JIMMA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

JIMMA INSTITUTE OF TECHNOLOGY

FACULTY OF CIVIL AND ENVIRONMENTAL ENGINEERING

HIGHWAY ENGINEERING STREAM

IMPLEMENTATION AND PERFORMANCE ASSESSMENT OF BUILD-OPERATE-TRANSFER SCHEME ROAD FRANCHISING. A CASE STUDY OF ADDIS ABABA- ADAMA TOLL ROAD.

BY

Sagni Dinkissa Iddessa

A Thesis Submitted to School of Graduate Studies of Jimma University, in Partial Fulfillment of the Requirement for Master of Science in Civil Engineering (Highway Engineering).

March, 2020

Jimma, Ethiopia

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March, 2020

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Declaration

This thesis is my original work and has not been presented for a degree in any other universities.

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ABSTRACT

The provision of road infrastructure is becoming the main agenda for the transport authorities and the road users. In case of inadequate public funds and the scarce financing opportunities with economies under transition, private provision offers a better means to achieve sustainability goals in road infrastructure. Private provision of roads is typically made through a so-called build-operate-transfer (BOT) contract. Under a BOT contract, a private firm would build a road, charge tolls to road users for a period, and then transfer the road to the government at the end of concession period.

The aim of the research was to assess implementation and performance of BOT road franchising in Ethiopia, and Addis Ababa-Adama toll road constructed under public agency was used for dissertation. Due to the fact that BOT concept is relatively a new approach to infrastructure development in our country and there is limited previous study on the scheme, the research provides general knowledge and experience on BOT road for future use to solve the problem of limitation of public funds.

The research was conducted by gathering data on factors that affect implementation and performance of BOT from stakeholder's view and identifying road user's perception toward road tolling by interviews. The first stage in the assessment was identifying the main factors that affect implementation and performance of BOT road and insight about BOT road infrastructure project was gained. From road user's interview analysis, tolling of road was almost acceptable at current toll price and road users have positive view toward road tolling principle for better road condition. For selected case study of Addis Ababa – Adama toll road, cost benefit analysis was undertaken and profitability and viability of road tolling was checked by comparing the financial benefits with the corresponding costs during the project's life span. And also economic benefit of saving from travel time, accident cost and vehicle operating cost was evaluated.

***Key words**: Infrastructure, Private provision, traffic condition, build-operate-transfer, concession period.*

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ACRONYMS

AADT	Average Annual Daily Traffic
AASHTO	American Association of State Highway Officials
ACS	Accident Cost Saving
BOO	Build-Own-Operate
BOT	Build -Operate-Transfer
BTO	Build -Transfer –Operate
CBA	Cost Benefit Analysis
DOT	Department of Transportation
ERA	Ethiopian Roads Authority
ESA	Equivalent Standard Axle
ETB	Ethiopian Birr
ETRE	Ethiopian Toll Road Enterprise
FHWA	Federal Highway Administration
GDP	Gross Domestic Product
HCM	Highway Capacity Manual
HDM	Highway Development and Management
IRAP	International Road Assessment Program
IRI	International Roughness Index
NHTSA	National Highway Traffic Safety Administration
NPV	Net Present Value
OD	Origin Destination
ORA	Oromia Road Authority
PCE	Passenger Car Equivalent
PCU	Passenger Car Units
PMS	Project Management System
PPP	Private – Public - Participation
RFR	Road Funding Report
RUCM	Road User Charge Model
SRS	Simple Random Sampling

TRL	Transport Research Laboratory
TTC	Travel Time Cost
TTS	Travel Time Saving
UNCITRAL	United Nation Commission on International Trade Law
UK	United Kingdom
USD	United State Dollar
USA	United State of America
USDOT	United States Department of Transportation
VKT	Vehicles Kilometers Travelled
VLI	Value of Light Injury
VOC	Vehicle Operating Cost
VOT	Value of time
VSI	Value of Serious Injury
VSL	Value of Saved Life

1. INTRODUCTION

1.1 Background of the Study

In recent years, awareness of the sustainability aspects of infrastructure projects has been increasing around the world. Making infrastructure projects technologically aware and adaptable to changes while meeting user needs normally increases total project cost (Minnesota department of transportation, 2006). In case of inadequate public funds and the scarce financing opportunities with economies under transition, a public-private partnership (PPP) offers a better means to achieve sustainability goals.

Furthermore, economic data analysis of twenty two countries over a decade depicted that higher amount of debt decreases the economic growth of the country and results in reduction in Gross Domestic Product (GDP) which is a measure of the economic wellbeing of a country (Reinhart, et al., 2012). Considering its existing debt, the government needs to take measures to decrease funding the country's major programs to be able to reduce accumulation of debt. The necessity of reducing the impact of infrastructure investments on government budgets has introduced private capital markets for infrastructure funding purposes (Grimsey & Lewis, 2004). Furthermore, Public private Partnerships have been implemented realizing the importance of designing an environmentally sustainable project as well as its monetary value during the life of the project with consideration of whole-of-life cycle costing. Familiar examples of PPPs are toll roads, rail roads, bridges, tunnels, water and wastewater facilities, hospitals, schools, prisons, fire and police.

Roads are becoming the basic infrastructure in the life of a given society. It has been and continues to be backbone of land transportation network to create accessibility and mobility to support economic growth and to support social activities. The question is how should society go about expanding its road systems? Who would decide where to provide more road capacity, and how much more? Where would funds for expansion come from?

The recent world-wide tendency toward the introduction of commercially and privately provided public roads proves to be an efficient answer to these questions (Fussel & Beresford, 2009).

The private supply of highway capacity offers one way to deal with growing traffic congestion in the face of insufficient public funds to finance new capacity, and insufficient support for public road pricing. Private involvement in highway supply is not exceptional. Around one-third of the Western European highway network is currently under concession, with a strong concentration in the more Southern countries of France, Spain, Italy and Portugal. And private toll roads are an increasingly common phenomenon in developing countries (Guo and Yang, 2009).

Private provision of roads is typically made through a so-called build-operate-transfer (BOT) contract. The use of Build-Operate-Transfer (BOT) model for transport infrastructure projects delivery, most especially road projects has increased over the past decades (Babatunde and Perera, 2017). Under a BOT contract, the private sector would build and operate the road at its own expense and in turn should receive the revenue from road toll charge for a period, and then the road will be transferred to the government. BOT projects use the market criterion of profitability for road development and rely on the voluntary participation of private investors, who hope to benefit financially from their participation.

Government always has financial constraint and unable to fulfill the need of the society by public funds. Especially in developing countries like Ethiopia to minimize the problem of unavailability of funds, the best way is to allow private parties/tolling road through BOT scheme. But BOT concept is relatively a new approach to infrastructure development.

Ethiopia has one of the average road densities in Africa (Ethiopian Roads Authority, 2018). According to the data obtained from ERA, It now stands at 121,171 km, including gravel roads. With 121, 171 km total road coverage, total land area of over 1.1 million sq. km and a population of about 100 million, road access has now reached to 110.15 km/1000 sq.km or 1.21 km per 1,000 Ethiopians.

According to reports of federal ministry of transport, Road building now consumes about a quarter of the federal government's annual infrastructure spending. The road-building programme had spent about $11bn over the past 20 years, and that the annual budget for the roads sector had grown 20% to reach $1.7bn until 2018 E.C (Ethiopian Federal Ministry of Transport, 2018).

1.2 Statement of the Problem

Roads have been and continue to be backbone of land transportation network to create accessibility and mobility, to support economic growth and social activities. But the question is how society should go about expanding its road systems, who would decide where to provide more road capacity, where would funds for expansion come from and how much more? The recent worldwide tendency toward the introduction of commercially and privately provided public roads proves to be an efficient answer to this question. Private provision of public road is made through build–operate-transfer (BOT) contracts. Build–Operate-Transfer (BOT) contract project is currently fashionable worldwide, especially for developing countries shortage of funds for road construction (Guo and Yang, 2009).

In Ethiopia the construction of road is still consuming huge amount of capital. It is once more requiring a very huge amount of investment. For developing countries like Ethiopia, it is important to answer the question of limitation of funds. Due to the problem of the capital shortage in road infrastructure, public sector decided to build and operate Addis Ababa -Adama toll road by funding through debt, in return it is collecting revenue from road toll charge to repay debt and as a source of fund for other projects.

Previous research done on Commercialization of Roads in Ethiopia before the implementation of toll road on the same case Study in 2008 by Nagawo Abdissa concludes that implementation of toll road in Ethiopia is feasible. But after implementation of the toll road, there are no study done to assess performance of the toll road depending on the actual data and existing condition concerning financial analysis, user attitudes toward toll road and public agencies and benefit and risk of toll road to society and public sector.

Due to the fact that toll road concept is relatively a new approach to infrastructure development in our country and there is limited/no previous study on the scheme, applicability and profitability under BOT scheme of road infrastructure should be assessed for future use.

This research deals with assessment of the factors that affect implementation and performance of BOT scheme for road franchising in Ethiopia. The perception of stakeholders toward implementation of BOT contract and its economic benefit was evaluated. Then, means of enhancing private involvement in road construction was stated. Because several stakeholders are party to BOT projects and a long period may be required to complete the contract, uncertainties and risks threaten implementation and performance of BOT agreement was identified.

1.3 Research Question

1. What are the factors that affect implementation and performance of BOT road in Ethiopia?
2. What is attitude of road user toward road tolling?
3. What are economic advantages of BOT scheme road project?
4. How best can we adopt BOT scheme for road infrastructure in Ethiopia?

1.4 Research Objectives

1.4.1 General Objective

The general objective of the study was to assess implementation and performance of BOT scheme road franchising.

1.4.2 Specific Objectives

Specifically, the research addresses the following objectives:

- To determine factors that affect implementation and performance of BOT scheme road franchising.
- To identify views and perception of road users toward paying toll charge of BOT road project.

- To evaluate economic benefit and financial analysis of BOT/toll roads.
- To suggest some countermeasures to enable smooth implementation of BOT scheme to solve problem of funds for road infrastructure.

1.5 Significance of the Study

Government has financial constraint most of the time, and unable to fulfill the need of the society using public funds.

To answer a natural question of solving the problem of shortage of fund, a government has to consider a private sector to build road infrastructure. Especially in developing countries like Ethiopia to minimize the problem of unavailability of funds, the best way is to allow private parties/tolling road through BOT scheme. But BOT concept is relatively a new approach to infrastructure development in Ethiopia and there is limitation of previous study on toll road/ BOT scheme of road franchising in Ethiopia, this motivated me to conduct a research, which was aimed at assessment of BOT scheme for road franchising. Thus it is important to check feasibility and profitable of BOT road project in Ethiopia, and how the project will benefit the private investor, the road users and the whole society.

Thus, conducting this research played a significant role to solve problem of fund in road infrastructure through implementation of BOT scheme.

1.6 Scope of the Study

The research was conducted in Oromia Region, East Shao zone and it focused on the assessment of adoption and performance of BOT scheme road franchising in Ethiopia. Reduction in cost of traffic accident, saving in travel time and vehicle operating cost for the toll road from its opening to this day will be determined to evaluate economic benefits of toll road to public and society. Then factors that affect implementation and performance of the BOT project was determined by interviews and questionnaire to the main stakeholders. Even if there are many factors that can affect implementation and performance of BOT scheme of road franchising, the researcher focused on factors that are assumed as main causes.

2. RELATED LITERATURE REVIEW

2.1 Definition of BOT

BOT is defined as the granting of a concession by the government to a private promoter, known as concessionaire, who is responsible for financing, constructing, operating, and maintaining the facility over the concession period before finally transferring the fully operational facility to the government at no cost (Sudki , 2005). BOT is an agreement that entrusts the design, financing, operation and maintenance of a facility to a concessionaire for a determined concession period. Operational and construction risks are endured by the concessionaire. The management and formal ownership of the facility will be returned to the public entity at the end of the concession period. BOT concessions are often observed to bring innovation, sustainability and diversity together while enabling the public sector to carry out its necessary objectives.

Empirical studies have shown that BOT concept has become a popular option for rapid scaling of operations, wider service offerings, lower infrastructure set-up costs and reduced time to operations. Furthermore, BOT might improve the pathways whereby private funds can be attracted to be invested in programs of public works or services within a framework of suitable contractual arrangements. Under a BOT agreement, the public sector brings political and regulatory stability; and is able to exercise authority on assets such as land, property, and the right-of-way, which brings to the development process and the private sector contributes with outside capital and technical expertise; and has an incentive of producing an efficient outcome at the lowest cost in the shortest time span (Shahrara, 2011).

The projects to be delivered through BOT include: transport (road, rail, ports, airports, bridges, tunnels), water resources (hydro plants, irrigation, sewage treatment, pipelines), tourism (facility development), health (hospitals), accommodation facilities (courts, police stations), educational facilities (schools, dormitories, museums, libraries), correctional facilities (prisons and detention centers), arts, sport and recreational facilities, convention centers, government office accommodation, and social housing (Shahrara, 2011).

However, the decision made about whether or not any of these services should be delivered by means of a PPP/BOT, depends on: the best project model that delivers the best value for money; the public interest's satisfaction of the project outcome; and that the proposed service is not a kind of service which must be delivered only by the government to its citizens (Grimsey & Lewis, 2004). Generally in the procurement method examination, which compares private sector provision of infrastructure services under a PPP/BOT arrangement with public sector provision, the expectation is based on a better value-for-money for private sector provision.

By alluding to Adam Smith principle, economic liberals believe that government should undertake only what cannot be done in the market; doing otherwise will impede free enterprise development. In this context, there remain a few services that absolutely have to be delivered by the government which consist of activities that revenue cannot be obtained due to being 'non-excludable and 'non-rival' (e.g. external defense); and those where the cost of collecting the revenue would exceed the revenue (e.g. parks and playgrounds). Non-rival goods/services are those whose cost of providing to an additional consumer is zero. Non-excludable goods/services are those which non-paying consumers cannot be prevented from accessing it (Grimsey& Lewis, 2004).

2.2 Historical Background of BOT Scheme

Build-Operate-Transfer (BOT) concept was first introduced by Turkey's late Prime Minister, Turgut al in the early 1980s and was known as zal's formula; however the concept was identified earlier, when in Hong Kong in mid-1950's, a privatized cross harbor tunnel was first proposed (Merna & Njiru, 2002) (Shahrara, 2011).

Build - Operate - Transfer (BOT) is a relatively new approach to infrastructure development, which enables direct private sector investment in large-scale projects such as roads, irrigation, telecommunication, bridges and power plants. According to the United Nations Commission on International Trade Law, (UNCITRAL) BOT is also increasingly being utilized for medium and small-scale projects (Lema, 2009).

Although the term Build - Operate- Transfer is relatively new, the practice of permitting private concerns to develop and operate infrastructure projects have been around for several years. By October 1992, there had been over 70 projects valued at USD 30 Billion in 14 countries that had been financed since mid-1980. In Europe, such projects were called "Concessions". The government, in such projects would establish the major objective of a particular project and assume the role of defender of the public interest, but would allow a private company or consortium to design, finance, construct and operate the particular project for a certain concession period. The concessionaire would assume responsibility for the completeness of design, any risks associated with construction, and the control of operational costs, all of which would be recouped through the collection of revenue from those benefiting from the use of the finished project (Lema, 2009).

2.3 Characteristics of BOT Projects

2.3.1 Initiatives of BOT

BOT has a simple attraction because it integrates private and public resources into infrastructure development. Many ambitious and innovative entrepreneurs would be interested in financing of construction and operation of an infrastructure. However, pure private approach is vulnerable to many risks such as: demand risk; changes in technology, regulation, and unorganized development of facilities (e.g. duplication of routes, railway, etc.). On the other hand, pure public developments often are unsuccessful as well because of the facts such as: bureaucracy; political meddling and interference; inadequate funds; tax and spend policy applications, which make the tax payers bear the burden; unsatisfactory management, operation and maintenance of the facilities. These initiatives are often stimulated by the need for investment, an interest to operational risk transfer, and by the goal of improved serviceability (Shahrara, 2011).

A BOT approach successfully brings the private and public approaches to infrastructure development by exploiting private sector's novelty and market insight while bestowing main planning, coordination and authoritative supervision of the infrastructure projects upon public entities.

In order to create incentives for the private sector to undertake an infrastructure project and bear the associated risks, the arrangements should clearly spell out each party's responsibilities; and in order to be protected from various political and country risks, the private sector needs to receive credibility (Grimsey & Lewis, 2004).

2.3.2 Main Parties of BOT

2.3.2.1. Public Sector

On a BOT project, the host government is responsible for determining the project objectives, specifying the priorities, executing the procurement plan, quality control check, and making sure that the public interest is secured. The host government should provide supports such as land provision, and bureaucratic support; and be prepared to take over in case of project defaults. In general, PPPs involve multiple levels of government to participate and approve the project (USDOT, 2010).

I. State Legislatures

State legislatures establish enabling legislation to specify which projects will be considered as concession projects, to determine concession terms and to introduce how the project will be selected.

II. Public Sector Project Sponsor

State authority or a local government can sponsor BOT concessions. Considering the defined legislative frameworks, the public sponsor establishes guidelines, sets objectives, outsources the project, negotiates, and is held accountable for errors. If the state authority is the sponsor; it should consult with the city or county which the project is happening within its jurisdiction.

III. Public Sector Advisers

Public sector may outsource consultants and advisers to help evaluate conceptual plans of a BOT, and negotiate the concession (USDOT, 2010, 2010).

2.3.2.2 Private Sector

The concession company or concessionaire is a combination of several firms with special skills and expertise such as construction company, engineering company, financing institutions and other entities which altogether constitute a Special Purpose Vehicle to implement: the concession, mobilize required funds, and negotiate contracts with the public sector (USDOT, 2010).

I. Equity Investors

Acquiring capital from concession company's partners is a strategic equity investment because it gives the partners strong incentive to complete the project with required quality. Investment banks, private investors, public and private pension funds can contribute to equity investment as well.

II. Commercial Lenders

Banks can provide debt capital to the concessionaire. These loans typically have higher interest and often require that the concessionaire refinance them during the life of the concession.

III. Bondholders

Concessionaires can also borrow funds from individual investors and institutions that purchase bonds in the capital markets (USDOT, 2010).

2.3.3 Characteristics of a Viable BOT

A BOT partnership becomes successful when the parties are open, innovative, willing to share the risks, willing to share the profits, and diligent to solve conflicts. A BOT requires: a financially profitable project, a responsive and cooperative host government, private partners, interested sponsors, and a consortium of experienced and skilled professionals. At the outset, government has to carry out a realistic evaluation and avoid encouraging underbidding. Also sponsors are to be cautioned against relying on future refinancing at more favorable rates; because this option generally is possible only when the project arrives at a lower risk stage.

If the risk during the life of the project remained at high levels, the private party would have to default or breach the contract and abandon the project. Having contingency plan for feasible resolutions for any risk is necessary (Grimsey & Lewis, 2004).

A successful contract management endeavors to resolve issues to keep the contract in operation for the benefit of both parties, not to search for conditions to breach it. Large projects (typically $500 million or greater in cost) make BOT arrangements more viable because while they may exceed public sector's financial capacity, their higher profit potential may justify undertaking the project (Grimsey & Lewis, 2004). Because concession projects require longer consideration of possible risks, both parties generally prefer projects that already have established strong support and will receive required political approvals (USDOT, 2010).

2.3.4 Variables of BOT Contract for Road

2.3.4.1 Concession Period

Concession period is the span of time granted by the government to the private sector within which the private sector is responsible for the financing, construction and operation of a BOT project (Hanaoka and Palapus, 2012).Concession period starts from the signing of the concession agreement between the government and the private sector indicating the span of time within which the private sector is responsible for the construction and operation phase of BOT project. In some cases, the facility is already provided by the government; hence, concession period only includes operation and maintenance of the facility.

The concession period, representing the number of years for operating the road by the private firm, directly governs the total toll revenue of the private firm and the total social welfare gain during the life of the road (the concession period and the post-concession period) (Guo and Yang, 2009). The concession agreement is the core feature of BOT projects, with the concession period being the most essential feature in determining the time span of the various rights, obligations and responsibilities of the government and concessionaire.

Concession period design is therefore crucial for financial viability and determining the benefit/cost allocation between the host government and the concessionaire.

2.3.4.2 Highway Capacity

Highway capacity implies how much a given facility can accommodate and under what operating Conditions. "The capacity of a facility is the maximum hourly rate at which persons or vehicles reasonably can be expected to traverse a point or a uniform section of a lane or roadway during a given time period under prevailing roadway, traffic, and control conditions" (HCM 2,000, pg. 2-2). The selected road capacity makes impacts on both the private firm's profit and the total social welfare in either direct or indirect manners. First, the road capacity determines the road construction cost, the major investment cost of the private firm for the road project; second, the road capacity affects the congestion degree and thereby the travel time on the road, which in turn affects the travel demand and, as a result, the revenue and the social benefit.

2.3.4.3 Toll Charge

Toll charge is a revenue payment from road user users to concessionaire in return to their service. The toll charge under the operation of the private sector to a large extent determines the total revenue that the private sector receives and the social welfare gain as well during the concession period. In summary, each of the three fundamental variables of concession period, capacity and toll charge, plays an important role in forming a feasible BOT contract. Their values determine how, and under what circumstances, a road BOT project is feasible and profitable, and how the project will benefit the private investor, the road users and the whole society (Guo and Yang, 2009).

2.3.4.4 Traffic Demand

Traffic demand is a set of all vehicles in a traffic system estimated to use or using the routes. If there is a substantial uncertainty in traffic demand, especially when the forecasting traffic demand is far lower than real demand, the mismatch between capacity and traffic demand may lead to untenable levels of under-utilization.

To reduce the risks caused by traffic demand uncertainty, it is best to study capacity and toll choices of BOT highway contracts by specifying the means of coordination with the future traffic demand (Meng and Lu, 2017).

2.3.5 Basic Elements of BOT

Basic elements of a concession based BOT contracting arrangement are mentioned below:

- The Public sector determines the functions of delivered project output, specifies characteristics and performance criteria over a long-term life cycle of the project (typically 15-30 years) without conditioning the means of the project delivery; and puts restrictions on operating standards and pricing.
- Payments are made upon asset delivery and its full serviceability; and relevant payments will be reduced if the deliverable is not compliant with specified standards.
- The private sector decides about the ways of delivering the service, owns and operates the facility during the concession period therefore bears the design risk, in reference to the serviceability and standard of the delivered asset and gains the merit of competent ownership.
- The public sector supplies no capital during the construction stage, and the private sector is obliged to undertake the risk of cost overruns, delays, etc.
- The public sector delegates control of the asset to the private sector to deliver the service; and while enduring the subsequent risks, the private sector collects the rewards of effective operation.
- The private sector transfers the facility's ownership to the public sector (with or without payment) at the end of the concession period (Grimsey & Lewis, 2004).

2.4 BOT Goals

Under a BOT agreement public and private sector become one team; and commit to achieve the following objectives:

- Improve government's operation system by introducing market practices into the public services

- Encourage and support involvement of private sector operators and their financial commitments
- Let the private equity increase up-front financing, or make greater total debt capacity available through private sector credibility
- Expand the number of participants in benefiting from the outcome; allow for financial risks to be transferred from public to private investors
- Create fundamental positive changes in public services and administrative procedures
- Allow for authority sharing arrangements
- Cultivate cooperation and trust in lieu of competitive relations and command and-control regulations
- Create incentives for long-term investment returns, better asset management; and
- Create a playground to share benefits of employing knowledge, or enduring responsibility and risk (Grimsey & Lewis, 2004).

2.5 Agreements of BOT Projects

In any BOT project, there are many inter-dependent agreements among various participants. Major participants in a BOT project include government, private company called concessionaire, lenders (Banks), equity investors, contractors, suppliers, operators and financial advisers. BOT projects mainly consist of different agreements. Involvement of many parties with different interests makes BOT project very complex.

Extensive risk allocation within a contractual framework is vital to a project's success; therefore establishment of strong contractual arrangements in a BOT project promises financial viability of a project (Finnerty, 2013).

Generally speaking, contracts are long term commercial agreements to protect the interests of the project sponsors. They allocate the probable risks associated with the projects. Contract documents are structured and negotiated. Typical contracts in a BOT arrangement are: concession arrangement; consortium arrangement; construction contract; operation and maintenance contract; construction subcontracts; supply contracts and off-take contracts (World Bank, 2014) (Sapte, 1997).

2.5.1 Concession Contracts

The given rights and responsibilities to the private sponsors by the government, to finance, design, construct, operate and maintain a BOT project are called concession. The contract which regulates these rights and obligations is called a concession contract.

Basically concessionaire will seek a clear, enforceable right to implement the project. However, the public sector, who has granted the concession, will want to insure that the facility will be constructed, operated and maintained to agreed standards (Grimsey & Lewis, 2004). A precise concession contract contains specifications below (US Department of Transportation, 2010):

- If the public entity is going to facilitate the project by any means such as site acquisition, obtaining permit, licenses and consents, these authorizations need to be identified and guaranteed in concession contract.
- Concession agreement should reflect risk allocation and risk sharing terms between the two sectors.
- Commercial incentives which attract the private sector are mentioned in the concession agreement.
- The public entity will stipulate the regulations and the extent of control over the project.
- The concession agreement will have to promote financial viability of the project for lenders, investors and guarantors during the concession term.
- The concession agreement will contain standards for design and construction, public entity's rights to inspect and approve the facility, government's certain powers and rights over financing, performance standards, and public entity's right over operation stage, maintenance standards, rights of access and inspection, government's control over user charges, intervention circumstances in the case of an emergency, force majeure clauses, termination rights, breach of contract cases, transfer of the assets to the government, the terms for dispute resolution, insurance requirements, liability terms, environmental requirements, confidentiality, etc.

This agreement is regarded as the "heart" of a BOT project as it determines the commercial viability and profitability. It is an agreement between the government and the concessionaire and it includes the following:

- The concession period
- The construction duration
- Toll/ tariff structure with toll/tariff revision provisions
- Rights and obligations of both parties and
- Government guarantees

2.5.2 Loan Agreement

This agreement occurs between the lenders (i.e. banks) and the concessionaire. Bank debt is the primary source of financing for a BOT infrastructure project. The debt is raised through international and local commercial banks. Lenders of debt (commercial banks) look at equity contribution as level of commitment by the concession company. BOT projects are financed on project finance basis, i.e., BOT projects are financed on forecasted cash flows and estimated revenue-generating capacity of the project (USDOT, 2010).

2.5.3 Consortium Arrangement

Having common interests of promoting and financing a large infrastructure project, its private sponsors such as construction company, suppliers, future operators and maybe purchaser of the outcome establish a consortium or joint venture to bid for the project. Naturally each member of the consortium has different interests and obligations which need to be defined at the outset. The provisions below may be addressed in a consortium agreement:

- The role of each party and their undertaking
- Each party's commitment to different phases of project development
- Potential liability protections
- Rapid and effective decision making provisions
- Risk allocation and risk sharing plans

- Cost and value measurement frameworks
- Termination and withdrawal terms; and
- Confidentiality terms (USDOT, 2010).

2.5.4 Shareholder Agreement

This agreement takes place between the equity investors and the concessionaire. Equity financing, in the context of BOT is defined as financing rose by consortium members from their own capital funds. Also equity is provided in the form of capital by other equity investors. The concession company agrees to pay the investors, dividends in return (USDOT, 2010).

2.5.5 Construction Contract

This contract takes place between the contractor and the concessionaire. The contractor is a key player in the consortium. The basic contractual structure of BOT comprises of single overall contractor design and construction. The fixed price turnkey contract assigns a single point of responsibility on overall contract thereby minimizing the risk element present in BOT projects.

Construction phase of a BOT project incurs a large amount of projects outlay; its timely completion would help earlier revenue generation; and its quality will impact the whole life cycle of the developed infrastructure. Lenders of the projects are always concerned about construction cost overruns. Contractors always should have acceptable reasons for any delay in project delivery or cost overrun due to unforeseen conditions. Drafting and negotiation of a construction contract are major tasks in a successful BOT concession. Construction contracts will contain provisions such as (USDOT, 2010):

- Liquidated damages provision for failure to deliver the project on the agreed completion date
- Scope of the design and construction in detail through project specifications
- Detailed and comprehensive scope of warranties following completion related to design, construction, and compliance with laws

- Degree of control over the contractor's performance; and right to inspect and test the works
- Risk allocation provision
- Liability terms for breach of contract
- Security for contractor's performance such as retention, bonds, insurance arrangements, and completion guarantee
- Payment methods; etc.

2.5.6 Supply Contract

It is an agreement between the supplier and the concessionaire. The supplier is often government agency that supplies raw material such as coal to the power plant (USDOT, 2010).

2.5.7 Off-take Agreement

It is an agreement between the government and the concessionaire to purchase minimum quantity of services such as electricity or water at a fixed price for a fixed time. Such agreement will generate revenue to the concession company (USDOT, 2010).

2.5.8 Operation and Maintenance (O&M) Contract

This is an agreement between the concession company and the operator. The operation phase of BOT projects presents the great management challenge and demands the highest level of attention.

It is to the advantage of the project that the operator becomes one of the project sponsors; this way the success of the project is directly linked to its own performance. The operation and maintenance (O&M) agreement is carried out when commissioning and testing procedure of the facility/ project outcome starts. Commissioning is carried out to verify if the project outcome functions according to its design objectives or specifications. The O&M agreements often contain clauses about (USDOT, 2010).

- Detailed specifications on the replacement of failed equipment and details of improvements to the facility

- The methods of payments such as fixed price, cost plus fee, or performance based fees (bonus/penalty mechanism) by taking inflation rate changes into account
- Liquidated damages for failure to perform, liability provisions, warranties, insurance, acquisition of operating permits, budget allocation terms, inspection rights, safety provision, emergency repair plans, operating manuals upkeep, routine maintenance schedules, transfer of intellectual property rights; and, termination provisions.

2.6 Competitive Tendering Process

2.6.1 Bid Evaluation Procedures

- Pre-qualification: To shortlist a number of competitive proposals by consortia that consists of reputable and experienced contractors, operators and bankers.
- Evaluation Criteria: 2 main evaluation techniques
  - ✓ Net Present Value (NPV)
  - ✓ Score System

2.6.2 Critical Success Factors

The following are six factors that are vital for project promoters in winning a BOT contract.

- Entrepreneurship and leadership
- Right project identification
- Strength of consortium
- Technical solution advantage
- Financial package differentiation
- Differentiation in guarantees

2.7 Advantages and Disadvantage of BOT Roads

2.7.1 The Economic Advantages of BOT Road

Since BOT road is undertaken by road tolling, the benefits of toll roads can be expressed in many ways.

The benefits of highway projects occur primarily because of highway use; road users are the initial beneficiaries of both reductions in cost and improvements in road quality.

Savings to automobile and truck operators in terms of shorter or faster trips, reduced operating costs, and safer travel are included in traditional analysis (Hibbard and Miller, 1974). Road user benefits relevant to this analysis include reduced crash rates, improvements in vehicle operating costs (VOC), travel time savings (TTC) and externalities in the form of reduced vehicle emissions (Sasika& Paysandú, 2017).

Where a project has demonstrable potential reductions in vehicle usage (by travelling reduced distances) there can reasonably be expected concurrent reductions in vehicle wear and tear and rates of depreciation. Similarly, where project road works result in a safer driving environment, benefits in the accident cost reductions may also be expected (Nagawo Abdissa, 2009).

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
- ✓ Building the Right Facilities:
- ✓ Providing Funding
- ✓ Fairness
- ✓ Greater Safety
- ✓ Matching Costs and Benefits

2.7.1.1 Reduction in Accident Costs

Accident cost savings arise when a project reduces either the expected accident rate (frequency) or the accident severity. The accident rate can improve due to changes in alignment, road type, lane width and speed factors. The average cost of a crash is measured by the number of all crashes and the resultant number of fatalities, serious injuries, minor injuries and property damage incurred from each accident across the state.

A detailed safety analysis should be undertaken with the assistance of specialized support (Sasika& Paysandú, 2017).

Accident costs are the economic value of damages caused by vehicle accidents/incidents. These costs can be classified in two major groups: (1) cost of foregone production and consumption, which can be converted into monetary values, and (2) life-injury damages, which involves more complex techniques to convert into monetary values. The accident cost function estimates the number of accidents that occur over a period of time, and converts the estimated number of accidents into a monetary value by multiplying the number of accidents by their unit cost values. The cost of any specific accident varies of course with individual circumstances. However, similar accidents typically have costs that fall within the same range (Sasika & Paysandú, 2017).

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 (TRL) UK, 2000).

2.7.1.2 Savings in Travel Time

Travel time, or journey time, savings are generally considered to be the most important component of transport projects designed to improve transport route and network efficiency. Reduction in congestion and lower travel times therefore represent the majority of road infrastructure benefits. The measurement of time is divided into two distinct streams based on the purpose of the trip.

These are either private (non-work) or business related travel. The valuation of business travel time is equal to the average wage rate (Sasika & Paysandú, 2017).

Austroads measures business travel time based on the driver's cost to the employer. Freight is also incorporated in the valuation of business travel time by multiplying vehicle payloads (measured in payload tones) and estimates of unit freight travel time estimated at a per pallet level. Private road users' TTC, not on business trips, are generally valued at a 'leisure rate' which is lower than business travel time. TTC are calculated from the average trip time, average occupancy rate, the value of time per occupant or value of freight per hour, and the AADT (Sasika & Paysandú, 2017).

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 was adopted in making the calculation.

The USDOT (17) suggests VOT values between 50% and 100% of the hourly wage rate depending on travel type such as personal and business.

2.7.1.3 Saving in Vehicle Operating Costs (VOC)

VOC are the ongoing expenses incurred by road users that result from car ownership. These costs comprise consumable items such as fuel, oil and tyre as well as repairs and maintenance and vehicle depreciation. VOC will vary from vehicle type to vehicle type and according to road roughness, vertical alignment, horizontal alignment, average speed and congestion. Improving the roughness or alignment of the road will reduce VOC. VOC are measured in resource prices and not at market rates. Parameters such as fuel and tyre costs have been adjusted to eliminate the effect of taxes and charges on unit values and are subsequently represented in resource prices. With respect to fuel for example, the unit values are expressed net of excises and levies (Sasika& Paysandú, 2017). The measurement of VOC incorporates a number of complex algorithms developed by Austroads. For detail on the calculation of VOC, see Section 4 of the Technical Guide (Cost-benefit Analysis manual, 2010).

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. The vehicle operating costs (VOC) also include allowances for the purchase of new vehicles.

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 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 and 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. 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 less than 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 (Nagawo Abdissa, 2009).

2.7.1.4 Externality Savings

Externality savings includes reductions in greenhouse gases, air pollution, noise pollution, water pollution, nature and landscape, urban separation, and upstream and downstream costs. All values for externality costs have been sourced from Austroads paper IR-156/05. Externality cost savings are calculated using vehicle kilometers travelled (VKT) per vehicle type.

Externality savings are sensitive to changes to annual average daily travel (AADT), composition of AADT and section length. Within the project, road section length has been reduced therefore producing externality cost savings through reduced distance travelled (Nagawo Abdissa, 2009).

2.7.2 Disadvantages of BOT Projects

- High transaction costs (5 – 10% of total costs).
- Not suitable for smaller projects
- Success depends upon successful raising finance.
- Projects are successful only when substantial revenues are generated during the operation phase.
- Loss of public control and flexibility
- Private profits at the public expense
- Loss of future public revenues
- Risk of bankruptcy or default
- Accountability and transparency
- Environmental issues
- Toll road controversies
- Specific contract terms *(NCSL's P3 for Transportation Toolkit for Legislators, 2014).*

2.8 Factors Affecting Performance of BOT Scheme of Road

2.8.1 Positive Factors Affecting Performance of BOT Scheme of Road

A number of success factors that may influence the adoption and performance of BOT from concessionaires and government official's perspective are (Sharaffudin& AL-Mutairi, 2015):

2.8.1.1 Privatization Policy Factors

It refers to government actions and operations for attracting the private sector. These actions can be described as follows:

- ✓ Strong Government Commitment: This is adopting of the BOT system as an integral part of the country's privatization strategy
- ✓ Government Incentives and Support: This includes Pre-investment Assistance, Land owning policy that enables foreign investor to own land, reduction of tax rate and industrial Loans

2.8.1.2 Economic Factors

It refers to the economic climate and policies that can be viewed through the following:

- ✓ Sound Macro Economic Stability
- ✓ Stable and Free Convertible currency
- ✓ No Restrictions on Repatriation of Funds/Profits
- ✓ Efficient Capital Markets

2.8.1.3 Financial Factors

It refers to potential source of finance, availability of finance in the form of equity and debt. This can be viewed as:

- ✓ Availability of Soft loans
- ✓ Availability of Equity
- ✓ Tax Reduction
- ✓ Demand for Infrastructure Projects

2.8.1.4 Legal Factors

It refers to the laws and regulations that have legal and business impact on the initiation and implementation of BOT delivery system. This may include sponsorship, property ownership rights etc.

- ✓ Right to own land by foreign investors
- ✓ New Foreign Investment Law

2.8.1.4 Technical Factors

This refers to the availability expertise in terms of technology, management, material, equipment and human resources to undertake infrastructure projects through BOT.

- ✓ Availability of Large and Experienced Construction Organizations
- ✓ Availability of Equipment and Material
- ✓ Availability of Cheap Labor and International Work Force
- ✓ Availability of Modern Infrastructure

2.8.2 Negative Factors Affecting Performance of BOT Scheme of Road

2.8.2.1 Knowledge Problems

It refers to the lack of understanding of legal and contractual aspects of the BOT project delivery method. As part of the process, knowledge factors play a great role in the success of BOT.

These knowledge problems can be grouped into four areas:

- ✓ Lack of owner's awareness of BOT concept
- ✓ Lack of contractors experienced in BOT
- ✓ Lack of financing experience in BOT projects
- ✓ Management and Control

2.8.2.2 Regulatory Problems

This refers to the existing laws and regulations of the host country impeding the procurement of construction projects, administrative process of developing BOT projects and legal framework.

These problems can be classified into three main areas:

- ✓ Absence of legislation dealing with BOT
- ✓ Lack of independent regulatory body
- ✓ Legal and regulatory framework

2.8.2.3 Financial Considerations

These refer to those factors impacting the ability of the project to earn a reasonable rate of return. These considerations can be grouped into:

- ✓ Service Fees
- ✓ Limited Capital Markets
- ✓ Market Risk

2.8.3 Risk Sharing Management

Risk should be transferred to the party best able to control it. BOT projects require sharing of risk among the parties. Both government and private sector are on learning curves and as such there are no records of successfully applied risk allocation principles. However a promoter who retains risks and offers guarantees against risk and uncertainties will have high probability of winning the concession. Risks may be political risk, currency and foreign exchange risk, cost overrun risk, delay risk, tariff demand uncertainty risk, market risk, operation risk and force major risk (Sudki, 2005).

A stable political environment in the relevant developing country is a mandatory pre-condition for the successful implementation of BOT projects.

Private sponsors will not be willing to spend the substantial amounts of time and money required to put together a BOT project, and then remain at risk for the 10 to 25 year periods that are typically required, if they cannot count on political stability and continuity over this period (lokiec & meerovitch, 2013).

2.9 Private Firm Costs

Agency costs in CBA refer to the infrastructure expenditure incurred by road agencies for the procurement of road works. Infrastructure agency costs include capital investment for new infrastructure works, and ongoing agency costs such as maintenance and operational costs needed to service the infrastructure over the life of the asset. Capital and maintenance agency costs should be included in both the base and project cases in the year of analysis in which they are to be incurred. Accurate estimation of the agency maintenance costs in the base case is important in order to gather a full representation on the magnitude of resources required even if a project does not proceed (Cost-benefit Analysis manual, 2012).

2.9.1 Capital Cost

Capital costs represent the initial outlay of expenditure required to start up a project (planning, design and construction). There are a number of inputs and activities that make up the total capital costs for a road project.

Each input and activity must be estimated as accurately as possible and a project plan is often required to determine the timing and duration of each task. The timing of capital cost expenditure must also be estimated. CBA can be used to inform decision makers between the staging options of projects.

The makeup of capital expenditure can include design and construction costs ,earthworks, pavement and seal, intersection work, value of land resumptions or voluntary acquisitions, value of any land purchased at an earlier date, costs of environmental mitigation, project construction, design contingences, management and other professional costs (Cost-benefit Analysis manual, 2012).

2.9.2 Maintenance Cost

Maintenance costs include all labor, machinery and materials costs for routine, periodic and rehabilitation maintenance.

Estimates of annual expenditure required to maintain and preserve road infrastructure can generally be determined based on historical expenditure levels (Cost-benefit Analysis manual, 2012).

2.10 BOT Compensation

2.10.1 Project Revenues and Toll (from Project to Private Sector)

The private sector may be granted the right to compensate, for its performance in a public-private concession, by collecting project revenues. By agreeing on this type of reimbursement, the private sector agrees to bear the risk of less than expected revenue which may result in default on debt repayment or equity return. However, depending on the degree of deficit, the public sector can share the revenue risk, for instance, by agreeing to secure a certain amount of gross revenue or return on equity investment; or to extend the concession period at no cost. In return, the public sector may bargain a percentage of future revenues of which exceed a certain level (US Department of Transportation, 2010).

2.10.2 Availability Payments and Performance Payments

Depending on availability and serviceability of the facility, the public sector compensates the private sector, by milestone payments, for its activities. Milestone payments are adjusted by considering fulfillment of specified performance level for constructing, operating and maintaining the facility.

Availability payment can be decreased or even canceled, if serviceability and performance specifications are not fulfilled. Because availability payments are nothing to do with user fees, then the public sector will require obtaining a form of revenue such as toll/tariff (US Department of Transportation, 2010).

2.10.3 Shadow Tolls

In a shadow toll concession, the private concessionaire receives a certain amount of fee from the public sector for each user of the facility. Although shadow toll model provides strong motivations for on-time and on-budget completion, and quality performance, it creates a motive to increase traffic, while the public sector's overall goal might be to reduce mass congestion (US Department of Transportation, 2010).

2.11 Traffic Data Collection

Traffic Data Collection and projections thereof of traffic volumes are basic requirements for planning of road development and management schemes. Main input parameters for design of the road are the Annual Average Daily Traffic (AADT) and the cumulative loading over the design life of the road that is the number of vehicles passing point in both directions per day taking into account the variation in the traffic flow throughout the year and the total number of axles for the same traffic volume. Determination of the AADT from 12-hour traffic count is achieved by converting to 16-hour flow (the volume of traffic flow counted in hours) by using applicable conversion factors. Having obtained the 16-hour counts, a further conversion to 24-hour flow may be carried out to obtain an Average Daily Traffic flow, and subsequently to Annual Average Daily Traffic.

Peak Hour Traffic is first converted to Average Daily Traffic (ADT). Peak hour traffic used for design is the traffic, which passes a point during the severest peak hour(s) of the counting period. In order to convert peak hour traffic to Average Daily Traffic (ADT), the peak hour traffic should first be converted to 12 hour or 16-hour traffic flow and then to 24-hour traffic flow (Botswana Ministry of Works and Transport, 2004).

The conversion factor is the proportion of traffic flow over a given peak time as it relates to that prevailing traffic counted under same traffic conditions and over a specific Average Daily Traffic is converted to Annual Average Daily Traffic. Annual Average Daily Traffic is the average traffic that is expected to use a particular road over a year (365 days).

2.11.1 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. 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.

2.11.2 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 (Frank Harley, 1998).

2.11.3 The Demand for a Specific BOT Road

The other crucial component of the economic picture of a BOT 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 (Antonio et al, 2000).

2.11.4 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.

2.11.5 Traffic Demand Uncertainty and Multiple Vehicle Types

Many sources of uncertainty or unexpected risks may occur during the long concession period. To reduce the risks caused by traffic demand uncertainty, it is best to study capacity and toll choices of BOT highway contracts by specifying the means of coordination with the future traffic demand. Traffic flow is a dynamic process and can fluctuate over time. Accuracy in traffic counting and establishment of these fluctuations in the traffic flow is of critical importance, as this influence derivation of projected traffic. This is because the demand uncertainty may cause some undesirable economic sequences and it is hard to guarantee the most efficient concessionaire (Meng and Lu, 2017).

Vehicles traveling on highways can be classified according to their physical dimensions, weights, intended uses and their Dynamic characteristics in to classes such as passenger cars, light trucks, heavy trucks, buses, and so on. In general, heterogeneous vehicle types differ in the three major ways: value of time, congestion externality measured by passenger car unit (PCU), and pavement damage power. Because of these distinctive characters, different vehicle type users on highways, as a matter of fact, always have different will-to-pay, user costs, and toll charges (Meng and Lu, 2017).

2.12 Financial Analysis

Financial analysis is a method to organize a project's relevant financial flows such as project outlays, receipts, and expenditures in comprehensive details on a yearly basis based on the discounted cash flow approach during the project life time.

Market demands are analyzed to identify who the prospective customers/users and the possibilities of growth in the price of the end product or service would be. Issues should be considered for financial analysis of BOT contract in project life span are length of construction period, total cost of private firm, project revenues and toll (from project to private sector), tax, interest rate, expected average return rate and investor's internal return rate. (Jenkins et al, 2011).

Undertaking a life cycle cost-benefit analysis of an investment project is necessary to enable a decision maker to appraise or evaluate the whole life of the project objectively, with the hopes of stopping a bad project from being implemented and preventing a good project from being rejected (Jenkins, et al., 2011). The word "appraise" refers to making a decision whether to allocate the resources to the projector not; and the word "evaluate' refers to analyzing the project performance (Brown& Campbell, 2003).

2.13 Public Acceptance

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

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.

2.13.1 Establishment of Toll Price

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.

Similarly a road toll for using specific facility will also not be considered as a tax (Kenneth, Gwilliam, & Shalizi, 1997).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.

To estimate the variable and fixed routine and periodic maintenance costs a series of runs of HDM 4 can be undertaken and the sensitivity to traffic loading interpreted. For bitumen paved roads equivalent standard axle loads (ESAs) is 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). 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.

2.14 Common Misconceptions

There are some common misconceptions that BOT projects and generally PPP arrangements:

- BOT are sources of revenue: concession projects do not generate revenue, but they require it. Concessionaires expect a reasonable return on their investment.

- Mean privatization: contrary to privatization, which involves absolute sale of the facility to the private sector, ownership of concession projects usually remains with the government.
- Are a fit for every project: a project is not suitable for BOT arrangements if it would not generate adequate revenue.
- Are free to come into being: the public sector will have to make money and time investments to gain potential benefits of a BOT model.
- Are guaranteed to succeed: every project, regardless of selected model, has risks. In a BOT model, the public sector allocates the risk to the party best able to manage it. In the case of unforeseen risks, the project may not be successful (US Department of Transportation, 2010).

3. RESEARCH METHODOLOGY

3.1 Research Design

The design of the research was descriptive assessment of BOT scheme of road franchising in Ethiopia. As a result, both qualitative and quantitative approach research methodology were used to achieve the desired objective. These approaches were suitable since they implement the use of qualitative analysis, measurable values and mathematical computations. In addition, illustrative case study of Addis Ababa-Adama toll road was used to demonstrate the proposed methodology in this research since there is no BOT road under private concessionary in the country.

To assess implementation and performance of BOT scheme road franchising in Ethiopia, the following procedure and techniques were adopted in the study.

First, related literature and previous studies concerning BOT road was reviewed. The reason behind this phase was mainly to get ideas and views towards the implementation of BOT projects at international level to follow the path that will yield valid and reliable results.

The second phase was developing the questionnaire and interview as main tool for the current study. Closed questionnaire and structured interview were used as a method of primary data collection. The questionnaires and interview tools were prepared after reviewing previous study made on BOT road worldwide. In closed questions, most of possible hindering factors were developed from views of respondents to a question, what in your opinion, affect the implementation and performance of BOT roads in Ethiopia?

Proper examination and determination of its hindering factors were conducted to ensure a smooth implementation of the BOT project. The questionnaire was distributed between two main stakeholders: government officers and private contractors, then they asked to give their degree of agreement on each possible factor. A mean and standard deviation were performed to examine the significance of differences in the respondents' opinion.

In interview, the researcher asked a predetermined set of questions, using the same wording and order of questions as specified in the interview schedule attached in appendix. The public perception collected through interview for different group of people using Addis Ababa - Adama toll road was used to determine perception of road users toward using toll road. The primary data obtained through closed questionnaire were recorded on Likert scale and data obtained through structured interview were recorded in response categories.

Third, the economic benefits of BOT road were evaluated by TTS, VOC and ACS. Saving in travel time was estimated through interviewing drivers using the road for different categories of vehicles. Saving in accident cost of new toll road was estimated by comparing accident trend of Addis Ababa-Adama old free toll and new toll road and changing accident difference to monetary value using accident cost by their severity. Saving in VOC from improved road condition for different categories of vehicles was 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).

Then C/B analysis was undertaken to check profitability of road tolling by financial analysis where the financial benefits are compared with the corresponding costs during the project's life span for applicability of BOT concerning current traffic condition of the country. The cost to be included in the analysis was capital costs that represent cost of planning, design and construction and, estimates of annual expenditure required to maintain and preserve road infrastructure in concession year. The benefits were revenues collected from the vehicles that use the road. Then the total annual revenue was calculated for the past operation years and estimated for forecasted traffic volume and toll rate.

3.2 Data Collection

To determine negative factors and degree of associated risks on BOT performance and implementation, 24 closed questionnaires that respondents from government officials and private companies had to answer with a 5-point Likert scale were conducted.

In order to get insight into road user's attitudes toward implementation of toll road, structured interview of drivers and passengers were also conducted.

Data collection was done through both secondary and primary sources. Secondary data mainly consists of technical documents and annual reports. Traffic and accident data used in financial analysis was based on the data available from the Ethiopian Toll Road enterprise and Ethiopian Roads Authority. In economic benefit analysis, different cost variables were taken from ERA Road Funding Report of January 2003 and ERA cost breakdown analysis, and then adjusted with inflation rate.

3.3 Study Population

In order to address the objectives of the thesis primary data were collected through interview and questionnaires from private contractors, public sector officials and road users. Addis Ababa- Adama road users were the population for the primary data collected through interviews. For data collected through questionnaire, individuals from private road construction companies and public sector officials were the population who are likely to provide best information looking at it from the point of view of professionals.

3.4 Method of Sampling

Both purposive and random sampling techniques were used to achieve the objective of the thesis. In order to collect the primary data from public sector and private companies, the sampling was carried out in two stages. First, the main public sector offices and private companies who believed to have any connection, involvement and local and international experiences in road construction were selected. Then certain number of professionals from each of the public offices and private companies based on researcher's judgment of who can provide the best information to achieve the objectives of the research and have willing to share it were purposively selected. For interviews of road users, SRS technique was taken so that that each element in the population has an equal and independent chance of selection in the sample.

3.5 Size of the Sample

As the main aim of the research is to explore the diversity of ideas and identify attitudes of stakeholders on implementation and performance of BOT roads in Ethiopia, sample size and sampling strategy do not play a significant role in the selection of a sample. Therefore, the researcher believes, if selected carefully, diversity of idea can be and extensively described based on information obtained from 80 professionals from both public officials and private companies. Also for qualitative analysis from road user's interview, the researcher collected data until he thought he had enough information and attained the saturation point in data collection. Having this in mind, 45 drivers from different vehicle class and 30 passengers were selected for interview.

3.6 Variables of the Study

Stakeholders view, road users Attitude, travel time, vehicle operating cost, traffic volumes, toll charge, traffic accidents and other factors that may affect the performance and implementation of BOT road were independent variables and BOT road was the dependent variable.

3.7 Data Presentation and Analysis

The answers to questionnaire have based on the Likert-scale of five ordinal measures of agreement towards each statement from one to five. Descriptive statistics method was used to analyze the responses in actual numbers. The mean scores and standard deviation were presented in forms of tables. Numerical values are computed in financial and economic analysis. Percentages were also used to express the findings as a proportion of the whole for results of interview.

Based on the nature and purpose of the research; text, tables, numerical values and bar chart and combination of them were used to communicate the findings of the research and presenting analyzed data.

3.8 Study Location for Case Study

The study location lies between Longitudes of ($38^0$49’6.01’’- $39^0$18’39.7’’) and Latitudes of ($8^0$51’38.89’’- $8^0$33’02.8’’).

Figure 3-1: Location map of Addis Ababa – Adama toll road (source: Google maps).

4. RESULTS AND DISCUSSION

4.1 Identification of Factors Hindering Implementation of BOT Scheme Road Franchising.

Assessment of private contractors and public agencies perception toward implementation and performance of BOT contract was the first part of the study. The information gathered from these groups was used to address important issues and concerns. The assessment also provides insight into the public agencies and private contractors perception of the concept.

The assessment was made by preparing questions related to specific stakeholder. The stakeholders were asked a series of questions pertaining to factors that affect implementation and performance of BOT scheme for road infrastructure in Ethiopia. The stakeholders were then asked to give their opinions through questionnaire contained twenty four issues(see appendix A) considered as hindering factors on 5 - point Likert scale items in general standing from the professional concept and experience of Addis Ababa-Adama toll road which is under public sector tolling.

Stake Holder Contacted

A total of 80 peoples from five stakeholders were approached, which are listed below.

1. Ethiopian Roads Authority (10 person).
2. Ethiopian Toll Roads Enterprise (10 people).
3. Addis Ababa City Roads Authority (10 peoples).
4. Oromia Roads Authority (10 peoples).
5. Local And International Private Contractors (40 people).

Respondents' Background

Table 4.1 summarizes background statistics of the participants who took part in the questionnaire survey. The table reveals that the majority of the participants (88.75 percent) were Ethiopians and the rest (11.25 percent) were Non-Ethiopians. The majority of the participants (78.75 percent) were male and (21.25 percent) were female.

Table 4.1: Informational background about the respondents

Characteristics	Frequency	Percent
1) Type of participant		
a) private contractors	40	50
b) Government officials	40	50
2) Nationality		
a) Ethiopian	71	88.75
b) Non-Ethiopian	9	11.25
3) Gender		
a) Male	63	78.75
b) Female	17	21.25
4) Level of education		
a) Diploma	9	11.25
b) University Degree	55	68.75
c) Master level	12	15
d) More than master degree	4	5
5) Participant age		
a) Less than 25 year old	6	7.5
b) From 25 to 35 year old	49	61.25
c) From 35 to 50 year old	25	31.25
d) More than 50 year old	0	0
6) Participant experience		
a) Less than 5 years	13	16.25
b) From 5 to 10 years	36	45
c) From 10 to 20 years	28	35
d) More than 20 years	3	3.75

It is worth to be mentioned that previous studies such as Askar and Gab-Allah (2002) in Egypt, Ismail (2013) in Malaysia, Lu et al. (2003) in Taiwan, Karmperis et al. (2012) in Greece and Yusof and Salami (2013) in Iran have used this scale. The complete list of the questions was attached in Appendix A1.

This finding was confirmed by mean and standard deviation. The result of the analysis was reported in Table 4.2.

Table 4.2: Significance rankings of the possible hindering factors according to party's degree of agreement

	Private companies (N=40)			Government Officials (N=40)			
Factor	Mean	S.D	Rank	Mean	S.D	Rank	**Sig.**
Absence of legislation dealing with BOT	4.35	0.7	1	3.4	0.81	4	0.89
Market risk	4.3	0.69	2	3.75	0.59	10	0.36
Unsound Macro Economic Stability	4.25	0.67	3	3.2	0.94	19	0.87
Unstable political situation	4.2	0.72	4	4.3	0.65	3	0.67
Unavailability of Equity	4.15	0.70	5	3.6	0.55	11	0.37
Project Identification Problem	4.13	0.72	6	3.4	0.81	15	0.69
Lack of public sector awareness of BOT concept	4.1	0.71	7	4	0.60	7	0.83
Lack of financing experience in BOT projects	4	0.72	8	4.45	0.64	1	0.30
Unattractive financial package	3.85	0.74	9	3.5	0.72	12	0.55
Lack of Society awareness of Toll Road/ BOT concept	3.85	0.83	10	4.2	0.69	5	0.66
Lack of favorable management and control	3.85	0.8	11	4.4	0.55	2	0.86
Lack of Foreign Investment Law	3.7	0.72	12	3.85	0.66	9	0.10
Limited capital markets	3.68	0.53	13	3.5	0.6	13	0.14
Lack of Local contractors experienced in BOT	3.6	0.84	14	4.05	0.75	6	0.80
Unavailability of Cheap Labor and International Work Force	3.55	1.11	15	3.1	0.81	21	0.68
Lack of Strong Government Commitment	3.45	0.93	16	2.85	0.74	23	0.6
Lack of Demand for Infrastructure Project	3.48	0.72	17	3.9	0.62	8	0.73
Lack of Tax Reduction	3.35	1.02	18	3.15	0.86	20	0.55
Unavailability of Financial market	3.35	0.62	19	2.85	0.62	24	0.75
Unstable and Not Free Convertible currency	3.3	0.91	20	3.25	0.71	18	0.10
Unavailability of Large and Experienced Local Construction organization	3.3	0.62	21	3.35	0.62	16	0.88
Lack of independent regulatory body	3.3	0.65	22	2.9	0.6	22	0.16
Lack of Utilizing local company in Project Company	3.1	0.66	23	3.35	0.53	17	0.47
Quality control and supervision problem	2.35	1.00	24	3.5	0.78	14	0.78

a) Findings

As stated before, Twenty four negative factors have been considered to recognize participants' views in these two groups, including 40 government officials and 40 from private companies. From the analysis, absence of legislation dealing with BOT was one of the main determinants for BOT implementation which was consistent with the result reached by Yusof and Salami (2013).

The mean scores obtained from private companies to Absence of legislation dealing with BOT, Market risk, unsound macroeconomic stability, unstable political situation, unavailability of equity, Project Identification Problem, Luck of public sector awareness of BOT concept and Lack of financing experience in BOT projects were greater than 4.0. This indicates that these eight factors are the most important factors in view of contractors/concessionaires to participate in BOT contract. One of the indicators related to this analysis is that political stability in Ethiopia played an important role in determining the economic system.

Table 4.2 also shows that Lack of financing experience in BOT projects, Lack of management and control, unstable political situation, Absence of legislation dealing with BOT, Lack of Society awareness of Toll Road/ BOT concept and Lack of Local contractors experienced in BOT contract are hindering factors from government official's perspective. The above table also shows that quality control and supervision problem and lack of independent regulatory body are less important to private companies.

In short, there was an agreement between two parties' government officials and private companies/concessionaires about the significant role of unstable political situation, Lack of financing experience in BOT projects and absence of legislation dealing with BOT as a hindering factor. However, there is a disagreement between the two parties towards project identification problem, market risk and Macro Economic Stability. While government officials give less value to project identification problem and Economic Stability, private contractors consider them as a main hindering factor.

4.2 Assessment of Road Users and Drivers Perception toward using Toll Road

A case study of Addis Ababa-Adama toll road was used in this thesis to illustrate the proposed procedures of the research approach. More specifically, interviewees were asked for their opinions on using BOT scheme for road infrastructure from their view of Addis Ababa–Adama Toll Road in particular.

Assessment of passenger and drivers attitudes toward using toll road provides to get insight into implementation BOT scheme road. That means, the information gathered from these groups was used to provide insight into the public acceptance of the concept.

A total of 45 drivers with (15 car drivers, 15 passenger car drivers, and 15 commercial truck drivers) and, 30 passengers (15 female and 15 male) who were using the toll road were interviewed. The contents of the interview for road users and drivers were listed in Appendix D & E respectively.

4.2.1 Drivers Perception toward using Toll Road

a) Interview Procedures: The small car drivers were interviewed at Adama town using a chance where entering the toll road; while passenger car drivers were interviewed in Adama bus station while they were queuing to accommodate passengers.

Also the location of interview for truck drivers was selected at Adama town, during the truck stop for a break. The content of the whole questions of the interview was attached in Appendix D, and results of the responses as presented below.

Table 4.3: Analysis of driver's interview

No.	Interview questions		Small car (15 peoples)	Passenger car (15 peoples)	Commercial truck (15 peoples)
1	How do you describe the traffic congestion and condition of the toll road?	Good (%)	80	93.3	73.3
		Fair (%)	20	6.6	26.6
		Poor (%)	0	0	0
2	How long on average does it take you to travel between Addis Ababa and Adama on old road?	Time range	80-100 min	105-125	120-160 min
		Average	90 min	115 min	140 min
3	How long on average does it take you to travel between Addis Ababa and Adama on toll road?	Time range	40-50 min	50-60 min	60-80 min
		Average	45 min	55 min	70 min
4	Are you using toll road with service charge taking in to consideration that condition of the road increase the speed of your driving?	Yes (No.)	15	15	15
		%	100	100	100
5	Do you think the condition of the toll road and its geometrical features reduce your vehicle operating cost?	Yes (No.)	11	7	6
		%	73.3	46.6	40
6	Have you ever disappointed by the delay due to traffic congestion or missed any scheduled business/task using the old toll free road?	Yes	10	6	3
		%	66.6	40	20
7	Do you think the condition of the toll road and its geometrical features reduce opportunities for accident occurrence?	Yes (No.)	6	9	7
		%	40	60	46.6
8	For the transport service on the toll road, do you think service charge for the toll road is the fair price?	Yes (No.)	8	11	10
		%	53.3	73.3	66.6
9	What is your attitude toward paying service charge for toll road?	Accept	13	10	12
		%	86.6	66.6	80

b) Findings:

From the driver's interview, tolling of the road is almost acceptable at current toll price. More than 86 % of small Car drivers, 66 % of passenger car drivers and 80 % truck drivers have positive attitudes toward the tolling of the road. All drivers using toll road know that condition of the road increase the speed of their driving and only 48.8% of the drivers thought the condition of the toll road and its geometrical features reduce opportunities for accident occurrence. More than 50 % of the drivers thought service charge for the toll road is fair price. 53.3 % of interviewed drivers thought that the condition of the toll road and its geometric features reduce their vehicle operating cost. This implies their knowledge gap on relationship between road condition and vehicle operating cost. Only few respondents mentioned that they use the existing toll-free road to avoid toll charge. They stated that the current toll price is fair; instead they use the old free toll road due to the fact that the road almost has fair road condition and traffic condition. Only 35.6% of the drivers responded the price of the toll road is not fair. In general respondents have positive view toward tolling principle.

4.2.2 Passenger Perception toward using Toll Road

a) Interview Procedures

The survey was conducted at Adama Bus Station while they are waiting for transport to Addis Ababa. Interviewed peoples were randomly selected and interviewed with questions which give reflection on using toll road. 30 passengers (15 female and 15 male) were interviewed.

Table 4.4: Analysis of passenger's interview

No.	Interview questions	Response			
			Yes	No	No idea
1	Do you think the condition of the toll road and its geometrical features reduce the time to reach your destination?	No.	30	0	0
		%	100	0	0
2	Are you using toll road with service charge taking in to consideration that condition of the road reduces opportunities for accident occurrence?	No.	15	8	7
		%	50	26.6	23.3
3	Have you ever disappointed by the delay due to traffic congestion or missed any scheduled business/task using the old road?	No.	15	9	6
		%	50	30	20
4	For the transport service on the toll road, do you think service charge for toll road is the fair price?	No.	20	6	4
		%	66.66	20	13.3
5	Do you accept the mechanism of paying service charge for using improved road?	No.	23	7	0
		%	76.6	23.3	0

b) Findings:

From the respondents view, most of the general population has positive view toward toll road with better road condition. The respondent generally expressed the current transport fee is fair comparing with the condition of toll road. Findings of the public opinion survey were summarized below.

- 76.6 % of the respondent accepts the mechanism of paying service charge for using improved road.
- 66.66 % of the general respondent thinks service charge for toll road is the fair price.
- Only 26.6% of the respondents think that condition of the road reduces opportunities for accident occurrence and this implies they are using toll road to reduce journey time and for comfort.
- Respondents are almost as favorable toward tolling and believe a tolled Addis Ababa – Adama road reduce their journey time.

- The majority of the respondents are enjoying the benefits of Addis Ababa– Adama toll road.
- People in the region are almost positive with the toll road system.
- Only 20 % of the surveyed people were negatively accepted the toll system with the current price.

4.3 Evaluation of Potential Benefits of BOT Scheme Road Infrastructure

Since there is no BOT road which is under private concessionaire in Ethiopia, again a case study of Addis Ababa-Adama toll road was used in this thesis to illustrate the proposed procedures of the research approach.

4.3.1 Savings in Travel Time

The researcher adopts the VOT ranges based on average hourly wages as recommended by the USDOT (17). According to USDOT, for passenger cars, the VOT range, based on the hourly wage, is assumed to be between 80% and 120% of the average hourly wage within peak period, and between 35% and 60% of the average hourly wage within off-peak periods, respectively.

For this study, 100% of the average hourly wage was used. Thus, the total time difference between a given OD pair can be calculated by the time loss of one driver along the route, multiplied by total traffic volume (*Q*). And the average value of time (VOT) was used to calculate saving from travel time between different route of different road condition. 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 toll road, however such data could not be obtained as most of the interviewee were not willing to respond for such question.

The Estimated Hourly Rate was assumed for the average of working time and non-working time by estimating the monthly income of passengers for each category of vehicle. Table 4.5 below shows the anticipated savings for each category of vehicle as a result of using the toll road.

The delay in travel time was estimated only for the delay anticipated due to traffic congestion and road geometric condition. The delay due to road deterioration was considered with saving in vehicle operating costs.

Table 4.5: 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
1	Car	6,512.00	208	31.30	31
2	Land Rover	3,256.00	192	16.95	17
3	Small Bus	1,628.00	208	7.826	8
4	Large Bus	651.2	208	3.130	3
5	Small Truck	976.8	208	4.696	5
6	Medium Truck	1302.4	208	6.261	6
7	Heavy Truck	1,628.00	208	7.826	8
8	Truck Trailer	1,628.00	208	7.826	8

The average travel time for the old road and new toll road was estimated from interview survey to road users and drivers. Then, the average of difference of travel time between the old free road and new toll road for different types of vehicle was estimated from interview surveys of drivers and used to determine saving from travel time.

Table 4.6: Travel time savings of the project for the past four operation years of the toll road

No.	Vehicle Type	Wage rate taken for analysis[ETB]/Hr.	Average no of passenger Per vehicle	Estimated Hourly Vehicle Rate [ETB]/Hr.	Time saved for vehicle type	Total numbers of vehicles in years				Total saving in four years[ETB] in NPV
						2014/15	2015/16	2016/17	2017/18	
1	Car	31	2	30	0.75 Hr.	249828	327899	413153	437942	112771684
2	Land Rover	17	3	50	0.75 Hr.	438591	604434	839649	890028	239404901
3	Small Bus	8	12	65	0.75 Hr.	452133	623096	865573	917508	422730679
4	Large Bus	3	50	250	1 Hr.	323872	446336	620027	657229	933519756
5	Small Truck	5	2	130	1.16 Hr.	404354	557251	774105	820551	473193181
6	Medium Truck	6	2	160	1.16 Hr.	487640	698610	909580	964155	696663611
7	Large truck	8	2	250	1.16 Hr.	481413	663447	921628	976926	1070404477
8	Truck Trailer	8	3	325	1.16 Hr.	564604	778095	108089	1145744	1647091314
	Total					3402435	469916	642460	6810082	5595779604

Due to improved road condition and reduction in length under the project, net TTC savings can reasonably be expected in the project case. As shown in Table 4.6, net discounted estimate of TTC savings in the past four of operation was ETB **5,595,779,604.** Thus, a new toll road provides savings in travel time for road users in addition to being a revenue stream for the operator. The proportion of savings in travel time received by road users is passed on to the operator in the form of the toll payment. In theory, the monetary value of the savings in travel time is equal to the toll price. This represents a transfer payment of the benefit.

4.3.2 Accident Costs Savings

In order to align the cost estimates based on the accident types available in accident database, the researcher regroup accident types in FHWA (27) into fatality/death, serious injury, light injury (incapacitating) and property damage accidents. The accident cost functions are based on unit accident cost for each accident type.

Accident cost estimation is not exact, it can only be approximated. The studies in the relevant literature show varying unit costs for accidents.

A NHTSA study reports the lifetime economic cost of each fatality and over 80% of this amount is attributable to lost workplace and household productivity. For accident cost estimation in this study, the researcher used IRAP (2009), The True Cost of Road Crashes: Valuing Life and the Cost of a Serious Injury, and estimate accident costs of light injury and property damage by relating to study conducted by AASHTO for accident costs by severity.

Table 4.7: IRAP Economic appraisal model values

	Lower	**Central**	Upper
Value of Fatality	60*GDP/Capita	70*GDP/Capita	80*GDP/Capita
Value of Serious Injury (VSI)	12*GDP/Capita (20% VSL)	17*GDP/Capita (24% VSL)	24*GDP/Capita (30% VSL)
Value of light Injury (VLI)	1.59*GDP/Capita	1.86*GDP/Capita	2.12*GDP/Capita
Value of property damage	0.15*GDP/Capita	0.18*GDP/Capita	0.2*GDP/Capita

This table summarizes the International Road Assessment Programs recommendations for estimating the monetized value of traffic crash deaths and serious injuries.

Table 4.8: Average cost by accident type

Accident Type	Cost estimate based on GDP/Capita	GDP/Capita	Estimate of Cost in birr
Fatality	70*GDP/Capita	262.69	515756.9
Major Injury	17*GDP/Capita	262.69	125255.2
Minor Injury	1.86*GDP/Capita	262.69	13704.4
Property Damage	0.18*GDP/Capita	262.69	1326.232

The accident trend of Eastern Shoa Zone which mainly includes the Addis Ababa – Adama road was indicated in the following Tables 4.9 and 4.10.

Table 4.9: Accident trend of Addis Ababa - Adama old road per year for the past four operation year.

No.	Accident level	**2014/15**	**2015/16**	**2016/17**	**2017/18**
1	Death	38	40	45	42
2	Serious injury	31	34	33	36
3	Light injury	29	31	32	30
4	Property damage	132	142	137	159

Table 4.10: Accident trend of Addis Ababa-Adama toll road per year for the past four operation year

No.	Accident level	**2014/15**	**2015/16**	**2016/17**	**2017/18**
1	Death	26	19	15	34
2	Serious injury	50	41	27	80
3	Light injury	99	114	73	139
4	Property damage	163	106	76	142

Although the construction of the expressway is expected to reduce total crash rates, increase in crash rate occurred on the new toll road and therefore total casualties. But the new toll road has lower crash severity as observed in Table 4. 11. The new toll road was expected to reduce risk to pedestrians but higher serious and light injury was recorded on the new toll road. The results were presented as a difference in the number of crashes on both facilities per year.

Table 4.11: Accident cost saving of project benefits breakdown (Discount rate 6%)

		Difference in accident				Accident Cost	Saving in ETB
No	Accident type	2014/15	2015/16	2016/17	2017/18		
1	Death	12	21	30	8	515756.9	36618739.9
2	Serious injury	-29	-7	6	-44	125255.2	-9268884.8
3	Light injury	-70	-83	-41	-109	13704.4	-4152433.2
4	Property damage	-31	36	61	17	1326.232	110077.256
	Total in four year						23,307,499

Accident cost savings in this project in the first four year of operation was estimated to be ETB 23,307,499.

4.3.3 Saving in Vehicle Operating Costs

A research made by the World Bank to develop fundamental relational links between the VOC and road condition shows that roughness's a dominant effect of road condition on vehicle operation costs. According to study made by World Bank, road roughness affects VOC as indicated in Table 4. 12.

Table 4.12: Relationship between road roughness and VOC

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 2 m/km was estimated as indicated in the following Table 4:13.

Table 4.13: Estimate VOC for smooth paved roads with IRI of 2m/km

No	Vehicle type	Value of Import [ETB]	Total Mileage [Km]	Own. Cost [ETB/ Km	Inv. Cost [ETB/ Km]	Total Own. Cost [ETB/ Km]	Fuel Cons. [lit/K m]	Fuel Cost [ETB/ km]	Oil & Lub. Cost [ETB/ Km]	Maint. & Rep. Cost [ETB/ Km]	Tyre Cost [ETB /k]	Total VOC [ETB/ Km]
1	Car	721,986	89,798	8.04	2.01	10.0	0.10	1.82	0.18	8.04	2.0	22.1
2	Land Rover	2,145,329	263,164	8.15	2.04	10.1	0.12	2.15	0.21	8.15	2.0	22.7
3	Small bus	783,870	192,547	4.07	1.02	5.09	0.13	2.15	0.21	4.07	1.0	12.5
4	Large bus	3,444,904	487,399	7.07	1.77	8.83	0.3	4.79	0.48	7.07	1.7	22.9
5	Small truck	1,712,138	139,019	12.3	3.08	15.3	0.27	4.13	0.41	12.32	3.0	35.3
6	Medium truck	3,754,326	255,391	14.7	3.68	18.3	0.33	4.95	0.5	14.70	3.6	42.1
7	Large truck	6,497,872	473,780	13.7	3.43	17.1	0.37	5.78	0.58	13.71	3.4	40.6
8	Truck trailer	4,870,539	662,299	7.35	1.84	9.19	0.53	8.25	0.83	7.35	3.3	28.9

N.B. *

- Value of Import and Total Mileage, was taken from ERA Road Funding Report, January 2003 and adjusting with the current inflation rate and Fuel cost was taken from The Ethiopian Ministry of Trade and Industry, where Oil, Lubricant and tyre cost was taken from ERA Cost Breakdown Analysis Manual.

For the toll road project, there were improvements in road surface roughness and vehicle fleet operating speeds, as well as the removal of a hilly, curvy and historically dangerous route. The old toll-free road will continue under the administration of ERA and its condition will continue with the current fair condition. The saving in vehicle operation costs due to improved road condition (roughness) can be calculated as shown in the following Table 4-14.

Table 4.14: Vehicle operating costs project benefits breakdown for the past four operation years of the toll road.

No	Vehicle type	VOC per Km [ETB/ Km]	Total VOC for 84.5 Km[ETB	Additional Exp. Due to roughness [%]	No. of vehicles per year				Total Saving in VOC[ETB]
					2014/15	2015/16	2016/17	2017/18	
1	Car	22.1	1868.0	6%	249828	32789	413152	437942	183186357
2	Land Rover	22.7	1919.7	6%	438591	60443	839648	890027	242693702
3	Small bus	12.55	1060.5	4%	452133	62309	865573	917507	138217021
4	Large bus	22.94	1938.2	4%	323872	44633	620027	657229	180938156
5	Small truck	35.34	2986.6	11%	404354	55725	774104	820551	957257005
6	Medium truck	42.19	3565.3	11%	487640	69861	909580	964154	1369385289
7	Large truck	40.63	3433.5	14%	481413	66344	921627	976925	1667554484
8	Truck trailer	28.93	2444.3	12%	564604	77809	1080890	1145743	1392265600
	Total								6131497613

Vehicle operating cost savings in this project in the first four year of operation was estimated to be ETB **6,131,497,613.**

The impact of toll roads and subsequently double counting was approached differently in the economic and financial evaluation. Generally a financial evaluation for concessionary include the toll revenue as a positive cash flow and include the relevant costs (capital, operation and taxes) as a negative flow to determine the net cash flow. In this way the inclusion of toll road impacts in the financial evaluation is relatively simple.

In an economic evaluation, toll revenue was generally excluded from the analysis to avoid double counting when toll road is operated under public agency. However, the impact of tolling can be measured in the economic evaluation through the infrastructure usage and demand for the road through comparisons of the 'with' and 'without' tolling scenario. But in this study, since BOT road is always through private concessionaire, both economic evaluation and financial analysis undertaken.

4.4 Cost Benefit Analysis

Financial analysis of Addis Ababa - Adama toll road project is used to evaluate financial profitability and applicability of this scheme of road in Ethiopia considering current traffic condition of the country. The cost benefit analysis of BOT scheme of road is a method to organize a project's relevant financial flows such as project outlays, receipts, and expenditures in comprehensive details on a yearly basis based on the discounted cash flow approach during the project life time. First the project's construction cost in real values and inflation over the life cycle of the project were determined. Operation and maintenance costs were estimated and revenues are calculated and NPV (Net Present Value) of the project was determined.

4.4.1 The Cost of Construction

The cost of construction and other costs related to initial investment like 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 were obtained from ERA. Hence, the total construction cost and other related investment is obtained from Ethiopian Road Authority and it was 11.2 billion ETB.

4.4.2 Maintenance, Operation and Expansion Costs

Construction of the road and other facilities was completed; the road is in operation phase for the past five years. During its operation period there are different costs all over the operation period till the end of the design period (concession period). The following assumptions and estimates were taken from ETRE.

According to information obtained from ETRE, Routine maintenance was made every year for the whole road length and other facilities. Annual cost of ETB 100,000.00 per Km was used at first operation year of the project for Routine maintenance, which was increasing yearly at an average escalation rate of 5-8 %.

Again according to information obtained from ETRE Periodic maintenance will be made every five year for the whole road length and other facilities and ETB 500,000.00 per Km was 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 made, routine maintenance will not be required.

Average annual cost of ETB 5 mil was used in the first operation year of the road for management and toll collection expenses, which was increasing yearly at an average escalation rate of 5-7 %.

4.4.3 Revenue from Toll Charge

It was discussed above that the Road Fund Administration Office is collecting toll charge from toll road as a revenue source. Small and medium vehicles pay 66 cents per kilometer, while large buses and trucks pay 79 cents per kilometer and Heavy trailers and semi-trailers pay 92 cents per kilometer. To avoid bulky calculation, instead of computing revenue per vehicle class let us take average of 0.79 ETB per km and ETB 66.913 for the whole 84.7 km. From this, the amount of toll revenue for the past four year was determined from traffic volume of the toll road with respective toll charge. For coming 16 years, increase of 6 % per year for AADT and toll charge was estimated and in twenty years details of project cash inflow and outflow was summarized in the following table.

Table 4.15: Determination of project cash flow

Year	Cash outflow	Cash inflow(toll revenue)	Net cash flow	NPV[ETB]
0	11,200,000,000	0	-11,200,000,000	-14,988,126,469
1	13,470,000	120,405,150	106,935,150	135,003,163
2	14,278,200	142,315,456	128,037,256	152,494,420
3	15,134,892	156,689,713	141,554,821	159,050,997
4	16,042,986	275,589,681	259,546,695	275,119,497
5	49,041,128	309,652,566	260,611,438	260,611,438
6	18,025,899	347,925,623	329,899,724	311,226,155
7	19,107,452	390,929,230	371,821,777	330,920,058
8	20,253,900	439,248,082	418,994,183	351,795,595
9	21,469,134	493,539,145	472,070,012	373,923,665
10	65,628,092	554,540,584	488,912,492	365,343,856
11	24,122,718	623,081,800	598,959,081	422,242,518
12	25,570,082	700,094,710	674,524,629	448,597,403
13	27,104,286	786,626,417	759,522,130	476,533,581
14	28,730,544	883,853,442	855,122,898	506,145,929
15	87,825,191	993,097,727	905,272,536	505,499,456
16	30,454,376	1,115,844,606	1,085,390,230	571,770,033
17	32,281,639	1,253,763,000	1,221,481,361	607,038,814
18	34,218,537	1,408,728,106	1,374,509,569	644,423,722
19	36,271,649	1,582,846,900	1,546,575,251	684,051,725
20		1,778,486,777	1,778,486,777	742,100,393
TOTAL			2,578,228,010	-6,664,234,050

This indicates that if private concessionaire operates the road for 20 years (design period of the road) it will not be benefited from the project with the current traffic condition of the road and the deficit will be ETB **-6,664,234,050** assuming 6 % increase in traffic volume and toll tariff.

4.4.4 Operational analysis of the old and toll road

For old road, LOS is LOS E. (appendix H). According to HCM maximum service volume of the road for 120 Km/hr. FFS in rural area is 2160. And the flow rate in one direction for the toll road under study is 1345 (appendix G.). This implies the tolled is operating below its capacity and the old toll free road is serving above its capacity.

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

In this study, an attempt was made to assess implementation of BOT road projects in Ethiopia from the public and private partners view and identification of road user's attitude toward BOT implementation through toll road. The study also contains evaluation of economic benefit and financial analysis of Addis Ababa-Adama toll road project for demonstration of BOT road project.

From the analysis, Privatization policy factors like legislation dealing with BOT infrastructure project, Economic and financial factors like market risk, sound macro-economic stability and availability of equity, stable political situation, Lack of public sector awareness of BOT concept and financing experience in BOT infrastructure are the most important factors to implement this scheme in Ethiopia from private company's perspective. From government official's perspective lack of financing experience in BOT, legislation dealing with BOT, Lack of Society awareness of Toll Road/ BOT concept, unfavorable project management, and unstable political situation were considered as the most hindering factors.

Public officials and private companies have different ideas on significant role of economic stability, market risk and project identification. Since concessionaires/private contractor depend upon revenues to pay for operating cost and cover debt financing, market risk (traffic volume) which can generate enough revenue was the most important factors in view of the concessionaires. In assessing the obstacles for the application of BOT in Ethiopia, lack of adequate awareness among public and society regarding the BOT concept also played significant impediment in the way of adopting BOT.

There is willingness toward road tolling principle for better and improved road condition. But significant percent of the respondents do not know economic benefit like saving from TT, VOC and AC which could be obtained when better road with improved road surface, geometric condition and reduced traffic congestion was provided.

This implies their knowledge gap on relationship between road condition and vehicle operating cost, travel time and accident. Generally tolling of road is almost acceptable with current toll price by more than half of the respondents.

From analysis of economic benefit of the toll road due to improved road condition there was an estimate of saving in travel time of ETB **5,595,779,604** in four years of operation. Taking average of this and assuming 6 % increase in road traffic, in 20 years of operation the toll road will have an estimate of ETB **27,978,898,021** saving in travel time. Saving in VOC is about ETB **6,131,497,613** in four years of operation. Assuming 6 % increase in road traffic, the toll road will have an estimate of ETB **30,657,488,064** saving in vehicle operating cost in 20 years of operation. There was also Accident cost savings in the project in the past four year of operation was estimated to be ETB **23,307,499.**

The toll road is performing below its capacity and only around 62 % of the total traffic is using the toll road. In twenty years of operation the estimate of total cost in NPV exceeds revenue obtained from toll charge by ETB **6,664,234,050** assuming 6 % increase in traffic volume and toll tariff. This indicates that if it was a private concessionaire who operates the toll road, it will not be benefited from the project with current traffic demand and established toll tariff. Low traffic/service volumes (demand risk) characterize most of our roads. This may inevitably result in most of road projects being not commercially viable.

5.2 Recommendations

The following recommendations toward the successful implementation of BOT road in Ethiopia are forwarded.

- BOT privatization policy and legal framework have to be established with the intention to protect and guide investors, the government and users tailored for BOT projects. This requires special legislation to be enacted for BOT projects or amendment of the existing legislation.

- For successful implementation of BOT strategy, a credible and efficient administrative framework has to be ensured. This may be explored through organizational set up, and experience and procedures of the procuring administrative entity. Government may wish to engage a specially trained team from either civil service and/or local consultant to accomplish this.
- Creation of awareness among all stakeholders is an important preparatory measure. Seminars, campaigns and other deliberate efforts to educate the public and society on BOT concepts and their effects are inevitable if smooth adoption and implementation of the model by the public is required.
- Creation of awareness of society to use toll road taking into account the economic benefit obtained from it was required. In addition if private concessionaire is to be involved in road construction and operation, road capacity which balances traffic demand at certain toll charge should be built. Otherwise, private public partnership will be the best solution.
- To sum up, BOT concept in a fairly well defined legal and institutional environment is needed for stimulating investments and promoting privatization of road infrastructure.
- It will be good for the government to implement BOT contract scheme for congested and deteriorated road in the country with relatively similar AADT, but a more narrow study is needed to investigate a road network that may require the applicability of BOT.

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APPENDICES

Appendix A. Questions to government officer's and private sectors

Possible negative factors affecting adoption and performance of BOT scheme of road in Ethiopia

1. Project Identification Problem
2. Unsound Macro Economic Stability
3. Market risk
4. Absence or Unfavorable of legislation dealing with BOT
5. Unstable political situation
6. Unavailability of Equity
7. Lack of favorable management and control
8. Lack of financing experience in BOT projects
9. Unattractive financial package
10. Lack of Society awareness of Toll Road/ BOT concept
11. Lack of public sector awareness of BOT concept
12. Lack of Demand for Infrastructure Project
13. Limited capital markets
14. Lack of Local contractors experienced in BOT
15. Unavailability of Cheap Labor and International Work Force
16. Lack of Strong Government Commitment
17. Lack of Foreign Investment Law
18. Lack of Tax Reduction
19. Unavailability of Financial market
20. Unstable and Not Free Convertible currency
21. Unavailability of Large and Experienced Local Const. organization
22. Lack of independent regulatory body
23. Lack of Utilizing local company in Project Company
24. Quality control and supervision problem

Appendix B. Private companies degree of agreement on identified possible factors

	Unsound Macro Economic Stability	Unstable political situation	Unavailability of Equity	Lack of public sector awareness	Unattractive financial packag	Market risk	Lack of Society awareness of Toll	Lack of favorable management and	Lack of Demand for Infrastructure Proje	Limited capital markets	Lack of Local contractors experienc	Lack of financing experience in BOT proje	Project Identification Problem	Unavailability of Cheap Labor and Internatio	Lack of Strong Government Commitm	Lack of Foreign Investment Law	Lack of Tax Reduction	Unavailability of Financial market	Unstable and Not Free Convertible curre	Lack of independent regulatory bod	Absence or Unfavorable of legislation	Unavailability of Large and Experienced Local	Lack of Utilizing local company in Proj	Quality control and supervision prob
1	4.00	5.00	4.00	5.00	4.00	4.00	4.00	5.00	3.00	3.00	3.00	5.00	5.00	4.00	4.00	5.00	2.00	3.00	3.00	3.00	5.00	3.00	3.00	3.00
2	5.00	3.00	4.00	3.00	3.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00	3.00	4.00	4.00	2.00	5.00	4.00	5.00	2.00	4.00	1.00
3	3.00	4.00	5.00	5.00	3.00	4.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	5.00	4.00	4.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
4	5.00	5.00	5.00	3.00	3.00	5.00	4.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00	5.00	3.00	3.00	5.00
5	4.00	4.00	3.00	5.00	4.00	4.00	4.00	4.00	3.00	3.00	3.00	5.00	4.00	4.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	1.00
6	4.00	5.00	5.00	3.00	3.00	5.00	5.00	5.00	3.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	2.00	3.00	5.00	3.00	3.00	3.00
7	4.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	4.00	4.00	4.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	3.00	3.00	2.00
8	4.00	3.00	3.00	5.00	5.00	3.00	4.00	3.00	3.00	3.00	4.00	4.00	3.00	6.00	4.00	4.00	4.00	4.00	1.00	2.00	4.00	4.00	2.00	3.00
9	5.00	4.00	4.00	4.00	4.00	5.00	3.00	3.00	4.00	4.00	3.00	3.00	4.00	5.00	5.00	5.00	5.00	3.00	5.00	4.00	5.00	4.00	4.00	3.00
10	3.00	3.00	4.00	4.00	3.00	3.00	4.00	4.00	4.00	4.00	5.00	4.00	3.00	4.00	4.00	4.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	5.00
11	5.00	4.00	4.00	4.00	4.00	5.00	3.00	4.00	2.00	3.00	3.00	3.00	4.00	2.00	2.00	2.00	2.00	2.00	3.00	3.00	5.00	3.00	3.00	3.00
12	4.00	3.00	3.00	5.00	5.00	5.00	4.00	4.00	3.00	3.00	4.00	4.00	3.00	3.00	3.00	3.00	2.00	2.00	4.00	4.00	4.00	4.00	4.00	1.00
13	4.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	2.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00	2.00
14	3.00	3.00	4.00	4.00	4.00	3.00	3.00	3.00	3.00	4.00	3.00	4.00	3.00	2.00	2.00	3.00	3.00	4.00	3.00	3.00	3.00	3.00	3.00	3.00
15	4.00	4.00	4.00	4.00	4.00	4.00	2.00	2.00	3.00	3.00	2.00	5.00	4.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	2.00
16	4.00	4.00	3.00	5.00	5.00	4.00	5.00	5.00	4.00	4.00	3.00	3.00	4.00	2.00	2.00	2.00	2.00	4.00	3.00	3.00	4.00	3.00	3.00	2.00
17	5.00	5.00	5.00	3.00	3.00	5.00	3.00	3.00	3.00	3.00	4.00	4.00	5.00	3.00	3.00	3.00	3.00	3.00	4.00	4.00	5.00	3.00	3.00	3.00
18	4.00	4.00	4.00	4.00	4.00	4.00	2.00	2.00	4.00	4.00	3.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	2.00	3.00	4.00	4.00	4.00	2.00
19	5.00	5.00	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	3.00	3.00	5.00	1.00	2.00	4.00	2.00	3.00	4.00	4.00	5.00	4.00	4.00	2.00
20	4.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	3.00	3.00	5.00	5.00	4.00	2.00	2.00	4.00	1.00	3.00	2.00	2.00	4.00	2.00	2.00	3.00
21	4.00	5.00	5.00	5.00	5.00	5.00	4.00	4.00	3.00	4.00	4.00	4.00	5.00	5.00	5.00	5.00	3.00	4.00	3.00	3.00	5.00	3.00	3.00	2.00
22	5.00	4.00	4.00	4.00	4.00	5.00	4.00	4.00	2.00	3.00	4.00	4.00	4.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	5.00	3.00	3.00	5.00
23	4.00	5.00	5.00	5.00	3.00	4.00	3.00	3.00	4.00	4.00	2.00	5.00	4.00	3.00	3.00	3.00	3.00	3.00	2.00	2.00	4.00	4.00	4.00	2.00
24	3.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00	3.00	3.00	3.00	2.00
25	4.00	5.00	5.00	4.00	4.00	4.00	5.00	5.00	3.00	3.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00
26	5.00	4.00	4.00	4.00	4.00	5.00	5.00	4.00	3.00	4.00	4.00	4.00	4.00	2.00	2.00	4.00	3.00	3.00	2.00	2.00	5.00	2.00	2.00	2.00
27	4.00	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00	5.00	2.00	2.00	4.00	5.00	3.00	4.00	4.00	4.00	4.00	4.00	2.00
28	4.00	4.00	4.00	4.00	4.00	3.00	3.00	4.00	4.00	4.00	2.00	4.00	4.00	4.00	4.00	3.00	3.00	3.00	5.00	3.00	4.00	4.00	2.00	4.00
29	5.00	5.00	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	3.00	3.00	4.00	2.00	4.00	4.00	3.00	5.00	3.00	3.00	3.00
30	4.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00	4.00	3.00	3.00	2.00
31	3.00	4.00	4.00	3.00	3.00	5.00	3.00	3.00	3.00	4.00	3.00	3.00	4.00	3.00	3.00	3.00	3.00	3.00	2.00	4.00	3.00	4.00	4.00	3.00
32	5.00	5.00	5.00	5.00	3.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	2.00	3.00	4.00	4.00	4.00	3.00	3.00	5.00	3.00	3.00	3.00
33	5.00	5.00	3.00	4.00	4.00	4.00	3.00	3.00	3.00	3.00	4.00	4.00	5.00	5.00	5.00	4.00	3.00	3.00	4.00	4.00	5.00	4.00	4.00	2.00
34	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	3.00	3.00	4.00
35	5.00	3.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	4.00	4.00	1.00	3.00	4.00	4.00	5.00	4.00	4.00	3.00
36	5.00	5.00	5.00	3.00	3.00	4.00	3.00	3.00	4.00	4.00	3.00	3.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	3.00	3.00	2.00
37	4.00	4.00	4.00	4.00	4.00	3.00	5.00	5.00	5.00	4.00	5.00	5.00	4.00	4.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	3.00	3.00	3.00
38	5.00	4.00	4.00	4.00	4.00	5.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	2.00	4.00	4.00	4.00	5.00	4.00	2.00	2.00
39	5.00	5.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	5.00	4.00	3.00	3.00	3.00	3.00	3.00	3.00	5.00	4.00	4.00	2.00
40	4.00	4.00	4.00	4.00	4.00	5.00	5.00	5.00	3.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	5.00	4.00	4.00	4.00	5.00	4.00	3.00	4.00
Mean	**4.25**	**4.20**	**4.15**	**4.10**	**3.88**	**4.30**	**3.85**	**3.85**	**3.43**	**3.68**	**3.60**	**4.00**	**4.13**	**3.55**	**3.45**	**3.70**	**3.20**	**3.35**	**3.30**	**3.30**	**4.35**	**3.35**	**3.23**	**2.35**
SD	**0.67**	**0.72**	**0.70**	**0.71**	**0.69**	**0.69**	**0.83**	**0.80**	**0.71**	**0.53**	**0.84**	**0.72**	**0.72**	**1.11**	**0.93**	**0.72**	**1.02**	**0.62**	**0.91**	**0.65**	**0.70**	**0.62**	**0.66**	**1.00**

Appendix C. Government official degree of agreement on identified possible factors

No	Unsound Macro Economic Stability	Unstable political situation	Unavailability of Equity	Lack of public sector awareness of	Unattractive financial package	Market risk	Lack of Society awareness of Toll Roa	Lack of favorable management and contr	Lack of Demand for Infrastructure Proj	Limited capital markets	Lack of Local contractors experienc	Lack of financing experience in BOT proje	Project Identification Problem	Unavailability of Cheap Labor and Inter	Lack of Strong Government Commit	Lack of Foreign Investment Law	Lack of Tax Reduction	Unavailability of Financial market	Unstable and Not Free Convertible curr	Lack of independent regulatory bod	Absence or Unfavorable of legislation	Unavailability of Large and Experienced Loca	Lack of Utilizing local company in Proj	Quality control and supervision pro
1.00	4.00	4.00	3.00	4.00	2.00	2.00	4.00	5.00	3.00	3.00	5.00	5.00	3.00	3.00	3.00	4.00	4.00	3.00	3.00	3.00	4.00	3.00	3.00	3.00
2.00	4.00	4.00	3.00	4.00	3.00	3.00	5.00	4.00	2.00	4.00	4.00	4.00	4.00	2.00	3.00	4.00	3.00	3.00	2.00	2.00	4.00	2.00	3.00	4.00
3.00	4.00	5.00	4.00	4.00	3.00	2.00	4.00	4.00	3.00	3.00	4.00	5.00	3.00	4.00	3.00	3.00	3.00	4.00	3.00	3.00	3.00	3.00	4.00	3.00
4.00	3.00	4.00	4.00	3.00	3.00	2.00	4.00	5.00	5.00	2.00	5.00	5.00	4.00	4.00	2.00	4.00	4.00	2.00	3.00	3.00	4.00	3.00	3.00	5.00
5.00	4.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00	3.00	5.00	2.00	3.00	3.00	3.00	3.00	3.00	4.00	2.00	4.00	4.00	4.00	2.00
6.00	4.00	3.00	4.00	3.00	3.00	3.00	5.00	5.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00	2.00	3.00	5.00	3.00	3.00	3.00
7.00	3.00	4.00	3.00	4.00	4.00	4.00	4.00	4.00	3.00	2.00	4.00	4.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	3.00	3.00	4.00
8.00	5.00	3.00	3.00	5.00	3.00	4.00	4.00	5.00	3.00	3.00	4.00	5.00	2.00	3.00	4.00	4.00	4.00	2.00	2.00	2.00	3.00	4.00	3.00	3.00
9.00	4.00	5.00	4.00	4.00	4.00	3.00	3.00	4.00	4.00	4.00	5.00	5.00	3.00	4.00	3.00	4.00	2.00	3.00	3.00	4.00	5.00	4.00	4.00	3.00
10.00	3.00	3.00	3.00	4.00	3.00	3.00	4.00	4.00	4.00	4.00	5.00	4.00	3.00	4.00	4.00	4.00	3.00	3.00	4.00	3.00	3.00	3.00	3.00	5.00
11.00	3.00	4.00	4.00	4.00	4.00	3.00	3.00	5.00	4.00	3.00	4.00	3.00	3.00	3.00	2.00	3.00	2.00	3.00	3.00	3.00	4.00	3.00	3.00	3.00
12.00	5.00	4.00	4.00	5.00	2.00	4.00	4.00	4.00	3.00	3.00	4.00	4.00	3.00	3.00	3.00	3.00	2.00	2.00	4.00	4.00	5.00	4.00	4.00	4.00
13.00	4.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	3.00	3.00	5.00	4.00	4.00	4.00	4.00	4.00	2.00	4.00	4.00	3.00	3.00	3.00	2.00
14.00	4.00	4.00	4.00	4.00	4.00	3.00	5.00	5.00	4.00	4.00	3.00	5.00	3.00	3.00	2.00	5.00	3.00	3.00	3.00	3.00	5.00	3.00	3.00	3.00
15.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00	2.00	5.00	4.00	5.00	2.00	4.00	4.00	2.00	4.00	4.00	4.00	4.00	4.00	2.00
16.00	4.00	4.00	3.00	5.00	5.00	3.00	5.00	5.00	4.00	4.00	3.00	3.00	4.00	2.00	2.00	5.00	2.00	4.00	3.00	3.00	4.00	3.00	3.00	4.00
17.00	3.00	5.00	4.00	3.00	3.00	3.00	5.00	5.00	3.00	3.00	4.00	4.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	3.00	5.00	3.00	3.00	3.00
18.00	4.00	5.00	4.00	4.00	4.00	3.00	4.00	4.00	4.00	4.00	5.00	5.00	4.00	2.00	4.00	4.00	4.00	2.00	3.00	3.00	4.00	4.00	4.00	4.00
19.00	5.00	5.00	4.00	3.00	5.00	3.00	4.00	4.00	4.00	4.00	5.00	5.00	3.00	2.00	2.00	4.00	3.00	3.00	4.00	4.00	5.00	4.00	4.00	4.00
20.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	3.00	3.00	5.00	5.00	4.00	2.00	2.00	4.00	2.00	3.00	4.00	3.00	4.00	2.00	2.00	3.00
21.00	4.00	5.00	4.00	4.00	2.00	4.00	4.00	4.00	3.00	4.00	4.00	4.00	2.00	4.00	3.00	5.00	3.00	2.00	3.00	3.00	5.00	3.00	3.00	3.00
22.00	3.00	4.00	3.00	4.00	3.00	3.00	4.00	4.00	2.00	3.00	4.00	4.00	2.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00	3.00	3.00	5.00
23.00	4.00	4.00	4.00	4.00	3.00	2.00	3.00	5.00	4.00	4.00	4.00	5.00	4.00	3.00	3.00	3.00	3.00	3.00	2.00	2.00	4.00	4.00	4.00	4.00
24.00	3.00	4.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	3.00	4.00	3.00	2.00	2.00	4.00	4.00	3.00	3.00	3.00	3.00	3.00	3.00	4.00
25.00	4.00	5.00	4.00	4.00	4.00	4.00	5.00	5.00	3.00	3.00	5.00	5.00	4.00	3.00	3.00	5.00	5.00	4.00	4.00	3.00	5.00	4.00	4.00	3.00
26.00	4.00	4.00	4.00	4.00	4.00	3.00	5.00	4.00	4.00	4.00	4.00	5.00	3.00	2.00	2.00	4.00	3.00	3.00	3.00	2.00	4.00	2.00	3.00	2.00
27.00	4.00	5.00	3.00	3.00	3.00	4.00	5.00	4.00	3.00	3.00	3.00	5.00	4.00	2.00	2.00	4.00	2.00	3.00	4.00	2.00	5.00	4.00	4.00	4.00
28.00	3.00	4.00	4.00	4.00	4.00	1.00	4.00	5.00	3.00	4.00	4.00	4.00	4.00	2.00	4.00	3.00	3.00	3.00	2.00	3.00	4.00	4.00	3.00	4.00
29.00	3.00	5.00	3.00	4.00	3.00	1.00	5.00	4.00	4.00	4.00	4.00	4.00	3.00	3.00	3.00	4.00	2.00	4.00	4.00	3.00	5.00	3.00	3.00	4.00
30.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	3.00	3.00	5.00	3.00	4.00	4.00	2.00	4.00	4.00	2.00	3.00	3.00	4.00	3.00	3.00	4.00
31.00	4.00	4.00	3.00	4.00	4.00	3.00	3.00	5.00	3.00	4.00	3.00	5.00	3.00	3.00	3.00	5.00	3.00	3.00	2.00	2.00	4.00	4.00	4.00	3.00
32.00	3.00	5.00	4.00	5.00	3.00	5.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	2.00	3.00	4.00	4.00	3.00	3.00	3.00	5.00	3.00	3.00	3.00
33.00	4.00	5.00	3.00	5.00	4.00	5.00	5.00	3.00	3.00	3.00	4.00	4.00	3.00	3.00	3.00	4.00	3.00	3.00	4.00	2.00	5.00	4.00	4.00	4.00
34.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	5.00	2.00	3.00	2.00	3.00	3.00	2.00	3.00	3.00	4.00	3.00	3.00	4.00
35.00	4.00	5.00	3.00	3.00	3.00	2.00	4.00	4.00	2.00	3.00	4.00	4.00	5.00	4.00	4.00	4.00	1.00	3.00	4.00	2.00	3.00	4.00	4.00	3.00
36.00	3.00	5.00	3.00	4.00	4.00	2.00	3.00	4.00	3.00	4.00	4.00	5.00	5.00	4.00	2.00	4.00	4.00	2.00	4.00	3.00	5.00	3.00	3.00	4.00
37.00	3.00	4.00	4.00	4.00	4.00	4.00	5.00	5.00	3.00	4.00	5.00	5.00	4.00	3.00	3.00	4.00	3.00	3.00	3.00	3.00	4.00	3.00	3.00	3.00
38.00	4.00	5.00	5.00	5.00	4.00	3.00	3.00	5.00	3.00	4.00	4.00	5.00	5.00	3.00	2.00	4.00	4.00	4.00	4.00	2.00	5.00	4.00	4.00	4.00
39.00	4.00	5.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	3.00	4.00	3.00	3.00	3.00	3.00	3.00	3.00	5.00	4.00	4.00	4.00
40.00	4.00	5.00	4.00	5.00	4.00	4.00	5.00	5.00	3.00	4.00	5.00	4.00	4.00	4.00	4.00	4.00	5.00	2.00	4.00	4.00	3.00	4.00	3.00	4.00
Mean	**3.75**	**4.30**	**3.60**	**3.95**	**3.50**	**3.20**	**4.20**	**4.40**	**3.35**	**3.50**	**4.05**	**4.45**	**3.40**	**3.10**	**2.85**	**3.85**	**3.15**	**2.85**	**3.25**	**2.90**	**4.20**	**3.35**	**3.35**	**3.50**
SD	**0.59**	**0.65**	**0.55**	**0.64**	**0.72**	**0.94**	**0.69**	**0.55**	**0.66**	**0.60**	**0.75**	**0.64**	**0.81**	**0.81**	**0.74**	**0.62**	**0.86**	**0.62**	**0.71**	**0.63**	**0.72**	**0.62**	**0.53**	**0.78**

Appendix D. Questions to Drivers Interview

Interview to Driver‘s to evaluate their perception about Addis Ababa – Adama toll road. Since BOT contract of road is through toll, identifying perception of using toll road helps us to evaluate their perception of BOT contract by 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:

Interview questions for toll road drivers

1. How long on average does it take you to drive between Addis Ababa and Adama on toll road?
2. How long on average does it take you to drive between Addis Ababa and Adama on the old toll free road?
3. How do you describe the traffic congestion and condition of the toll road? Good, Fair or Worse?
4. Do you think the condition of the toll road and its geometrical features (curves and gradients) increase the speed of your driving?
5. Do you think the condition of the toll road and its geometrical features (curves and gradients) reduce your vehicle operating cost?
6. Do you think the condition of the toll road and its geometrical features (curves and gradients) reduce opportunities for accident occurrence?
7. Have you ever disappointed by the delay due to traffic congestion or missed any scheduled business/task using the old road?
8. For the transport service on the toll road, do you think toll charge for toll road is the fair price?
9. What is your attitude toward paying service charge for toll road?

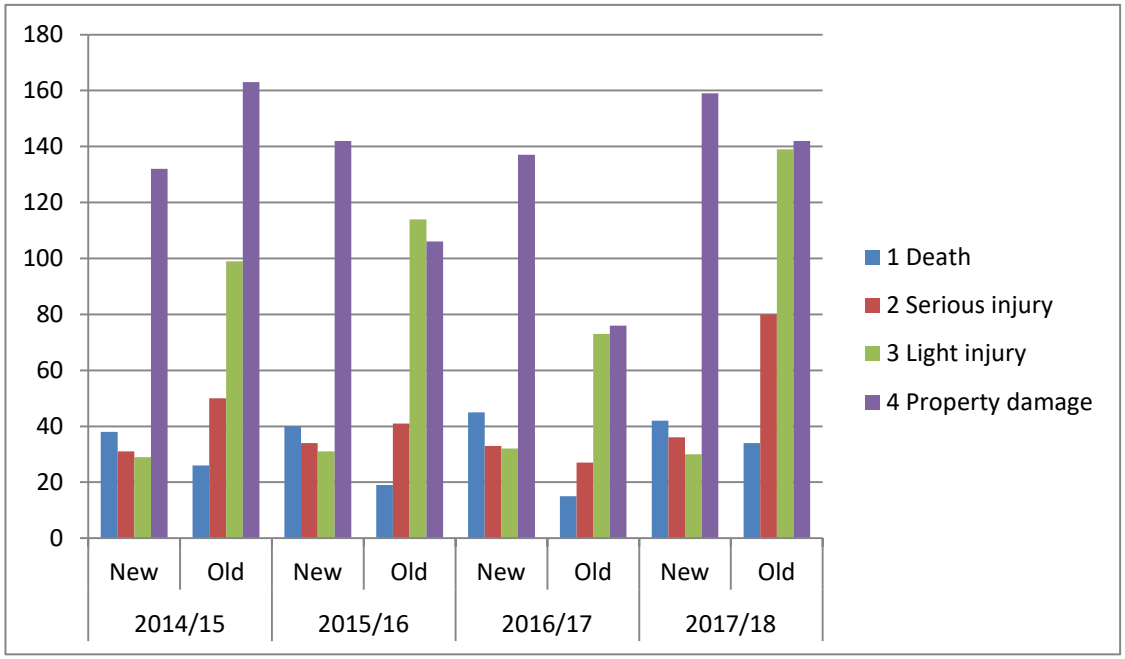
Appendix E. Questions to Passengers

Interviews to public road users to evaluate their perception about Addis Ababa – Adama toll road. Since BOT contract of road is through toll, identifying perception of using toll road helps us to evaluate their perception of BOT contract by 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:

Interview questions for toll road users/passengers

1. Do you think the condition of the toll road and its geometrical features (curves and gradients) reduce the travel time?
2. Do you think the condition of the toll road and its geometrical features (curves and gradients) reduce opportunities for accident occurrence?
3. Have you ever disappointed by the delay due to traffic congestion or missed any scheduled business/task using the existing previous toll free road?
4. For the transport service on the toll road, do you think toll charge for toll road is the fair price?
5. What is your attitude toward paying service charge for improved road?

Appendix F. Difference in accident trend of old and toll road



Appendix G. Performance analysis of toll road

7 am: 8 am	Volume	Avg. Speed Km/Hr.
7:00 -07:05	94	96.8
07:05 -07:10	93	97.65
07:10 -07:15	91	
07:15 -07:20	92	
07:20 -07:25	93	
07:25 -07:30	96	
07:30 -07:35	95	
07:35 -08:40	96	
08:40 -07:45	94	
07:45 -07:50	103	
07:50 -07:55	98	
07:55 -08:00	102	
	1147	
FFS(Average)		**97.225**

TOLL ROAD

5:00 pm - 5:15 pm	278
5:15 pm - 5:30 pm	281
5:30 pm - 5:45 pm	285
5:45 pm - 6 :00 pm	303
Total	**1147**

$$PHF = \frac{Peak\ Hour\ Volume}{Peak\ 15-\min.\ flow\ rate}:$$ **0.94637**

$$f_{HV} = \frac{1}{1 + P_T(E_T - 1) + P_R(E_R - 1)}$$ **0.900901**

$$v_p = \frac{V}{PHF \times N \times f_{HV} \times f_p}$$ **448.44**

	Number of Lanes	FFS (km/h)	Service Volumes (veh/h) for LOS A	B	C	D	E
Urban	2	98	1230	1940	2820	3680	4110
	3	101	1900	2980	4340	5570	6200
	4	103	2590	4070	5920	7500	8310
	5	106	3320	5210	7550	9450	10,450
Rural	2	120	1440	2260	3150	3770	4120
	3	120	2160	3400	4720	5660	6180
	4	120	2880	4530	6300	7540	8240
	5	120	3600	5660	7870	9430	10,300

Maximum hourly flow rate in one direction=1345

Appendix H. Performance analysis of old road

7 am: 8 am	Volume	Avg. Speed Km/Hr.
7:00 -07:05	48	58.08
07:05 -07:10	56	58.59
07:10 -07:15	52	
07:15 -07:20	45	
07:20 -07:25	50	
07:25 -07:30	56	
07:30 -07:35	58	
07:35 -08:40	56	
08:40 -07:45	59	
07:45 -07:50	48	
07:50 -07:55	50	
07:55 -08:00	54	
FFS(Average)		**57.95**

5:00 pm - 5:15 pm	**156**
5:15 pm - 5:30 pm	**151**
5:30 pm - 5:45 pm	**173**
5:45 pm - 6 :00 pm	**152**
Total	632

$$FFS = S_{FM} + 0.0125\frac{V_f}{f_{HV}}$$ **68.9468**

$$PHF = \frac{Peak\ Hour\ Volume}{Peak\ 15-\min.\ flow\ rate}$$ **0.913294798**

$$f_{HV} = \frac{1}{1+P_T(E_T-1)+P_R(E_R-1)}$$ **0.718390805**

963.264

$$ATS = FFS - 0.0125v_p - f_{np}$$ **54.206**

f_{np} 2.7(iterated)

$f_{d/np}$ 10.1(iterated)

$$PTSF = BPTSF + f_{d/np}$$ **67.217616**

$$BPTSF = 100\left(1-e^{-0.000879v_p}\right)$$ **57.117616**

EXHIBIT 20-2. LOS CRITERIA FOR TWO-LANE HIGHWAYS IN CLASS I

LOS	Percent Time-Spent-Following	Average Travel Speed (km/h)
A	≤ 35	> 90
B	> 35–50	> 80–90
C	> 50–65	> 70–80
D	> 65–80	> 60–70
E	> 80	≤ 60

Note:
LOS F applies whenever the flow rate exceeds the segment capacity.

Average travel time governs. Thus level of services for old road is LOS E

Appendix I. Cost benefit analysis of toll road

Year	Cash outflow		Cash inflow	Net cash	NPV
	Type of cost	Cash outflow	(toll revenue)		6% Discount rate
0	Construction Cost	11,200,000,000	0	-11,200,000,000	-14,988,126,469
1	Routine Maint. & Toll Manag.	13,470,000	120,405,150	106,935,150	135,003,163
2	Routine Maint. & Toll Manag.	14,278,200	142,315,456	128,037,256	152,494,420
3	Routine Maint. & Toll Manag.	15,134,892	156,689,713	141,554,821	159,050,997
4	Routine Maint. & Toll Manag.	16,042,986	275,589,681	259,546,695	275,119,497
5	Periodic Maint& Toll Manag	49,041,128	309,652,566	260,611,438	260,611,438
6	Routine Maint. & Toll Manag.	18,025,899	347,925,623	329,899,724	311,226,155
7	Routine Maint. & Toll Manag.	19,107,452	390,929,230	371,821,777	330,920,058
8	Routine Maint. & Toll Manag.	20,253,900	439,248,082	418,994,183	351,795,595
9	Routine Maint. & Toll Manag.	21,469,134	493,539,145	472,070,012	373,923,665
10	Periodic Maint& Toll Manag	65,628,092	554,540,584	488,912,492	365,343,856
11	Routine Maint. & Toll Manag.	24,122,718	623,081,800	598,959,081	422,242,518
12	Routine Maint. & Toll Manag.	25,570,082	700,094,710	674,524,629	448,597,403
13	Routine Maint. & Toll Manag.	27,104,286	786,626,417	759,522,130	476,533,581
14	Routine Maint. & Toll Manag.	28,730,544	883,853,442	855,122,898	506,145,929
15	Periodic Maint& Toll Manag	87,825,191	993,097,727	905,272,536	505,499,456
16	Routine Maint. & Toll Manag.	30,454,376	1,115,844,606	1,085,390,230	571,770,033
17	Routine Maint. & Toll Manag.	32,281,639	1,253,763,000	1,221,481,361	607,038,814
18	Routine Maint. & Toll Manag.	34,218,537	1,408,728,106	1,374,509,569	644,423,722
19	Routine Maint. & Toll Manag.	36,271,649	1,582,846,900	1,546,575,251	684,051,725
20	Routine Maint. & Toll Manag.		1,778,486,777	1,778,486,777	742,100,393
Total				2,578,228,010	-6,664,234,050