2004-05	2005-06	2006-07	2007-08	Average (2004-08)
Car	7%	0%	31%	-6%	8%
Station Wagon	7%	0%	31%	-6%	8%
Small Bus	31%	16%	31%	6%	21%
Large Bus	31%	16%	31%	6%	21%

Vehicle Type	2004-05	2005-06	2006-07	2007-08	Average (2004-08)
Small Truck	27%	11%	19%	1%	14%
Medium Truck	27%	11%	18%	1%	14%
Heavy Truck	27%	11%	18%	1%	14%
Truck Trailer	38%	0%	46%	-1%	21%
Total	**23%**	**8%**	**28%**	**0%**	**15%**

6.3.2 Savings in Travel Time

Travel time is one of the largest transport costs, and travel time savings are often the greatest potential benefit of transport improvements (Department for Transport (DfT), UK, 2009).

One of the reasons for the road users prefer the toll road to free road is that there would be a travel time saving principle on toll road. The resulting "time value" puts a cash value on amount of time saved for each vehicle type. Naturally the actual amount of time saved will depend on the individual vehicle, but an average for each type of vehicle is adopted in making the calculation.

The average value of time for working person and non-working could not be available from any sources. It was tried to estimate based on the average income of passengers using the existing road, however such data could not be obtained as most of the interviewee were not willing to respond for such question. On the other hand the effort made to get from the East Shoa Zone Finance and Economic Development Department was not successful as they didn’t have such data nor such study was not performed.

The following assumptions were considered in estimating the value of time for different class of road users.

- The average number of passengers is estimated based on the observation at vehicles using the road, and the type of passengers is divided in to ‘Working’ and ‘Non-working’ based on the purpose of journey.

- The average monthly salary and number of working hours per month is estimated based on the assumption that:
    - **Car**: usually traders and owners of car. Average monthly income is estimated ETB 4,000.00. Working 8 hours per day for 26 days per month including Saturdays – 208 hours per month.
    - **Station Wagon**: usually civil servants, 1 driver and 2 middle level professionals. Average monthly salary is estimated ETB 2,000.00. Working 8 hours per day for 22 days (Monday – Friday) and 4 hours per day for 4 days (Saturdays) per month – 192 hours per month.
    - **Small Bus**: Mix of traders & civil servants, plus 1 driver and 1 helper. Average monthly income is estimated ETB 1,000.00. Working hours per month is considered average of civil servant and traders – 200 hours per month.
    - **Large Bus**: Mix of traders, civil servants and unemployed or students, plus 1 driver, 1 casher and 1 helper. Average monthly income is estimated ETB 400.00. Working hours per month same as Car – 208 hours per month.
    - **Small, Medium & Heavy Truck and Truck Trailer**: 1 driver and 1 helper. Average monthly income is estimated ETB 600.00 – 1,000.00. Working hours per month same as Car – 208 hours per month.

Summary of hourly wage rate for different class of passengers by vehicle type is shown in the following Table 6-7.

Table 6-7: Estimation of Hourly Income

No.	Vehicle Type	Average Monthly Income per person [ETB]	No. of Working Hours per month [Hrs]	Hourly wage rate [ETB]	Wage rate taken for analysis [ETB]
1	Car	4,000.00	208	19.23	20.00
2	Station Wagon	2,000.00	192	10.42	10.00
3	Small Bus	1,000.00	208	5.00	5.00
4	Large Bus	400.00	208	2.00	2.00
5	Small Truck	600.00	208	2.88	3.00

No.	Vehicle Type	Average Monthly Income per person [ETB]	No. of Working Hours per month [Hrs]	Hourly wage rate [ETB]	Wage rate taken for analysis [ETB]
6	Medium Truck	800.00	208	3.85	4.00
7	Heavy Truck	1,000.00	208	4.81	5.00
8	Truck Trailer	1,000.00	208	4.81	5.00

On average the existing free road takes about 90 min – 120 min to travel between Adama and Addis Ababa. The new toll road is proposed to have a speed of 120Km/hr and the travel time is estimated to be less than 60 min. For the purpose of this study an additional travel time of 30 min will be taken in estimating time value of money for cars, Station Wagons and small buses, while an average 45 min delay is considered for large bus and trucks and 60 min (1 hr) is considered for articulated trucks. The average vehicle Working and Non-Working Passengers for each category of vehicle is estimated. The Estimated Hourly Rate is assumed for the average of working time and non-working time by estimating the monthly income of passengers for each category of vehicle.

Table 6-8 below shows the anticipated savings for each category of vehicle as a result of avoiding using the existing congested road using the toll road. The delay in travel time is estimated only for the delay anticipated due to traffic congestion, the delay due to road deterioration is considered with saving in vehicle operating costs. The saving due delay in cargo handling is included in the equipment rate.

Table 6-8: Estimation of savings in Travel Time by using the Toll Road

No.	Vehicle Type	No. of Working Passenger	No. of Non-Working Passengers	Total	Estimated Delay per Trip [Hr]	Extra time due to congestion [Man-Hr]	Estimated Hourly Wage Rate [ETB]	Total Wage Rate	Estimated Hourly Vehicle Rate [ETB]	Total Equipment Rate	Grand Total
1	Car	1	1	2	0.5	1.0	20.00	20.00	20.00	10.00	30.00
2	Station Wagon	1	2	3	0.5	1.5	10.00	15.00	30.00	15.00	30.00
3	Small Bus	2	10	12	0.5	6.0	5.00	30.00	40.00	20.00	50.00
4	Large Bus	3	47	50	0.75	37.5	2.00	75.00	150.00	150.00	225.00
5	Small Truck	2	-	2	0.75	1.5	3.00	4.50	80.00	60.00	64.50
6	Medium Truck	2	-	2	0.75	1.5	4.00	6.00	100.00	75.00	81.00
7	Heavy Truck	2	-	2	0.75	1.5	5.00	7.50	150.00	112.50	120.00
8	Truck Trailer	3	-	3	1	3.0	5.00	15.00	200.00	200.00	215.00

6.3.3 Saving in Vehicle Operating Costs

Vehicle operating costs (VOC) constitute the dominant share of the total costs of road transport. According to the World Bank (Harral & Faiz, 1988), VOC is about 75 – 95 percent of the total cost of road transport, except when the traffic volume is extremely low.

One of the reasons that road users prefer better road condition with extra out-of-pocket costs is by considering the savings from the vehicle operating costs. If maintenance is neglected, road users bear the major burden of the increase in total transport costs (the sum of infrastructure and vehicle operating costs), since the share of infrastructure costs in the total cost of transport is small.

The use of road system in poor condition gives rise to operating costs for the users. These include the costs of fuel, oil and tyres, and an element of vehicle maintenance. The vehicle operating costs (VOC) also include allowances for the purchase of new vehicles. VOCs are calculated from the sum of the vehicle resource components, including:

- Fuel and lubricating oil consumption,
- Tyres and spare parts,
- Vehicle maintenance labour costs,
- Vehicle depreciation and Interest on capital

Extra VOCs have been calculated in the Highway Development and Management Model (HDM), which is based on numerous studies that have measured the impact of various factors, including road conditions, on vehicle operating costs. The HDM study found that road deterioration increases ownership costs, maintenance and repair costs, fuel and lubricant consumption costs, and tire costs. It is found that deteriorated roads accelerate the pace of depreciation of vehicles and the need for repairs because the stress on the vehicle increases in proportion to the level of roughness of the pavement surface. Similarly, tyre wear and fuel consumption increase as roads deteriorate since there is less efficient transfer of power to the drive train and additional friction between the road and the tyre.

The World Bank's Highway Design and Maintenance (HDM) Standards Study focused on the rigorous empirical quantification of tradeoffs between the costs of road construction, road maintenance and vehicle operation, and also on the development of planning models incorporating total life-cycle cost simulation as a basis for highway decision- making (Chesher & Harrison, 1987).

These procedures are combined in a computer model, HDM-VOC, for the calculation of user costs under a variety of road and traffic conditions, but not including congested traffic operation's. The relationships were developed from controlled experiments and extensive user surveys in Kenya, Brazil, India and the Caribbean, which together produced an enormous body of knowledge on road user costs in three continents with diverse road conditions and economic environments. They can be adapted to local conditions in other countries using estimates of local vehicle prices, labor and repair costs, vehicle utilization and other parameters. The HDM-VOC program predicts the various components of vehicle operating costs based on road and vehicle characteristics and unit costs in a free-flow traffic environment.

Estimating the savings in VOC due to using the new toll road facility is not a simple task. It requires knowing the level of deterioration of the existing toll-free road. If it will be kept in good condition, which is more unlikely, the saving is minimum. On the other if it will be deteriorated to a level of poor or bad condition, high saving will be gained by using the new facility.

A research made by the World Bank to develop fundamental relational links between the VOC and road condition shows that 'roughness' is a dominant effect of road condition on vehicle operation costs. Based on a case study made in Costa Rica, the research has developed an index by how much the road roughness affects VOC as indicated in Table 6-9 below (Harral & Faiz, 1988).

Table 6-9: The Effect of Road Roughness on Vehicle Operating Costs

No.	Vehicle Class	Road Condition		
		Good (2.3 IRI)	**Fair (4.6 IRI)**	**Poor (6.9 – 9.2 IRI)**
1	Car	100	106	114 – 126
2	Bus	100	104	109 – 116
3	Light Truck	100	111	124 – 138
4	Heavy Truck	100	114	129 – 146
5	Articulated Truck	100	112	127 – 144
	Average	**100**	**109.4**	**120.6 – 134**

The VOC for smooth paved roads with IRI (International Roughness Index) of about 2m/km is estimated as indicated in the following Table 6-10.

Table 6-10: Estimation of VOC on Addis Ababa – Adama Toll Road

No.	Vehicle Type	Value of Import [ETB]	Total Mileage [Km]	Owning Cost [ETB/Km]	Investment Cost [ETB/Km]	Total Owning Cost [ETB/Km]	Fuel Consumption [lit/Km]	Fuel Cost [ETB/Km]	Oil & Lub Cost [ETB/Km]	Maint. & Repair Cost [ETB/Km]	Tyre Cost [ETB/Km]	Total VOC [ETB/Km]
1	Car	175,000.0	89,798	1.95	0.49	2.44	0.11	0.90	0.09	1.95	0.49	5.86
2	Station Wagon	520,000.0	263,164	1.98	0.49	2.47	0.13	1.07	0.11	1.98	0.49	6.11
3	Small Bus	190,000.0	192,547	0.99	0.25	1.23	0.13	1.07	0.11	0.99	0.25	3.64
4	Large Bus	835,000.0	487,399	1.71	0.43	2.14	0.29	2.26	0.23	1.71	0.43	6.77
5	Small Truck	415,000.0	139,019	2.99	0.75	3.73	0.25	1.95	0.20	2.99	0.75	9.61
6	Medium Truck	910,000.0	255,391	3.56	0.89	4.45	0.30	2.34	0.23	3.56	0.89	11.48
7	Heavy Truck	1,575,000.0	473,780	3.32	0.83	4.16	0.35	2.73	0.27	3.32	0.83	11.31
8	Truck Trailer	2,125,000.0	662,299	3.21	0.80	4.01	0.5	3.90	0.39	3.21	0.80	12.31

N.B. * - Value of Import is taken from ERA Road Funding Report, January 2003 and adjusting with the current inflation rate.

* - Total Mileage is taken from ERA Road Funding Report, January 2003.

* - Total VOC = Total variable costs (fuel, oil & lub, tyre and maintenance) + depreciation (owning) cost.

* - Investment Cost is 25% of Owning Cost.

* - Maintenance and repair costs is equal to Owning cost, based on ERA Cost Breakdown Analysis Manual.

* - Fuel, Oil and Lubricant, and tyre cost is taken from ERA Cost Breakdown Analysis Manual.

For the purpose of this study the following assumptions are considered in estimating the saving on vehicle operating costs:

- The new toll road will be constructed to a better standard with design speed of 120 Km/hr and it will be kept in good condition with a proper maintenance at all times, rehabilitation and upgrading or expansion when it requires;
- The existing toll-free road will continue under the administration of ERA and its condition will continue with the current one – ‘FAIR Condition’. Expansion is not expected;

Hence, using the index developed by the World Bank indicated in Table 6-9 above, the saving in vehicle operation costs due to road deterioration (roughness) can be calculated as shown in the following Table 6-11.

Table 6-11: Total Estimated Saving in VOC by Using the New Toll Road

No.	Vehicle Type	VOC per Km (Table 6-10) [ETB/Km]	Total VOC for 80 Km [ETB]	Additional Expense Due to Roughness [%]	Total Saving in VOC [ETB]
1	Car	5.86	468.8	6%	28.13
2	Station Wagon	6.11	488.8	6% [1]	29.33
3	Small Bus	3.64	291.2	4%	11.65
4	Large Bus	6.77	541.6	4% [2]	21.66
5	Small Truck	9.61	768.8	11%	84.57
6	Medium Truck	11.48	918.4	11% [3]	101.02
7	Heavy Truck	11.31	904.8	14%	126.67
8	Truck Trailer	12.31	984.8	12%	118.18

N.B. [1] - The index value estimated for Car is used for Station Wagon;
[2] - The index value estimated for Bus is used for Small Bus and Large Bus;
[3] - The index value estimated for Light Truck is used for Medium Truck.

6.3.4 Reduction in Accident Costs

Road accidents are the major problems observed specially in developing countries. Though there are many factors contributing to accidents, the geometrical condition of the road, mainly the degree of curve, the width of driving lane, sight of distance are factors for rise of accidents in addition to road condition. The volume of traffic is also affecting the accident rate.

A number of studies of road crashes worldwide carried out by the Transport Research Laboratory (TRL) UK in recent years have shown that the road safety situation throughout the African continent is one of the worst in the world. With approximately only 4 per cent of the world's motor vehicles, Africa's road fatality share is about 10% of the world (2 ½ times greater). In several African countries, a motor vehicle is over a hundred times more likely to be involved in a fatal road crash than in the UK or USA (Transport Resarch Laboratory (TRL) UK, 2000).

This study identified that the number of people killed worldwide in road crashes in 1999 was between 750,000 and 880,000 and that, perhaps surprisingly about 85 percent of these deaths occurred in the developing and transitional countries of Africa, Asia, Latin America and the Middle East. The Fatality Rate in Ethiopia was also estimated 199 per 10,000 vehicles in the year 1998.

A report by the National Road Safety Council under the Ministry of Transport and Communications revealed that out of the accidents registered in 2006, 68% was occurred due to pedestrians strike and 3% due to animal strike. Table 6-12 below shows the accident of personnel by type (National Road Safety Council, 2006).

Table 6-12: Accident of Personnel by Category

No.	Accident of Personnel by Category	
1	Pedestrian Strike	68%
2	Overturn	13%
3	Fall from Vehicle	6%
4	Anima Strike	3%
5	Other	10%
	Total	**100%**

This report (National Road Safety Council, 2006) also disclosed the accident trend of Easten Shoa Zone which mainly includes the Addis Ababa – Adama road as indicated in the following Table 6-13.

Table 6-13: Accident Trend of East Shoa Zone

No.		2001/02	2002/03	2003/04	2005/06
1	Death	200	190	195	175
2	Serious Injury	100	110	165	95
3	Light Injury	50	80	45	30
4	Property Damage	250	340	335	285
	Total	**600**	**720**	**740**	**585**

A study for a review of road safety in Ethiopia by a joint TRL - Ross Silcock team estimated that the annual cost of road crashes was about Birr 400 million in the year 1999 (Transport Resarch Laboratory (TRL) UK, 2000). Out of this annual accident cost, the proportion of traffic flow for Addis Ababa – Adama Road would be about 9% (comparing 3,771,565 Vehicle-Km of 1996/97 national traffic flow with 322,830 vehicle-Km for this road). This makes the accident cost of Addis Ababa – Adama Road was about ETB 36 million. If we estimate the accident cost for the year 2008 with the ratio of accident cost to vehicle-Km of 1996/97costs, it would be about ETB 122 million.

It is believe that the new toll road would significantly decrease this accident cost. The accident of personnel due to pedestrian strike and animal strike, which constitutes 70%, will not be expected as the new toll road will be protected from such interference.

6.4 Public Perception

6.4.1 Stakeholders View

Assessment of stakeholders view is an integral part of the study. The involvement of various stakeholders and stakeholder groups are imperative for a successful project. The information gleaned from these groups provides with information that can be used to address important issues and concerns. The assessment also provides insight into the public acceptance of the concept.

A total of 5 stakeholders were approached, which are listed in Table 6-14 below.

Table 6-14 List of Stakeholders Interviewed

No.	Stake Holder	Role	Contacted Person
1	Ethiopian Roads Authority	Responsible for the administration and management of the road.	• Ato Bekele Nigussie, Planning & Programming Division Manager; • Ato Mesfin, Planning Branch Head.
2	Road Fund Administration	Funding for the maintenance of the road.	• Ato Alemayehu Teferi, Planning & Programming Division Head.
3	Addis Ababa City Roads Authority	Responsible for the administration and management of the roads in Addis Ababa City.	• Ato Getachew Dilnessaw, Civil Engineer.
4	Oromia Roads Authority	Responsible for the management & administration of the regional roads in Oromia Region.	• Ato Hailu Kenea, Planning & Programming Division Head.
5	East Shoa Zone Administration Office	Responsible for the political, social and economic administration of the East Shoa Zone.	• Ato Debbo Tunka, Adama City General Manager.

The assessment was made through interviews and by preparing questions related to specific stakeholder. The stakeholders were each asked a series of questions pertaining to the general road network in the country, their general view about tolling roads, their role in the road administration, and the general problems in the current road administration, management and financing.

More specifically, interviewees were asked for their opinions on traffic congestion in the road, where congestion was worse and how these problems might be addressed. The stakeholders were then asked their opinions on toll roads in general and their feelings of tolling Addis Ababa – Adama Trunk Road in particular. Complete list of the questions is attached in Appendix A.

1. General

The stakeholders have a similar view that the current condition of the Addis – Adama Road is highly congested and if some sort of solution would not be giver sooner, the condition will worsen.

2. The Ethiopian Roads Authority

The Ethiopian Roads Authority observes that currently the road is highly congested and considers possible expansion or upgrading to alleviate the existing congestion problem. In doing so the Authority believes if potential investor who will construct and collect tolls would be found, the Authority can make a concession agreement with a private sector to construct a new road, upgrade or rehabilitate the existing road, operate for limited time and transfer to public at the end of concession period. But as it requires huge investment capital, ERA doesn't expect such potential private sector either from local or foreign investors.

The current regulation concerning road administration does not allow a private sector or public enterprise to construct road for business purpose, and the law and regulation is required to be revised if tolling of road is going to be implemented, as per ERA's general view.

On the other hand ERA is planning to construct a new toll road from Addis Ababa – Adama under its own administration. As per the current ERA's plan it is not yet specifically identified who is going to operate the toll road at the end of construction. In general terms, ERA has understood the current traffic congestion problem of this road and funding for maintenance with the current practice will not be sustainable.

In addition it is stated that there is no study which estimates the time wasted due to delay by traffic congestion neither in the country nor specifically to this road. In addition there is no study which estimates the saving in VOC due to different road condition.

3. The Road Fund Administration Office

The Road Fund Administration Office has a general impression that the Addis Ababa – Adama road is currently handling traffic volume more than its expected capacity and damage on the pavement is usually observed more than expected. Though intensive and continuous maintenance has been carried out on this road, the condition of the road is getting worse from time to time due to heavy traffic.

The Office generally supports the implementation of toll road in general and the tolling of this road specifically as the traffic is highly increasing and will not be able to accommodate the traffic after a few years if another solution is not implemented.

4. Addis Ababa City Roads Authority

Though the Addis Ababa – Akaki Section of road is administered by the Ethiopian Roads Authority, it is fully located in the City and can be considered as urban road. However, the current condition of the road specially the number of lanes would not allow free flow for the traffic as it serves for both the urban traffic and the traffic from the main Addis Ababa – Modjo Road.

The Addis Ababa City Roads Authority (AACRA) is currently administering the roads in Addis Ababa City and expanding the road network of the City at a high rate. The Authority considers the Training Center – Akaki road (Section 1) as one of the highest traffic roads and is considering different alternative options to improve the traffic congestion. As an option the Authority is currently constructing a 4-lane road from Akaki to Lebu Round About on the Ring Road. There is also a plan to construct another outer ring road from Akaki to around Kotebe.

According to AACRA, if the traffic from the main trunk road (i.e. Addis Ababa – Modjo Trunk Road) is fully or partially diverted to a new toll road, the Authority can administer the Training Center – Akaki Section as other roads in the City without problem with minor upgrading or expansion. In general terms the Authority fully supports the implementation of the Addis Ababa – Adama toll road.

5. Oromia Roads Authority

The Oromia Roads Authority is responsible for the administration and management of rural roads in the Oromia Region. The Authority has a general impression that though the toll road implementation would be advantageous for high traffic roads like the Addis Ababa – Adama, it would not be feasible for rural roads or roads with low traffic volume.

In general the Authority supports the toll road implementation with subsidization for roads with low traffic volume.

6. East Shoa Administrative Zone Office

The East Shoa Zone Administrative Office, located in Adama Town, is responsible for political, social and economical administration of the East Shoa Zone. The second and third section of the road i.e. from Akaki to Modjo and to Adama is fully located in the Zone. The Zonal Office is of course worried about the traffic congestion of the road and expects the federal Government to expand the existing road to accommodate the increasing traffic and administering with the current condition, toll free road.

Concerning opening another toll road parallel to the existing road, the Zonal Office is concerned about the ability of the public to afford any additional transport cost. The other great concern of the Zonal Office is that the road will cut the community into two which will have great social impact.

6.4.2 Drivers Interviews

a) Interview Procedures:

Interviews were conducted with 15 car drivers (5 private car, 5 Station Wagon and 5 taxi drivers), 15 passenger car drivers (5 mini bus, 5 medium bus and 5 large bus drivers), and 20 commercial truck drivers (5 small truck, 5 medium truck, 5 heavy truck and 5 articulated truck drivers) who were using the existing road. The car owners/drivers were interviewed in Adama Town by using a chance where they stop for tea break, while the taxi drivers were interviewed in Akaki Town where they were queuing to accommodate passengers. The small bus and large bus drivers were interviewed in Adama Bus station.

The location of interview for truck drivers was selected in Dukem city, because of the opportunity to interview truck drivers during a break the truck stop.

The content of the whole questions of the interview is attached in Appendix A, and summary of the responses is presented below.

b) Findings:

There was a general consensus among most of the drivers that tolling the road is not recommended in any way. Car drivers, small (mini) bus drivers and small truck drivers were generally against the tolling of the road. They are mostly owners of the vehicle or employed by a close relative. The owner operators typically held the view that roads should be financed with fuel or other taxes, and that toll costs would be unfair, out-of-pocket expenses for them. Several mentioned that they will use the existing toll-free road to avoid toll road. They stated that the current price escalation on fuel, parts and other expenses cannot be affordable and if toll costs would be added, it will worsen the situation and make things terrible. Only 30% of the drivers responded the may prefer the toll road with a minimum fee and provided that the condition of the existing road will not be improved.

The large bus drivers and truck drivers interviewed were almost employed drivers or were company drivers, and their opinions on tolling tended to be either in favor of a toll or were agreeable to tolling, particularly because their company would cover toll costs. 50% - 60% of these drivers are in favor of toll road, but still has a fear of high price which may discourage them from using it.

Several of the independent operators were also more similar to the company drivers in their viewpoints toward use of the toll road even though they might have expressed a negative view toward tolling in principle.

The summary of the interview result is summarized in the following Table 6-15.

Table 6-15: Summary of Analysis of Driver's Interview

No.	Statement		Car & Station Wagon	Small bus & Small Truck	Medium Bus & Medium Truck	Large Bus & Trucks	Total
	No. of Interviewee		10	15	10	15	50
1	The traffic congestion is affecting the travel time much and worried by the delay.	Number	6	11	9	13	39
		%	60.0%	73.3%	90.0%	86.7%	78.0%
2	The traffic congestion has delayed the travel time.	Free flow time	45 min	60 min	60 min	75 min	-
		Actual time	75 min	90 min	90 min	135 min	-
		Delay	30 min	45 min	45 min	60 min	-
3	The condition of the road & its geometrical features affect on the speed of driving.	Number	4	4	2	2	12
		%	40.0%	26.7%	20.0%	13.3%	24.0%
4	The condition of the road & its geometrical features increase VOC.	Number	3	2	3	4	12
		%	30.0%	13.3%	30.0%	26.7%	24.0%
5	Have awareness about toll road system	Number	7	3	3	4	17
		%	70.0%	20.0%	30.0%	26.7%	34.0%
6	If a toll road will be built which has better condition, free flow do you think will you use the road with additional payment?	Number	3	4	5	9	21
		%	30%	26.7%	50%	60%	42%

6.4.3 Public Opinion Survey

a) Survey Procedures

The survey was conducted at Adama Bus Station. People of different category were randomly selected and interviewed with short and simple questions, which take not more than 5 minutes. The interviewed people are waiting for transport to Addis Ababa in the bus station. The contents of the initial draft of the interview were:

- Range of Age;
- Educational level;
- Income level;
- How frequent she/he uses the road;
- Her/his view about the current transport fee — fair, high or low;
- How long it would take on average to reach Addis, and her/his view about this time — slow, fast or average;
- What does she/he think if a road with good condition that can save time will be built and vehicles are paying to use that road — good, not good, or no idea;
- Will she/he is going to use such road by paying additional fee, and how much can she/he pay additionally if such road would be built for such service;

Questions asking about range of age, educational level and income level have offended most of the interviewees and not willing to respond to other questions. Therefore, these questions were omitted from the interview for ease of the survey. In addition, the category of the general population by age, education level and income level could not be found to indicate the percentage of the sample with the general population.

20 persons (10 female and 10 male) were interviewed. It has been tried to select people from different categories just by looking the physical of the person (civil servant, trader, resident from rural area (farmer), student, etc).

b) Findings:

The general population is highly worried about the soaring of transport fee in recent days or months. They generally expressed the current transport fee in unaffordable for any citizen and any other form of increase would worsen the case.

In general terms the ability to pay for the new toll cost among the general public is very minimum, and the willingness is also almost nil. Without exception all of the public respondents did not hear about tolling any road.

Respondents were asked how much they would be willing to pay as a toll for the completed section from Adama to Addis Ababa. As indicated below in summary of results, no toll price was acceptable for 85% percent of the respondents. In general, respondents were more willing to pay a minimum toll for the whole route, and a few were willing to pay more than 5% of the current transport fee. Findings of the public opinion survey are summarized in Table 6-16 below.

Table 6-16: Summary of Public Opinion Survey

No.	Content of Question	Responses		
1	The current transport cost in comparison to their income.	Very high	Fair	Low
		80%	20%	0%
2	Knowledge about toll road	No Knowledge	Fair	Low
		80%	20%	0%
3	If a toll road will be built, are you willing to use it?	No, at any cost above the current.	Yes with 5% increase	Yes with <20% increase
		85%	10%	0%
4	General attitude of the public towards to toll road implementation.	Do not accept	Accept but with minimum increment	Positive attitude
		85%	10%	5%

Analysis of the survey data supports the following conclusions:

- People in the region are not highly familiar with the toll road system.
- The majority of people see a need for and the benefits of upgraded existing Addis Ababa – Adama road.
- People are not as favorable toward tolling and believe a tolled Addis Ababa – Adama road will not be used. Their own projected use was substantially lower for a tolled facility.
- Almost 85% of the respondents said they will not use a toll road, and do not support the opening of toll road. About 10% are willing to use the toll road

with a minimum increase (5 – 10 %) in the current transport price due to tolling the road. Only less than 5% of the surveyed people were positively accepted the toll system with a fair increase (less than 20%) in transport costs.

6.5 Cost Benefit Analysis

The cost benefit analysis of toll road projects are very complex depending on many factors including the cost of road construction, maintenance, operation and related costs, and the revenue which is mainly depend on the traffic amount, the toll amount, which itself affect the traffic volume along with the ability to pay and willingness to pay.

The construction of road will depend on the physical characteristics of road way, the number of lanes and road width, land acquisition and RoW clearance costs. The number of lanes will depend on the traffic forecast so that it will accommodate the actual traffic without any congestion. As the traffic amount increases and reaches or nearing to reach its design capacity, it requires expansion during the course of operation.

6.5.1 Traffic Volume

Before estimating the cost of construction, it is required to estimate the traffic volume to determine the geometric features of the road. The traffic volume is estimated based on the diverted traffic from the existing road as explained above.

To estimate the diversion ratio, the road users' general opinion is taken into consideration. The toll amount and the condition of the existing toll-free road in the future will influence the amount of traffic. Based on the drivers' opinion and the public opinion survey, the possible savings in travel time, savings in VOC and the saving of accident costs, the following diversion factor is considered at the start of the toll road operation in this study.

- For car, station wagon and small bus: - 0.5
- For small truck and medium truck: - 0.6
- For large bus, heavy truck and articulated truck: - 0.75

The diversion ratio will obviously increase through time as the condition of the toll-free road will be getting worse. Accordingly, the base traffic volume in the year 2008 and the estimated diverted traffic volume of the toll road is indicated in the following Table 6-17.

Table 6-17: Estimated Diverted Traffic Volume

Vehicle Type	Diversion Factor	Addis – Akaki Section		Akaki – Modjo Section		Modjo –Adama Section	
		Base Traffic (2008)	Diverted Traffic	Base Traffic (2008)	Diverted Traffic	Base Traffic (2008)	Diverted Traffic
Car	0.50	4,176	2,088	1,737	869	1,342	671
Station Wagon	0.50	4,984	2,492	1,979	990	1,543	772
Small Bus	0.50	5,523	2,762	2,146	1,073	1,907	954
Large Bus	0.75	2,819	2,114	1,520	1,140	1,072	804
Small Truck	0.60	3,797	2,278	1,686	1,012	1,269	761
Medium Truck	0.60	4,691	2,815	1,933	1,160	1,576	946
Heavy Truck	0.75	4,278	3,209	1,904	1,428	1,532	1,149
Truck Trailer	0.75	4,852	3,639	2,366	1,775	1,993	1,495
Total		**35,120**	**21,397**	**15,271**	**9,447**	**12,234**	**7,552**

6.5.2 Determination of No. of Lanes

Once the traffic volume is forecasted, the width of roadway or number of lanes which would accommodate the estimated traffic without any congestion can be determined. It is assumed that a high speed road with 100Km/hr for Addis Ababa – Akaki Section and 120Km/hr for the Akaki – Modjo and Modjo – Adama sections would be constructed.

For the purpose of this study, for multi lane rural road with a design speed of 120Km/hr, a road capacity of 700 vehicles/hour/lane is considered with a vehicle of passenger car equivalence 1.0. In the same way for semi-urban road section a road capacity of 600 vehicles/hour/lane is considered.

The other factor which influences determining the number of lanes is that the road should freely accommodate the traffic for peak hours. Accordingly the hours of a day for weekdays is divided into four periods based on the traffic flow as indicated in the following Table 6-18. The proportion of traffic volume in these periods is also indicated based on traffic data collected from ERA showing the hourly traffic volume.

Table 6-18: Proportion of Traffic Volume in Hours of Weekday

No.	Period	Proportion of Traffic Volume	
		Addis-Akaki Section	Akaki-Adama Section
1	Morning peak: 07:00 AM – 10:00 AM	30%	25%
2	Daytime interpeak: 10:00 AM – 4:00 PM	30%	35%
3	Afternoon peak: 4:00 PM – 7:00 PM	30%	25%
4	Evening/nighttime: 7:00 PM – 7:00 AM	10%	15%

The above hourly road capacity is based on a car. To determine the other vehicle's rate of congestion, a value reflecting the contribution to congestion, Passenger Car Equivalent (PCE), as set by the World Bank's HDM-IV is taken to calculate the equivalent traffic amount of the road sections, as indicated in the following Table 6-19.

Table 6-19: Equivalent Diverted Traffic Volume

No.	Vehicle Type	PCE	Addis Ababa – Akaki Section		Akaki – Modjo Section		Modjo –Adama Section	
			Diverted Traffic	Equivalent Traffic	Diverted Traffic	Equivalent Traffic	Diverted Traffic	Equivalent Traffic
1	Car	1.0	2,088	2,088	869	869	671	671
2	Station Wagon	1.1	2,492	2,741	990	1,089	772	849
3	Small Bus	1.1	2,762	3,038	1,073	1,180	954	1,049
4	Large Bus	1.8	2,114	3,805	1,140	2,052	804	1,447
5	Small Truck	1.3	2,278	2,961	1,012	1,316	761	989
6	Medium Truck	1.5	2,815	4,223	1,160	1,740	946	1,419
7	Heavy Truck	1.6	3,209	5,134	1,428	2,285	1,149	1,838
8	Truck Trailer	2.2	3,639	8,006	1,775	3,905	1,495	3,289
	Total		**21,397**	**31,996**	**9,447**	**14,436**	**7,552**	**11,551**

The number of lanes is then calculated based on the equivalent traffic volume which would accommodate the traffic in peak hours as shown in Table 6-20 below.

Table 6-20: Required No. of Lanes for Addis Ababa – Akaki Section

Description	Morning Peak	Day Interpeak	Afternoon Peak	Evening/ Nighttime
Period	07:00AM-10:00AM	10:00 AM–4:00 PM	4:00 PM–7:00 PM	7:00 PM–7:00 AM
No. of Hours	3 Hrs	6 Hrs	3 Hrs	12 Hrs
Proportion of traffic Volume	30%	30%	30%	10%
Equivalent Traffic Volume (Total traffic=31,996)	9,599	9,599	9,599	3,200
Equivalent Traffic Volume per Hour	3,200	1,600	3,200	267
Required No. of Lane (600 veh/hr/lane)	5.33	2.67	5.33	0.45

As indicated in the above Table 6-20, at peak hours in the morning and afternoon, just more than 5 (five) lanes are required to accommodate the estimated traffic volume. Hence, **6 (six) lanes**, three lanes in each direction separated by median is considered for Addis Ababa – Akaki Section Inter-Urban road.

Table 6-21: Required No. of Lanes for Akaki – Modjo Section

Description	Morning Peak	Day Interpeak	Afternoon Peak	Evening/ Nighttime
Period	07:00AM-10:00AM	10:00 AM–4:00 PM	4:00 PM–7:00 PM	7:00 PM–7:00 AM
No. of Hours	3 Hrs	6 Hrs	3 Hrs	12 Hrs
Proportion of traffic Volume	25%	35%	25%	15%
Equivalent Traffic Volume (Total traffic=14,436)	3,609	5,053	3,609	2,165
Equivalent Traffic Volume per Hour	1,203	842	1,203	180
Required No. of Lane (700 veh/hr/lane)	1.72	1.2	1.72	0.26

Table 6-22: Required No. of Lanes for Modjo – Adama Section

Description	Morning Peak	Day Interpeak	Afternoon Peak	Evening/ Nighttime
Period	07:00AM-10:00AM	10:00 AM–4:00 PM	4:00 PM–7:00 PM	7:00 PM–7:00 AM
No. of Hours	3 Hrs	6 Hrs	3 Hrs	12 Hrs
Proportion of traffic Volume	25%	35%	25%	15%
Equivalent Traffic Volume (Total traffic=11,551)	2,888	4,043	2,888	1,733
Equivalent Traffic Volume per Hour	963	674	963	144
Required No. of Lane (700 veh/hr/lane)	1.61	1.12	1.61	0.24

As indicated in the above tables, Table 6-21 and

Table 6-22, at peak hours in the morning and afternoon, about two (2) lanes are required to accommodate the estimated traffic volume. However, 4 (four) lanes, two lanes in each direction separated by median is considered for Akaki – Modjo and Modjo – Adama Sections road.

6.5.3 The Cost of Construction

The cost of construction depends on many factors among which the type of terrain, the type of subgrade soil extension, number of drainage structures, availability of construction material, and the type of pavement are the major factors. For the purpose of this study the current construction costs for similar projects implemented by the Ethiopian Roads Authority and Addis Ababa City Roads Authority are taken into consideration to estimate the construction cost of Addis Ababa – Adama Toll road.

Accordingly, the average construction cost of paved road with Asphalt concrete (AC) pavement per lane is about ETB 6.0 million per Km for pavement thickness of 25 Cm and about ETB 5.5 mil per Km. Other costs related to initial investment are Land acquisition costs, compensation costs for the removal of properties within the right of way, costs for the construction of junctions and toll plazas, the installment of toll collection machines and utilities and other road related features.

Concerning the land acquisition cost, currently the road agencies are not paying for acquiring a land for road service – they get the land free of charge; they only pay a compensation for properties on the right of way. However, it is expected that the Land Acquisitions Law will include some payment terms which helps for implementing the resettlement of those displaced or affected by the project. For the purpose of this study ETB 2.00 per sq. m is considered for semi urban section (Addis Ababa – Akaki Section) and ETB 1.50 per sq. m is considered for rural section (Akaki – Modjo and Modjo – Adama Sections). It is estimated that right of way width of 100 meters is required for all sections, which makes the land acquisition cost to be ETB 2 million per Km for Addis Ababa – Akaki Section and ETB 1.5 million per Km for Akaki – Modjo and Modjo – Adama Sections.

The compensation costs for the removal of properties within the ROW is estimated to be ETB 4 million per Km for Addis Ababa – Akaki Section based on the data found from the AACRA for similar area. Similarly ETB 1 million per Km is estimated for Akaki – Modjo and Modjo – Adama Sections based on the data found from ERA for projects of similar nature.

It is considered that toll plazas are required at 5 locations, and ETB 20 million per station is assumed to calculate the cost of construction of toll plazas.

Hence, the total construction cost and other related investment is calculated as indicated in the following Table 6-23.

Table 6-23: Estimation of Cost of Construction and Related Services

No.	Road Section	Addis – Akaki	Akaki – Modjo	Modjo –Adama	Total
1	Length of Road [Km]	13	50	17	80
2	No. of Lanes	6	4	4	-
3	Pavement thickness	25 cm	20 cm	20 cm	-
4	Construction cost per lane per Km	ETB 6.0 mil	ETB 5.5 mil	ETB 5.5 mil	-
5	Total Construction cost	ETB 468.0 mil	ETB 1,100.0 mil	ETB 374.0 mil	ETB 1,942.0 mil
6	Land Acquisition Cost per Km	ETB 2.0 mil	ETB 1.5 mil	ETB 1.5 mil	-
7	Total Land Acquisition Cost	ETB 26.0 mil	ETB 75.0 mil	ETB 25.5 mil	ETB 126.5 mil
8	Compensation for property removal cost per Km	ETB 4.0 mil	ETB 1.0 mil	ETB 1.0 mil	-
9	Total Cost for Compensation	ETB 52.0 mil	ETB 50.0 mil	ETB 17.0 mil	ETB 119.0 mil
10	No. of Junctions or Toll Collection Plazas	2 plazas at Kaliti & Akaki	1 plaza at Bishoftu	2 plazas at Modjo & Adama	
11	Cost for construction of junction and installation of toll collection machines per station	ETB 20.0 mil	ETB 20.0 mil	ETB 20.0 mil	-
12	Total Cost for construction of junction and installation of toll collection machines	ETB 40.0 mil	ETB 20.0 mil	ETB 40.0 mil	ETB 100.0 mil
	Total Cost for construction and related services	**ETB 586.0 mil**	**ETB 1,245.0 mil**	**ETB 456.0 mil**	**ETB 2,287.0 mil**

6.5.4 Maintenance, Operation and Expansion Costs

Once construction of the road and other facilities is completed, the road will start operation. During its operation period there are different costs all over the operation period till the end of concession period. The following assumptions are made to estimate these costs.

- Routine maintenance will be made every year for the whole road length and other facilities. Annual cost of ETB 100,000.00 per Km is considered for Routine maintenance, which will be increasing yearly at an estimated escalation rate of 5%.
- Periodic maintenance will be made every five year for the whole road length and other facilities. ETB 500,000.00 per Km is considered for Periodic maintenance cost every five-year, which will be increasing yearly at an estimated escalation rate of 5%. During the year Periodic Maintenance will be made, routine maintenance will not be required.
- Annual cost of ETB 5 mil is estimated for management and toll collection expenses, which will be increasing yearly at an estimated escalation rate of 5%.
- Rehabilitation or upgrading/expansion is required every 20 years at an estimated cost of ETB 2.0 mil per Km. During the year Rehabilitation will be made, Periodic Maintenance and routine maintenance will not be required.

6.5.5 Total Costs

The total project costs include the total construction cost at the start of the project and the maintenance and operation costs which would incur all over the contract or concession period. The summary of expenses for the first 30 years is shown below in Table 6-24.

Table 6-24: Summary of Total Costs for Addis Ababa – Adama Toll Road

Year	Yearly Routine Mainten. Cost	Yearly Routine Mainten. Cost	Periodic Mainten. Cost	Rehabilitation Cost	Yearly Operation Cost	Total Yearly Expenses
0	2,287,000,000	-	-	-		2,287,000,000.00
1	-	8,000,000.00	-	-	5,000,000.00	13,000,000.00
2	-	8,400,000.00	-	-	5,250,000.00	13,650,000.00
3	-	8,820,000.00	-	-	5,512,500.00	14,332,500.00
4	-	9,261,000.00	-	-	5,788,125.00	15,049,125.00
5	-	-	40,000,000.00	-	6,077,531.25	46,077,531.25
6	-	10,210,252.50	-	-	6,381,407.81	16,591,660.31
7	-	10,720,765.13	-	-	6,700,478.20	17,421,243.33
8	-	11,256,803.38	-	-	7,035,502.11	18,292,305.49
9	-	11,819,643.55	-	-	7,387,277.22	19,206,920.77
10	-	-	51,051,262.50	-	7,756,641.08	58,807,903.58
11	-	13,031,157.01	-	-	8,144,473.13	21,175,630.15
12	-	13,682,714.86	-	-	8,551,696.79	22,234,411.66
13	-	14,366,850.61	-	-	8,979,281.63	23,346,132.24
14	-	15,085,193.14	-	-	9,428,245.71	24,513,438.85
15	-	-	65,155,785.07	-	9,899,658.00	75,055,443.07
16	-	16,631,425.44	-	-	10,394,640.90	27,026,066.33
17	-	17,462,996.71	-	-	10,914,372.94	28,377,369.65
18	-	18,336,146.54	-	-	11,460,091.59	29,796,238.13
19	-	19,252,953.87	-	-	12,033,096.17	31,286,050.04
20	-	-	-	160,000,000.00	12,634,750.98	172,634,750.98
21	-	21,226,381.64	-	-	13,266,488.53	34,492,870.17
22	-	22,287,700.72	-	-	13,929,812.95	36,217,513.68
23	-	23,402,085.76	-	-	14,626,303.60	38,028,389.36
24	-	24,572,190.05	-	-	15,357,618.78	39,929,808.83
25	-	-	83,157,127.18	-	16,125,499.72	99,282,626.90
26	-	27,090,839.53	-	-	16,931,774.70	44,022,614.23
27	-	28,445,381.50	-	-	17,778,363.44	46,223,744.94
28	-	29,867,650.58	-	-	18,667,281.61	48,534,932.19
29	-	31,361,033.11	-	-	19,600,645.69	50,961,678.80
30	-	-	106,131,908.21	-	20,580,677.98	126,712,586.18

6.5.6 Determination of Toll Rate

The viability or profitability of toll road projects will depend heavily on the volume of traffic and the setting of tolls. While determining the toll rate, different factors are considered including the recovery of investment within in a limited concession period, interest payback and a profit margin on one hand, and the fairness of the toll amount so that the road users will prefer it to the existing toll-free road, the ability to pay and the willingness to pay.

One of the reasons that the road users would prefer the toll road to toll-free road is that they would compare the amount they pay for using the toll road and the saving in time and vehicle operating costs.

When setting the toll rate different factors would be taken into consideration. Among them it would first recoup the initial expenditure of construction and the annual expenses in relation to the maintenance and operation costs, and the financial costs like interest. The revenue will mainly depend on toll level and actual traffic volume. If the toll level is unaffordable by the prospective road users, the traffic would definitely decrease as the road users will find another alternative or even avoid or minimize their business in the project area. The period of toll collection or concession period will also influence the recoupment of total costs. In addition the savings from using the new toll road over the existing toll-free road will be also taken into account, as the users will consider this savings in deciding whether using the road or not.

The annual traffic volume growth rate of 5% is considered in the analysis, and the toll level is also increasing with the same inflation rate of 5% annually. In actual case the growth rate of traffic volume is 15% for Akaki – Modjo Section and Modjo – Adama Section for the existing toll-free road.

The revenue is considered for Addis Ababa – Adama road and the traffic that will use only Section 1 and Section 2 are not considered in the analysis. It is of course believed that significant traffic will use these sections specially between Addis Ababa and Modjo.

To estimate a reasonable initial toll level, it is logical to know the savings a road user gets from using the toll road. As indicated in Table 6-8 above, a Car user saves ETB 30.00 from saving in Travel Time, and saves ETB 28.13 from savings in VOC from Table 6-11. A Car road user benefits **ETB 58.13** from decreasing the Travel Time and saving from the VOC, which of course there is additional benefit from accident costs though it is not simple to estimate the value for individual road user.

If a toll level of ETB 50.00 is set for Car, the user still prefers the toll road as he/she saves ETB 8.13 from reduction of travel time and saving in VOC, and reduces the risk of accident. Hence, an initial toll rate of **ETB 50.00** is considered in the economic analysis.

6.6 Different Toll Rates

As indicated above in the analysis eight categories of vehicles are considered. There should be of course different toll rates for different vehicles based on the equivalent standard axel (ESA) load and the passenger car equivalent (PCE) units of the vehicle. However, as the category of the vehicles is much, it would not be simple for administering the collection of tolls. Hence, it is required to minimize the category to a maximum of three or four. It is proposed here four categories as shown in the following Table 6-25.

Table 6-25: Categories of Vehicles for Toll Rate

No.	Category	Type of Vehicles	PCE	Toll Rate
1	Category 1	Car, Station Wagon, Mini bus	1.0	ETB 50.00
2	Category 2	Small truck and Medium truck	1.4	ETB 70.00
3	Category 3	Heavy truck and Large Bus	1.8	ETB 90.00
4	Category 4	Truck trailer	2.2	ETB 110.00

6.7 Determination of NPV and IRR

The NPV and IRR is calculated using spreadsheet, and for a toll level of ETB 50.00 for car. As shown in Table 6-19 above the diverted traffic in the first year of the project is 7,552. Using different toll rates indicated in Table 6-25 above for different categories of vehicles, the equivalent traffic volume is calculated based on a PCE unit of 1.0 for Car. The total equivalent traffic at the first year is indicated in the following Table 6-26.

Table 6-26: Equivalent Initial Traffic for Modjo – Adama Section

No.	Vehicle Type	PCE	Diverted Traffic	Equivalent Traffic
1	Car	1	671	671
2	Station Wagon	1	772	772
3	Small Bus	1	954	954
4	Large Bus	1.8	804	1,447
5	Small Truck	1.4	761	1,065
6	Medium Truck	1.4	946	1,324

No.	Vehicle Type	PCE	Diverted Traffic	Equivalent Traffic
7	Heavy Truck	1.8	1,149	2,068
8	Truck Trailer	2.2	1,495	3,289
Total			**7,552**	**11,590**

Using the initial equivalent traffic of 11,590 and initial toll rate of ETB 50.00, a concession period of 15 years will make the project feasible at IRR of 12%. A 20-years Concession Period is recommended and the spreadsheet which analyses the cost benefit with a toll rate of ETB 50.00 for car showing the IRR = 15.56% and NPV of ETB 791,236,481.01 as tabulated below in Table 6-27.

6.8 Sensitivity Analysis

Sensitivity Analysis is undertaken on the base case result of the economic evaluation to determine the effect of changes in some important parameters of analysis. If a worst case scenario of simultaneous 10.0% increase in capital investment and annual recurrent costs and 10.0% decrease in traffic is considered, the project still remains viable with an IRR of 12.94%, and NPV of ETB 217,206,912.15. The spreadsheet indicating this sensitivity analysis is shown in Table 6-28 below.

At 20% increase of construction and maintenance costs and 20% decrease in traffic volume indicates that the NPV is positive and the IRR is 12.2% after 24 years. The spreadsheet indicating this analysis is shown in Table 6-29 below.

Table 6-27: Determination of NPV and IRR (Initial toll level = ETB 50.00 for car)

Year	Total Yearly Expenses	AADT	Tariff	Daily Income	Yearly Income	Yearly Cash Balance	NPV for __ year at 12%		IRR for __ years at 12% interest rate
		Annual Growth							
0	-2,287,000,000.00	5.0%	5.0%	--	--	-2,287,000,000.00	0 years =	-2,287,000,000.00	
1	-13,000,000.00	11,590	50.00	579,500.00	211,517,500.00	198,517,500.00	1 years =	-2,109,752,232.14	
2	-13,650,000.00	12,170	52.50	638,925.00	233,207,625.00	219,557,625.00	2 years =	-1,934,722,237.72	
3	-14,332,500.00	12,779	55.13	704,442.38	257,121,466.88	242,788,966.88	3 years =	-1,761,909,846.71	
4	-15,049,125.00	13,418	57.88	776,650.61	283,477,473.56	268,428,348.56	4 years =	-1,591,318,778.45	
5	-46,077,531.25	14,089	60.78	856,263.38	312,536,132.90	266,458,601.65	5 years =	-1,440,123,011.93	
6	-16,591,660.31	14,793	63.81	944,001.66	344,560,605.06	327,968,944.75	6 years =	-1,273,963,737.74	
7	-17,421,243.33	15,533	67.00	1,040,785.28	379,886,626.94	362,465,383.61	7 years =	-1,110,002,805.88	-4.22%
8	-18,292,305.49	16,310	70.36	1,147,490.39	418,833,994.06	400,541,688.56	8 years =	-948,230,735.76	0.00%
9	-19,206,920.77	17,126	73.87	1,265,145.10	461,777,960.23	442,571,039.46	9 years =	-788,635,182.17	3.23%
10	-58,807,903.58	17,982	77.57	1,394,799.20	509,101,707.63	450,293,804.05	10 years =	-643,652,628.66	5.58%
11	-21,175,630.15	18,881	81.44	1,537,757.97	561,281,659.93	540,106,029.78	11 years =	-488,385,051.42	7.64%
12	-22,234,411.66	19,825	85.52	1,695,373.89	618,811,469.39	596,577,057.73	12 years =	-335,258,579.68	9.29%
13	-23,346,132.24	20,816	89.79	1,869,127.26	682,231,451.41	658,885,319.17	13 years =	-184,259,070.27	10.64%
14	-24,513,438.85	21,857	94.28	2,060,731.67	752,167,057.79	727,653,618.94	14 years =	-35,366,723.11	11.76%
15	-75,055,443.07	22,950	99.00	2,271,971.51	829,269,601.28	754,214,158.21	15 years =	102,425,383.79	12.64%
16	-27,026,066.33	24,098	103.95	2,504,900.56	914,288,705.63	887,262,639.30	16 years =	247,157,140.00	13.43%
17	-28,377,369.65	25,303	109.14	2,761,663.79	1,008,007,281.70	979,629,912.06	17 years =	389,834,692.90	14.11%
18	-29,796,238.13	26,568	114.60	3,044,717.13	1,111,321,753.68	1,081,525,515.55	18 years =	530,475,827.64	14.68%
19	-31,286,050.04	27,896	120.33	3,356,752.51	1,225,214,665.11	1,193,928,615.07	19 years =	669,099,030.98	15.17%
20	-172,634,750.98	29,291	126.35	3,700,844.91	1,350,808,391.65	1,178,173,640.68	20 years =	791,236,481.01	15.56%

Table 6-28: Determination of NPV and IRR (Sensitivity Analysis — 10% increase in cost and 10% decrease in traffic volume)

Year	Total Yearly Expenses	AADT	Tariff	Daily Income	Yearly Income	Yearly Cash Balance	NPV for __ year at 12%		IRR for __ years at 12% interest rate
		Annual Growth							
0	-2,515,700,000.00	5.0%	5.0%		0.00	-2,515,700,000.00	0 years =	-2,515,700,000.00	
1	-14,300,000.00	10,431	50.00	521,550.00	190,365,750.00	176,065,750.00	1 years =	-2,358,498,437.50	
2	-15,015,000.00	10,953	52.50	575,032.50	209,886,862.50	194,871,862.50	2 years =	-2,203,147,781.81	
3	-15,765,750.00	11,501	55.13	633,992.63	231,407,308.13	215,641,558.13	3 years =	-2,049,658,380.13	
4	-16,554,037.50	12,076	57.88	698,973.98	255,125,500.88	238,571,463.38	4 years =	-1,898,041,902.16	
5	-50,685,284.38	12,680	60.78	770,630.96	281,280,301.31	230,595,016.94	5 years =	-1,767,196,096.76	
6	-18,250,826.34	13,314	63.81	849,620.64	310,111,532.20	291,860,705.85	6 years =	-1,619,330,380.12	
7	-19,163,367.66	13,980	67.00	936,726.85	341,905,301.27	322,741,933.61	7 years =	-1,473,338,319.70	-8.58%
8	-20,121,536.04	14,679	70.36	1,032,741.36	376,950,594.65	356,829,058.61	8 years =	-1,329,221,047.67	-4.12%
9	-21,127,612.85	15,413	73.87	1,138,601.04	415,589,378.78	394,461,765.93	9 years =	-1,186,974,180.40	-0.67%
10	-64,688,693.94	16,184	77.57	1,255,334.79	458,197,199.21	393,508,505.28	10 years =	-1,060,274,973.33	1.83%
11	-23,293,193.16	16,993	81.44	1,383,990.32	505,156,466.67	481,863,273.51	11 years =	-921,750,796.76	4.07%
12	-24,457,852.82	17,843	85.52	1,525,879.26	556,945,929.30	532,488,076.47	12 years =	-785,074,370.23	5.89%
13	-25,680,745.46	18,735	89.79	1,682,268.41	614,027,970.89	588,347,225.43	13 years =	-650,240,371.33	7.39%
14	-26,964,782.74	19,672	94.28	1,854,724.50	676,974,441.18	650,009,658.45	14 years =	-517,235,516.82	8.63%
15	-82,560,987.38	20,656	99.00	2,044,873.36	746,378,774.90	663,817,787.53	15 years =	-395,958,488.88	9.61%
16	-29,728,672.97	21,689	103.95	2,254,493.66	822,890,187.42	793,161,514.45	16 years =	-266,576,664.53	10.51%
17	-31,215,106.61	22,773	109.14	2,485,530.15	907,218,504.77	876,003,398.16	17 years =	-138,991,726.95	11.28%
18	-32,775,861.94	23,912	114.60	2,740,337.10	1,000,223,041.78	967,447,179.83	18 years =	-13,185,292.23	11.94%
19	-34,414,655.04	25,108	120.33	3,021,269.79	1,102,763,471.88	1,068,348,816.84	19 years =	110,857,245.49	12.51%
20	-189,898,226.07	26,363	126.35	3,330,899.40	1,215,778,281.01	1,025,880,054.94	20 years =	217,206,912.15	12.94%

Table 6-29: Determination of NPV and IRR (Sensitivity Analysis — 20% increase in cost and 20% decrease in traffic volume)

Year	Total Yearly Expenses	AADT	Tariff	Daily Income	Yearly Income	Yearly Cash Balance	NPV for __ year		IRR for __ years at 12% interest rate
		Annual Growth					at	12%	
0	-2,744,400,000.00	5.0%	5.0%		0.00	-2,744,400,000.00	0 years =	-2,744,400,000.00	
1	-15,600,000.00	9,272	50.00	463,600.00	169,214,000.00	153,614,000.00	1 years =	-2,607,244,642.86	
2	-16,380,000.00	9,736	52.50	511,140.00	186,566,100.00	170,186,100.00	2 years =	-2,471,573,325.89	
3	-17,199,000.00	10,223	55.13	563,542.88	205,693,149.38	188,494,149.38	3 years =	-2,337,406,913.54	
4	-18,058,950.00	10,734	57.88	621,297.34	226,773,528.19	208,714,578.19	4 years =	-2,204,765,025.87	
5	-55,293,037.50	11,271	60.78	684,998.55	250,024,469.72	194,731,432.22	5 years =	-2,094,269,181.58	
6	-19,909,992.38	11,835	63.81	755,239.61	275,662,459.33	255,752,466.96	6 years =	-1,964,697,022.50	
7	-20,905,491.99	12,427	67.00	832,668.43	303,923,975.60	283,018,483.61	7 years =	-1,836,673,833.51	-12.75%
8	-21,950,766.59	13,048	70.36	917,992.32	335,067,195.25	313,116,428.65	8 years =	-1,710,211,359.58	-8.05%
9	-23,048,304.92	13,700	73.87	1,012,056.98	369,400,797.33	346,352,492.41	9 years =	-1,585,313,178.64	-4.38%
10	-70,569,484.30	14,385	77.57	1,115,792.82	407,264,379.06	336,694,894.76	10 years =	-1,476,906,433.63	-1.77%
11	-25,410,756.18	15,104	81.44	1,230,141.22	449,001,546.08	423,590,789.90	11 years =	-1,355,134,203.61	0.67%
12	-26,681,293.99	15,859	85.52	1,356,213.59	495,017,961.82	468,336,667.83	12 years =	-1,234,923,845.87	2.65%
13	-28,015,358.69	16,652	89.79	1,495,229.98	545,758,941.62	517,743,582.94	13 years =	-1,116,270,379.55	4.30%
14	-29,416,126.62	17,485	94.28	1,648,528.76	601,712,998.38	572,296,871.76	14 years =	-999,167,100.89	5.67%
15	-90,066,531.68	18,359	99.00	1,817,478.21	663,379,547.27	573,313,015.59	15 years =	-894,424,956.41	6.73%
16	-32,431,279.60	19,277	103.95	2,003,774.93	731,377,847.89	698,946,568.29	16 years =	-780,411,630.65	7.74%
17	-34,052,843.58	20,241	109.14	2,209,178.23	806,350,052.92	772,297,209.34	17 years =	-667,930,912.59	8.61%
18	-35,755,485.76	21,253	114.60	2,435,613.27	888,998,841.88	853,243,356.12	18 years =	-556,975,496.29	9.36%

Year	Total Yearly Expenses	AADT	Tariff	Daily Income	Yearly Income	Yearly Cash Balance	NPV for __ year at 12%		IRR for __ years at 12% interest rate
		Annual Growth							
19	-37,543,260.05	22,316	120.33	2,685,305.74	980,136,595.45	942,593,335.40	19 years =	-447,534,022.20	10.01%
20	-207,161,701.17	23,432	126.35	2,960,574.85	1,080,609,819.85	873,448,118.68	20 years =	-356,986,481.27	10.49%
21	-41,391,444.20	24,604	132.66	3,264,086.84	1,191,391,695.46	1,150,000,251.26	21 years =	-250,542,904.59	11.00%
22	-43,461,016.41	25,834	139.30	3,598,627.88	1,313,499,175.48	1,270,038,159.07	22 years =	-145,583,762.78	11.45%
23	-45,634,067.23	27,126	146.26	3,967,531.11	1,448,148,856.77	1,402,514,789.54	23 years =	-42,095,063.57	11.85%
24	-47,915,770.59	28,482	153.58	4,374,156.98	1,596,567,297.99	1,548,651,527.40	24 years =	59,933,356.40	12.20%
25	-119,139,152.27	29,906	161.25	4,822,491.95	1,760,209,560.23	1,641,070,407.96	25 years =	156,466,544.08	12.51%

6.9 Financial and Partnering Considerations

6.9.1 Revenue from Fuel Levy

It is discussed above that the Road Fund Administration Office is collecting fuel levy to fund for routine and periodic maintenance of roads. The road fund levy and municipality taxes collected by the Road Fund Administration Office need to be estimated for the amount of fuel used on this road and be reimbursed to the toll road operator.

As indicated in Table 4-1: Build up of Fuel Prices (2007/08) above, about 12.34% of the fuel price would go to the road fund to finance the maintenance of roads. In this case a car user expends about ETB 0.90 per Km for fuel which is about ETB 72.00 for the 80Km between Addis Ababa and Adama. Hence, ETB 8.88 (12.34% of ETB 72.00) goes to the Road Fund, and therefore this amount needs to be reimbursed to the toll road users. From the interview made with the Road Fund Administration, it has been confirmed that the RFA would reimburse the fuel levy collected from the fuel consumed by the toll road users. This means such amount will be reimbursed to the toll road operators based on the actual traffic volume, and the same amount shall be reduced from the toll.

Hence, the initial toll amount for a car becomes **ETB 41.12**, and the above economic analysis remains the same.

6.9.2 Non-Toll Revenue Generation

Other toll authorities have programs of non-toll revenue. These range from right-of-way lease agreements. Each of these efforts helps to financially support the facility. The key is to be open to business opportunities. This requires a new way of thinking but can also foster new relationships between unlikely partners. These concessions may include:

- food,
- fuel,
- vending,
- leases,
- retail,
- ATM,

- games,
- telephones,
- sundries, and
- amusement tickets.

Other types of revenue may include transponder sales, parking, and advertisements or billboards.

Each of the funding methods described above can be used in tandem with one another to complete a financing package that may make the project more viable. Each of these methods is innovative and has been used successfully for project financing. The methods are not mainstream transportation funding at this point, but the trend is moving toward combining financing strategies and taking advantage of every available resource.

6.10 Impact Analysis

The economic analysis made for Addis Ababa – Adama road shows that a toll road can be implemented. The sensitivity analysis for roads which provide better road condition and reducing transportation costs. However, it is observed that the new toll road must attract a reasonable volume of traffic to return its initial investment and operation costs.

In line with this the impact analysis has been done to assure the required traffic volume will be maintained in the following three areas:

- Public Opinion – Willingness vs. ability to Pay;
- Current public transport system;
- Experience of other Developing Countries.

6.10.1 Public Opinion – Willingness to Pay

From the public opinion survey it has been observed that the public is generally against tolling of the road. About 85% of the respondents are against the toll road and only 5% have positive attitude to toll. It can be concluded that the general public is against toll road and may avoid using the toll road if implemented with this situation. The public may not easily understand the benefit of toll road especially by comparing with the value of travel time savings. Effective public relations works need to be done to aware the public the real benefit of the new system.

In the absence of such effort, the public may avoid using the toll road particularly at the initial stages and in the presence of other alternative toll-free road even if it costs them higher than the toll road. One of the problems in such public acceptance effort is the absence of research based data that indicates the cost of delay in travel time either at national level or for any specific road network. If such facts were available, the costs and benefits of each alternative would be easily demonstrated to be perceived by the public.

It can also be observed from the driver's view survey that they have not fully accepted the tolling of the road. Only 30% of the car and station wagon drivers responded positively to the new system, and on average 42% of the drivers showed their acceptance to the toll road. This is mainly because of unawareness of the real benefits of using the toll road in respect with savings in Vehicle Operating Costs (VOC), savings in travel time and reducing the accident costs. This benefit could not be also easily demonstrated as there is no research based data showing the difference in VOC for different road conditions.

The willingness to pay is also largely a function of the potential user's wealth, ability to pay. Most of the public transport users (80%) expressed that the existing transport fee is unaffordable and any form of increment would worsen the situation.

In general, though the economic analysis shows the implementation of toll road for Addis Ababa – Adama road is viable, the survey from public opinion and the driver's interview indicated that the willingness to pay is very minimum. The ability to pay particularly in the case of public transport users is also low. The implementation of the system may face a problem of less than forecasted traffic especially at early stage.

6.10.2 Current Practice of Public Transportation

Currently two forms of public transportation are in use. The first one is the use of large buses which usually charge ETB 15.00 between Addis Ababa and Adama (March 2009). They are categorized as the 'legal' transport service provider. It usually takes 10 to 15 minutes to get full of all seats — about 45 passengers — and most people are using it.

The whole journey, including waiting till the bus is full of its capacity, would take on average about two hours during uncongested hours.

The second category is the use of small buses. They usually call for passengers outside the bus station and collect the seat capacity— about 10 passengers — within not more than 5 minutes. They are considered as illegal because they don't be in the queue waiting for their turn. They usually charge ETB 17.00 between Addis Ababa and Adama (March 2009). The whole journey would take about 75 minutes. The extra ETB 2.00 charge is considered as a value for travel time saving of about 45 minutes.

It can be observed from such practice that some parts of the public are already paying for better service, shorter travel time. If we consider the average traffic volume of the last five years as indicated in Table 6-3: Traffic Volume of Modjo – Adama Section, to estimate the total passengers using small bus and large bus with their seat capacity, about 30% of the passengers are using small buses (mini-buses) by paying extra transport fee.

We can assure here that, if improved road will be constructed through tolling, 30% of the passengers will use it to benefit only savings in travel time. The 10 passengers in the mini bus users pay ETB 20.00 for the total savings in travel time, which covers about 40% of the recommended toll. If the extra payment would be reduced by 50% (i.e. ETB 1.00 per person or ETB 10.00 per vehicle) and the remaining 50% is covered by the vehicle operator for the minimum benefit from saving of vehicle operating costs, the road users will be definitely increased by 100%. This increases the toll road users to 60% and will increase the total revenue.

6.10.3 Shadow Tolls

One way in which toll road implemented is that a private sector or a public and private partnership constructs a toll road, and the Government shall pay the whole amount or part of the toll as a shadow toll based on the actual traffic. In this case the traffic volume will be much higher than estimated above as the toll road users will pay no toll or minimum toll.

Normally the shadow toll has a minimum guaranteed payment and there is a maximum traffic level over which no additional payments are made. Hence, the concessionaire and the Government can agree on the basis of shadow toll based on a minimum agreed traffic volume for a fixed period of time.

As indicated above in the case of public transport, if the passengers pay ETB 1.00 extra fee per person for using the toll (i.e. ETB 10.00 per vehicle) and the owner of the vehicle operator pays ETB 10.00 for the minimum benefit from saving of VOC, ETB 20.00 or 40% of the recommended toll rate can be collected as a toll. The other 18% or ETB 8.88 can be reimbursed by the RFA from the collected fuel levy. If the remaining 42% is covered by the Government as shadow toll from the general taxation, it will be more feasible with higher revenue because of the increase of traffic volume than forecasted above.

6.10.4 Experience of Other Developing Countries

6.10.4.1 Kenyan Experience

The Kenyan Government has a programme to implementing the rehabilitation and upgrading of part of its National Highway through a financial assistance from the African Development Fund. The Appraisal Report by the African Development Fund indicates that the Government of Kenya has solicited assistance from the African Development Fund for the upgrading of a 45 km road from Nairobi – Thika which originates in downtown Nairobi and extends to Moyale at the Ethiopian border (African Development Fund, 2007).

According to the Report the road section currently operates beyond capacity, carrying more than 60,000 vehicles per day, and its condition has deteriorated requiring rehabilitation. It is planned to upgrade to a six/eight-lane dual carriageway highway with an estimated cost of USD 268.4 million. The proposed project is jointly financed by an ADF loan and grant, and the Government of Kenya, in which case the ADF loan and grant finances 70% of the project cost with the Government of Kenya covering the remaining 30%.

It is planned that the project will be operational by 2011 and the economic analysis considers service life of 20 years ending in 2030. The benefits include road user benefits in terms of Vehicle Operating Cost Savings, time savings for passengers and cargo, road maintenance savings as a result of the new facility. Accident cost savings are not quantified and valued due to incomplete documentation and therefore not taken into account in the estimation of project benefits.

The economic analysis is made using the World Bank's HDM IV model using the measures of investment worth on the basis of most likely traffic forecast scenario and resulted in an Economic Internal Rate of Return of 30.04% which is higher than the current opportunity cost of capital of 12.0% in Kenya.

Legislation for establishing different road sector agencies has been passed by parliament and signed into law by the President in September 2007. The legislation – referred to as Kenya Roads Act of 2007, gives the responsibility to the Roads Department of Ministry of Roads and Public Works (MORPW) for the implementation of the project which includes employing a Contractor and Consultant for the civil works.

The Government of Kenya has been exploring the potential for private sector participation (PSP) in the management, operation and financing of road infrastructure including tolls or shadow tolls in the form of BOT (build operate transfer) or MOT (maintain operate transfer). Given the importance of the Nairobi- Thika Highway and its geometric characteristics and the high level of traffic, there is considerable scope for post construction private sector participation such as MOT.

The project will finance the consultancy services to investigate the PSP option and the follow-up transaction advisory services. Accordingly, the Roads Department will also employ a Consultant who will study the Private Sector Participation (PSP) for the proper management, operation and maintenance of the project road either through concessioning or long term maintenance contracts to ensure efficient service delivery. The consultant will be responsible for preparing the necessary bidding and contractual documents and advising the government in the transaction process.

6.10.4.2 South African Experience

South Africa had passed enabling legislation that allowed the tolling of roads in 1983. The legislation enabled the National Transport Commission (NTC), which was responsible for national roads in South Africa, to procure loans from the money and capital markets and to service the debt through toll revenue, after allowing for the cost of maintenance and operations, to fund road infrastructure. A soft loan was made through the national budget to toll roads to enable toll rates to be kept at a level acceptable to the public. A number of criteria had to be met before a road could be tolled:

- That toll financing conforms to the principle of user charging for the financing of arterial roads;
- The tariffs should reflect a percentage of the perceived benefit to ensure acceptance of the toll road by the public, and t hat tariffs be differentiated according to the vehicle class and type;
- That an alternative route should be provided;
- That government participation in toll financing is necessary for the co-ordination of the investment and for overall priority determination of the country's resources;

The first modern toll road in South Africa was the Tistsikamma Toll Road on N2 Route. The road was 27 Km in length with a bridge 272 m long, and opened in 1984. The finance for the project was obtained on the capital markets through a bond issue. The debt, which was state-guaranteed, was to be repaid from the toll revenues over a period of 20 years.

Although the objective of toll financing was to select projects with a reasonable self funding potential, the relative low traffic volumes, low possible toll tariffs and high initial capital expenditure meant that most state toll road projects could only generate revenues to cover up to 60 percent of the financing required. This required that size of the private sector loan could be procured should not be greater than the present value of the future net toll revenue.

Following the 1983 legislation, tariffs were based on a percentage of the 'perceived benefit' of using the toll road as opposed to the alternative route. For light vehicles, benefits were defined as the time and fuel saved when using the toll road instead of alternative road. For heavy vehicle, this benefit was defined as the value of variable cost savings (fuel, lubricants, maintenance and tyres) and time saving offered by the toll road. This resulted in tariffs being lower than those required to finance a toll road fully.

The South African National Roads Agency Ltd (SANRAL) was established in April 1998 by an Act of Parliament as an independent statutory company operating along commercial lines and at arm's length from Government. The purpose of the company, which is registered in terms of the Companies Act – with the Minister of Transport as the sole shareholder – is to maintain and develop South Africa's expanding national road network (currently 16,150 km) and to manage assets with an estimated value of more than USD 520 million (excluding land). Replacement value is more than USD 4 billion.

Since the advent of democracy in South Africa, Government has sought to realign its public expenditure and the financing of public services to redress the imbalances of the past. Recognizing the enormity of many demands on the fiscus and the advantage of constructive engagement with the private sector, SANRAL has proactively sought alternative sources of finance for road infrastructure and opportunities to reduce dependence on tax-based revenues. This would release additional money that could be used on non-toll roads or even other projects and services such as health, education and housing.

Toll tariffs are now based on the savings accrued to the motorist, including the perceived willingness of road user to pay. However, it took on average between 15 and 20 years before the combined effect of tariff inflation and traffic growth for roads generate more net revenue than the interest on outstanding debt (Evdorides & Robinson, 2009).

The average toll tariff in South Africa for the Expressway is South African Rand (ZAR) 1.00 per Km (1 USD ≈ 8 ZAR), which is about USD 0.12 per Km.

6.10.4.3 Lessons from Developing Countries

It can be learnt from the experience of developing countries that the implementation of toll road is a key factor to improve the road network and seek alternative source of finance from private sector. The involvement of government in identifying the priority to which section of the network to be tolled and in participating with the private sector is also crucial.

In general the following lessons are learnt from the experience of developing countries.

- The government should take the initiative in issuing the required legislation, making the study, financing part of the project costs (up to 30%) and securing a loan for the remaining amount, facilitating for the private sector to participate in financing and management of toll road. This is required especially in the greenfield project where the system has not been tested in other part of the country and unlikely attract the private sector.
- The revenue from the toll can hardly recover the full investment cost of the project, and could only cover about 60% of the costs in the case of South Africa. The remaining 40% was covered by the Government from the general taxes for the first 20 years of the implementation of the project.
- Alternative toll-free road is a mandatory particularly when first introducing the toll road system to minimize the public objection.

7 CONCLUSION AND RECOMMENDATION

7.1 Conclusion

The current management and financing system of roads in Ethiopia doesn't allow the private sector either to finance or administer the road infrastructure for commercial purpose. This is a bottleneck for the development of road network as the huge effort made in the past decade didn't alleviate the problem of road transport, which is a key for development of the country.

The case study made for Addis Ababa – Adama road indicated that implementation of toll road in Ethiopia is feasible. The economic analysis based on toll rate of ETB 50.00 between Addis Ababa and Adama for a car and 15 years project period resulted in an Internal Rate of Return of 12.64% which is higher than the current opportunity cost of capital of 12.0% used by the World Bank for such projects.

A sensitivity analysis is also made by considering a 10% increase in initial investment and annual operation and maintenance recurrent costs, and a decrease of traffic volume by 10%, and found that the NPV > 0 after 19 years at interest rate of 12%. In addition a sensitivity analysis which considers 20% in initial construction costs and annual operation and maintenance recurrent costs, and 20% decrease in traffic volume shows that the project is feasible after a concession period of 24 years.

However, the public is generally against tolling of the road and has no willingness to pay the toll. The drivers view has also indicated that they have not fully accepted the implementation of the system and may avoid the use of the toll road, especially at the initial stage.

The initial investment cost is too high and the return period is very long, which may not attract the private sector to participate in the business. In addition though most of the initial investment is expected on loan from foreign Banks, the concessionaire is expected to raise a minimum of 10% - 30% of the total cost which is about ETB 250 mil - 700 mil (African Development Fund, 2007). For such reason the Government should take the initiative in financing the toll road and facilitate to participate the private sector.

About 30% of the passengers using public transport are currently paying extra cost of about ETB 20.00 per small bus for the benefit of savings in travel time of up to 45 minutes. This shall cover for about 40% of the recommended toll rate. If the extra transport fee by the passengers is reduced by half and the owner of the vehicle pays the remaining ETB 10.00 for the benefit of savings from VOC, the traffic volume will be definitely increased by 100%. The reimbursement from fuel levy can also cover for about 18% (ETB 8.88) of the toll rate. If the remaining 42% is covered by the Government as shadow toll from the general taxation, it will be more feasible with higher revenue because of the increase of traffic volume than forecasted above.

The experience from other developing countries like Kenya shows that the implementation of toll road is feasible at Internal Rate of Return (IRR) of more than 30% for higher traffic volume, even without considering the accident costs. In addition in countries like South Africa, where tolling roads has been implemented for a long time, the toll collected from users was able to cover only up to 60% of the costs, and the remaining 40% was covered from the Government.

7.2 Recommendation

In general the following recommendations toward the implementation of toll road in Ethiopia are forwarded.

1. Institutional Reform and Legal Issues

Fundamental reforms are required to road agencies so that the administration and management of roads should be separated from operation. Appropriate laws and regulations should be drafted and issued which will bring the road operation to a pure business and facilitate the participation of the private sector in road financing, and administration. The Law must incorporate the land acquisition procedures, the bidding and contract negotiation procedures and other legal issues.

The Government should concentrate in the expansion of roads to rural areas where it is not practical to implement the tolling option due to very low traffic, till it will develop and generate more traffic. Hence, the author recommends further study to be carried out in detail covering the whole country to determine the level at which tolling can be implemented

2. Government Support

The Government should support in providing bonds for loans from foreign Banks. In addition as the toll road implementation involves huge loan in foreign currency, the Government should provide foreign exchange guarantee which protects the concessionaire from the risk of currency devaluation.

3. Public Private Participation

The toll road implementation requires big amount of fund raising, and the private sector may not involve in such new business. The Government needs to establish an independent public corporation which will involve the private sector for efficient implementation, whereby the public sector can raise more funds and the private sector contributes for efficient management. The experience from South Africa also shows that toll road implementation would be successful in Private public participation.

4. Toll-Free Road

There should be a toll-free road parallel to the toll road, as the general public may not easily accept the system and to avoid other political consequences. The existing toll-free road should be kept with acceptable condition to create competitive alternative.

5. Public Awareness

Both the Government and the Concessionaire will be expected to highly involve in public awareness to attract more traffic and increase the acceptance from the public. The Concessionaire is specifically required to show the advantages of using the toll road by demonstrating the benefits from the reduced travel time, savings in VOC and reduction of accident risks.

6. Setting and Adjusting Toll Amount

It has been indicated that ETB 50.00 for a car makes the project viable. However, as there is no or minimal willingness to pay it is recommended the toll should cover only 40% of the cost (ETB 20.00 for a car), while 20% shall be covered by the RFA from fuel levy reimbursement and the remaining 40% to be subsidized by the Government from the general Taxation. There should also be appropriate toll adjustment system based on the actual traffic volume and revised at a regular interval.

7. Exempting Non-road Users from Paying Fuel Levy

The fuel levy collected by the Road Fund Administration Office is including on diesel used by non-road users. In principle, non-road users should have not paid fuel levy. Among the alternatives discussed in Section 4.3.1 above, coloring the diesel to be used by non-road users and exempt the fuel levy and other related taxes is appropriate way to ensure they don't pay the fuel levy. This system is simple to administer as road users are easily identified if they use on roads, and the coloring doesn't have any environmental impact from the experience of some countries currently implementing it.

8. Tolling Implementation

The conceptual tolling implementation plan for Addis Ababa – Adama Toll Road consists of 5 (five) tolling locations — 1 at Addis Ababa plaza, 1 at Akaki, 1 at Bishoftu, 1 Modjo at and 1 at Adama. At each of the tolling plazas, two additional lanes will be provided. The inside lane is proposed as an ETC-only lane, and the other lane will be equipped with a kiosk where motorists can purchase tags or replenish their existing tags using cash, credit, or debit forms of payment. Kiosks and other forms of tag distribution may be located off-site.

9. Concession Period

As indicated above a concession period of 15 years with a starting toll rate of **ETB 50.00** for Car (Category 1 vehicles) becomes feasible. However, a concession period of **25 years** is recommended which makes the project viable at a worst case scenario of 20% increase in projects costs and a 20% decrease in traffic volume.

10. Further Studies

The Author recommends further studies to be carried out in the following areas.

- **Estimation of Savings in Travel Time**

  The actual value of travel time needs to be studied and the cost of delay due to traffic congestion at national level and for different road network should be studied. The outcome of the research should be recognized by the concerned public agency to be used as a reference in the valuation of travel time of different scenarios.

- **Estimation of Savings in Vehicle Operating Costs**

  The VOC for different types of roads and different conditions roads should be studied and an index which reflects the savings in VOC should be derived for reference.

- **Estimation of the Cost of Accident**

  The cost of accident and the risk of occurrence need to be studied and a standard must be developed to indicate the real benefit of toll road in reducing the accident costs over the existing road.

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APPENDICES

Appendix A. Questions to Stakeholders Interview

Perception about Addis Ababa – Adama Toll Road.

I just selected the concerned department in the stakeholder organizations and made thorough discussion with each stakeholders. For more detailed data and information, I was referred to experts and got full cooperation.

The content of the general questions is the following:

1. *How do you evaluate the current road administration and management system?*
2. *What are the main problems for poor road network?*
3. *What are the main problems for poor road condition?*
4. *Does the existing law and regulation of the country have any clause which allows a private sector to participate in road administration?*
5. *Is there any study concerning the time wasted by traffic congestion and the total economic loss of the country due to idle man power?*
6. *Is there any study estimating the accident cost of roads in Ethiopia?*
7. *Is the rate of expansion of road network and the rate of increase in vehicle fleet balance each other?*
8. *Is there any study which estimates the increase in vehicle operating cost (VOC) based on different road condition for the case in Ethiopia?*

Appendix B. Questions to Drivers Interview

Interview to Driver's to evaluate their perception about Addis Ababa – Adama Toll Road.

The method of recruitment was to approach the driver while they got out of the vehicle or they were in a stopping vehicle waiting for something so that they can have a time for interview. I first introduce myself showing the Support Letter written from Addis Ababa University, Department of Civil Engineering, and then explained the purpose of the 5 to 10-minute interview.

After I got permission or willingness from the driver, I directly interviewed by writing the answers step by step. The questions are conducted in Amharic and the English version is the following:

1. *How long have you been using the Addis Ababa – Adama road?*
2. *How often you use Addis Ababa – Adama road?*
3. *How long on average does it take you to drive between Addis Ababa and Adama?*
4. *How do you describe the traffic congestion of the road? Good, Fair or Worse?*
5. *How is the condition of the road? Good, Fair or Bad?*
6. *Do you think the existing number of lanes is sufficient to accommodate the existing traffic?*
7. *Do you think the existing number of lanes will be sufficient to accommodate the traffic after 5 or 10 years?*
8. *If the traffic is free, how long do you think it would take you to drive between Addis Ababa and Adama (in comparison with covering the same length of road between Adama and Methehara)?*
9. *Do you think the condition of the road and its geometrical features (curves and gradients) affect on the speed of your driving?*

10. *Do you think the condition of the road and its geometrical features (curves and gradients) increase your vehicle operating cost?*

11. *Do you know that you are paying for the maintenance of the road with some amount levied on fuel and oil prices?*

12. *Have you any awareness about toll roads?*

13. *If another road which has a very good condition, geometrical features, one way two or three lanes in both directions would be constructed for service with fee, do you think you prefer the new road and use it?*

14. *If the new toll road would shorten the current travel time by half and you want to use the road, how much do you think is the fair toll rate?*

Appendix C. Questions to Public Opinion Survey

The survey was conducted in Adama Bus Station by interviewing passengers who were waiting for transport bus to travel to Addis Ababa. The method of recruitment was to approach the person while they were waiting for the bus or they were in the bus waiting till it leaved the station. I first introduce myself showing the Support Letter written from Addis Ababa University, Department of Civil Engineering, and then explained the purpose of the 5-minute interview.

After I got permission and willingness from the person, I directly interviewed by writing the answers step by step. The questions are conducted in Amharic and the English version is the following:

1. *How long have you been using the Addis Ababa – Adama road?*
2. *How often you use Addis Ababa – Adama road?*
3. *How long on average does it take you to travel between Addis Ababa and Adama?*
4. *How do you describe the traffic congestion of the road? Good, Fair or Worse?*
5. *Have you ever disappointed by the delay due to traffic congestion or missed any scheduled business/task?*
6. *Have you any awareness about toll roads?*
7. *If another road which has a very good condition, geometrical features, one way two or three lanes in both directions would be constructed for service with fee and alternative transport system with higher rate would be provided on this road, do you think you prefer the new transport and use it?*
8. *If the new transport service on the toll road would shorten the current travel time by half and you want to use it, what percent increase on the current fee do you think is the fair price?*

STATEMENT OF THE AUTHOR

The author declares that this thesis work is his original work and that all sources of materials used for this thesis have been dully acknowledged. This thesis has been submitted in partial fulfillment of the requirements for M.Sc. Degree at the Addis Ababa University and is deposited at the University Library to be made available to borrowers under rules of the Library. The author declares that this thesis is not submitted to any other institution anywhere for the award of any academic degree, diploma or certificate.

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Date of submission: _______________, 2009