A Proposed System-Based Subsidy Approach for Integrated Public Transport Systems in South African Metropolitan Areas

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Declaration

By submitting this dissertation electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the owner of the copyright thereof (unless to the extent explicitly otherwise stated) and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

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I would like to thank my loved ones for supporting me through the past year. A special thanks to my dad for helping me with my thesis.

ABSTRACT

The current subsidy system, designed to make South Africa's public transport more affordable, has instead contributed to a worsening of the existent neglected state of affairs. Although subsidy policies are in place, misdirected allocation renders them mostly ineffective. The implementation of the new integrated public transport systems for metropolitan areas affords an opportunity to adopt a broad spectrum approach and initiate a redesigned and improved subsidy system.

The purpose of this study is to assess the South African urban public transport industry with the aim of finding by means of a system-based process a subsidy approach that will overcome the remaining inequalities of the past. This study will consequently evaluate different subsidy theories and determine which one(s) will be best suited to the demands of a specific period. The final objective is to design a product which offers government a system-based process that will help it determine, every few years, whether the subsidy regime being applied at that juncture is still relevant to the requirements of the market and/or what (new) approach is necessary to achieve social and economic wellbeing.

Commuter transport in South Africa is currently in a transition phase where new public transport infrastructure is being implemented in the metropolitan cities. The current economic recession (making people's demand more elastic to prices) present a good time to conduct the system-based process necessary for transition of the public transport system and determine an optimal subsidy approach for the new system.

The first step in the system-based process was to determine the scope of work and the overall objectives that should be reached. The main public transport shortcomings are the lack of accessibility to affordable transport for the poor and increasing private transport ownership by the rich, which increases congestion and forms the second step of the system-based process. The third step stated the action plan of strategies on how the objectives could be reached. These three steps also form the basic measurement criteria against which the different subsidy approaches needed to be tested.

The fourth step in the system-based process to a better subsidy approach was to evaluate different theoretical subsidy approaches. The review of different subsidy approaches has indicated that some approaches work better than others, but an optimal subsidy system is almost never found.

Step number five indicated that capital supplier-side subsidy, and corridor-focused, user-side subsidy (with additional consideration to distances travelled by commuters within corridors), coupled to congestion pricing, are the subsidy-related approaches that showed most promise for relieving the public transport and subsidy problems of South Africa. Step number six tested the proposed subsidy approaches against the demographics and financial implications to determine if the overall objectives were reached.

Step seven followed once promising results had been reached in steps five and six and acceptance and buy-in from stakeholders had been reached.

The case study demonstrated step eight: the implementation of the system-based process. The subsidy amount will increase once the new system has been implemented. Although the subsidy amount is larger, the equity problems of the previous subsidy system are improved on. Even with the conservative congestion pricing approach government subsidy budget saving was calculated at 35 percent. This saving in budget will enable the government to better support public transport commuters by upgrading and extending of public transport infrastructure while also increasing subsidy amounts allocated to operators and commuters.

The final step of the system-based process is monitoring of the subsidy approach implemented. Although this step was not evaluated in this research study, it is recommended that the government implement monitoring measurement such as continuous data collection, training of officials and establishing of control centres.

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LIST OF ABBREVIATIONS

BRT	: Bus Rapid Transport
BTCE	: Bureau of Transport, Communications and Economics
CBD	: Central Business District
DOT	: Department of Transport
IDP	: Integrated Development Plan
IPTS	: Integrated Public Transport System
IRT	: Integrated Rapid Transit
ITP	: Integrated Transport Plan
MSA	: Moving South Africa
NLTTA	: National Land Transport Transition Act
NMT	: Non-Motorised Transport
OLS	: Operating Licence Strategy
PFMA	: Public Finance Management Act
PPP	: Public Private Partnership
PSO	: Public Service Obligations
PTP	: Public Transport Plan
TDM	: Transport Demand Management
UPTS	: Urban Public Transport System

1 BACKGROUND TO URBAN PUBLIC TRANSPORT AND THE INTRODUCTION OF SUBSIDY SYSTEMS

1.1 INTRODUCTION

The first step of the system-based process is to determine the stakeholders and the objectives the stakeholders want to reach. The government, public transport users and operators, private transport users and society as a whole are identified as the stakeholders.

In the second step of the system-based process, the background of the system, problems, shortcomings and challenges will be investigated in order to identify gaps between the current transport system and the objectives established. The history of UPTS and subsidy systems all around the world provides the fundamentals for determining how future improvements to urban public transport can be made.

This chapter covers the following aspects:

- the history of South Africa's urban public transport and subsidy system and its consequences for an UPTS (Section 1.2)
- the problems experienced under the current UPTS and subsidy system (Section 1.3)
- a clear concept and overview of the proposed IPTS and the BRT system (Section 1.4)
- avoiding the transfer of shortcomings of the current UPTS and subsidy system to the proposed IPTS (Section 1.5)

1.2 THE HISTORY OF THE CURRENT URBAN PUBLIC TRANSPORT AND SUBSIDY SYSTEM AND ITS CONSEQUENCES

The current urban public transport systems in South Africa are expensive, of low standard, inefficient and ineffective. No alternatives are in place to manage the rising fuel costs and lessen environmentally unfriendly aspects of the transport system. Most commuters are unaware of how an efficient public transport system operates and what advantages such a system can hold for themselves and the country.

MSA states (South Africa, 2004):

"South Africa rated worst of 46 countries in a survey of human resource development practices. Whereas the pre-transport economy stressed labour creation in transport jobs, the new economy that is competing globally needs transport workers with sufficient skills to create value in their work. With nine provinces holding increasing responsibility for transport to meet the national capacity within, Government becomes a critical potential obstacle for transport to meet the national and customer objectives.....As provinces gain responsibilities, new skills are needed in the realm of land use and infrastructure planning, contract design and management, monitoring and enforcement, and multi-modal passenger system research, design, and support. These skills are also needed at the national level to help create and propagate the vision and make the critical scope and density decisions."

1.2.1 URBAN COMMUTERS AND SYSTEM PERFORMANCE

MSA has completed thorough research regarding travel patterns of urban commuters and the current state of the UPTS. Urban commuters were divided into six commuter segments, each with different needs from the UPTS. Figure 1-1 indicates the urban commuter segmentation.

Figure 1-1: Urban Commuter Segmentation

Customer Segments	Key Transport Needs (prioritised)	% of SA Urban Population (1996 = Black, 2020 = Grey)	Number in 1996 (m)	Growth to 2020
Strider (prefers to walk or cycle)	Cost	25% / 23%	5.4	28%
Stranded (no affordable public transport available)	Cost	13% / 12%	2.8	28%
Survival (captive to cheapest PT option)	Cost, Speed	19% / 17%	4.1	24%
Sensitive (captive to PT but selects 'best' option)	Speed, Cost, Choice	10% / 9%	2.1	25%
Selective (can afford car but willing to use PT)	Speed, Choice, Convenience	19% / 19%	4.1	39%
Stubborn (only uses car)	Convenience, Speed	14% / 19%	3.0	88%
		TOTAL Urban Population	21.4 million	38% (1.4% pa)

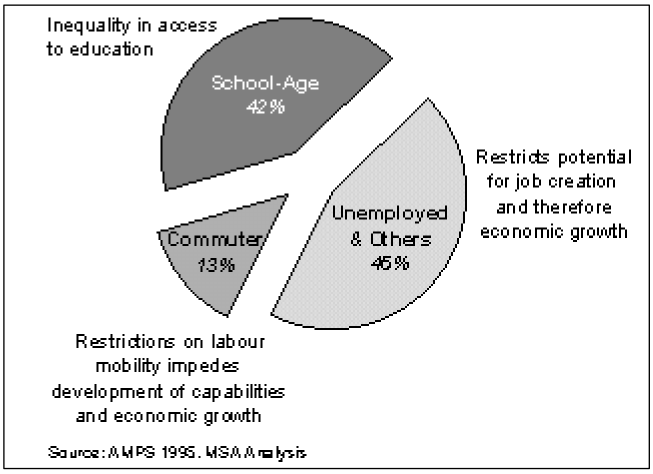
Note: All customer segments rated safety as a key transport need

Source: MSA, 1997:26

The ***Strider*** segment (5.4 million inhabitants) prefers to walk or cycle. This group is satisfied with dimensions of travel time, affordability and availability. Their main determinant is low-cost access to destinations.

The ***Stranded*** segment (2.8 million inhabitants) has no basic access to private or public transport and therefore has little ability to integrate with society or participate in the economy. This group's basic need is a low-cost public transport system, but this is in most cases absent. Two inhibiting factors, low income levels and long travelling distance, lead to their inability to access possible available public low-cost transport. Figure 1-2 indicates that the majority of the stranded are learners or unemployed, which has a negative impact on their ability to access further educational opportunities, jobs and stimulate economic growth.

Figure 1-2: Stranded Breakdown



Source: MSA, 1997:27

Distances to be travelled by the stranded segment tend to be great and lead to high fares, which this segment cannot afford.

The ***Survival*** segment (4.1 million inhabitants) has a need for low cost, accessible public transport. This group is captive to the least expensive transport option. Of this group 70 percent spend more than 10 percent of their household income on transport and 46 percent have prolonged travelling times. This leads to dissatisfaction with both service and cost.

The ***Sensitive*** segment (2.1 million inhabitants) has sufficient income to select the most suitable available transport option. Of this group 47 percent travel longer than their desired travel times, 12 percent have a choice of three modes and 51 percent have a choice of two modes of transport.

The ***Selective*** segment (4.1 million inhabitants) can afford their own vehicles, but are willing to use public transport, provided that their primary requirements of speed, freedom of choice of destination and route and, personal convenience are met. This segment is critical to the future of public transport, because of its expected growth rate of 39 percent between 1998 and 2020 and its ability to afford private transport.

The ***Stubborn*** segment (3 million inhabitants) which only makes use of private transport, is expected to grow significantly (88 percent projection) between 1998 and 2020 and, in so doing, create significant challenges for urban transport in terms of road infrastructure and traffic congestion.

1.3 PROBLEMS EXPERIENCED WITH THE CURRENT URBAN PUBLIC TRANSPORT AND SUBSIDY SYSTEM

National objectives such as basic mobility, basic access and social integration, determined by the DOT and captured within the sentiment of the NLTTA, are not being met. Commuters are dissatisfied with the level of safety and security they experience on public transport.

It is important to identify and discuss the problems currently occurring in the UPTS and subsidy system. These problems must be considered to gain a better understanding of their extent.

1.3.1 INEFFECTIVE PUBLIC TRANSPORT POLICIES AND GUIDANCE

1.3.1.1 GUIDANCE AND DECISION-MAKING

South Africa is experiencing serious strategic transport problems because of decisions made between the late 1980s into the 1990s and the way public transport was managed from the late 1990s to the present. Poor decision making can be considered to be one cause that contributed to the present unsatisfactory state of public transport (MSA, 1997).

The commuter rail system is a good example of poor decision making. In the late 1980s, it was still being operated with substantial commuter numbers, high frequency of trains, efficiency and safety. In the mid-1980s the budget (specifically the subsidy budget) was extensively cut, leading to a significant increase in commuter fares. This increase, coupled to a growing economy which made greater private transport ownership possible, led to a decrease in rail commuter numbers. Since then urban rail transport has deteriorated to its present state.

This historic cut in subsidy budgets was not solely responsible for the problems rail transport (or any other mode of public transport) presently has to deal with. A number of other factors, such as the growing economy, land use patterns, increased car ownership, decline of public transport services and decentralisation of businesses, have led to the current state of the UPTS while government decision making is only one of them.

1.3.1.2 EXECUTION OF PLANS

National objectives, as stated previously, are currently not being met. Public transport services lack quality and accessibility. Safety and security and social integration are some of the other objectives that are not being met by the current UPTS.

In 2004 the then Minister of Transport, Jeff Radebe, issued the following statement: “I have instructed the Department to complete a review of the subsidy system to align it with our stated objectives as soon as possible. This will include the question of subsidisation of minibus taxis for, as you know, more than 60 percent of commuters use minibus taxis, while 850 000 of the estimated two million migrant workers in this country use unsubsidised public transport.”

This statement aimed at incorporating a formalised and regulated industry into a safer, reliable and affordable public transport system. The new proposed IPTS, which will have as one of its constituent parts the BRT system currently being implemented, has presented itself as a possible solution to form a dynamic public transport system that will enhance urban economies and social welfare.

More than 60 percent of commuters use minibus taxis as their main mode of transport, but, because no subsidies are allocated to the minibus-taxi industry, these commuters (mostly from the stranded segment of commuters) spend around 40 percent of their income on public transport costs.

Low income, in some cases as little as R200 per week for minibus-taxi drivers, is one of the causes that has led to fast and irresponsible driving and to violence and high accident rates in the minibus-taxi industry. This is because drivers need to be increasingly competitive to grow their individual share of the rush-hour custom.

The role which a well-managed minibus-taxi system can play in the UPTS must be the core focus of the new transport regime. It must shift towards formally incorporating and supporting the minibus-taxi industry.

1.3.1.3 ALLOCATION OF FINANCIAL RESOURCES

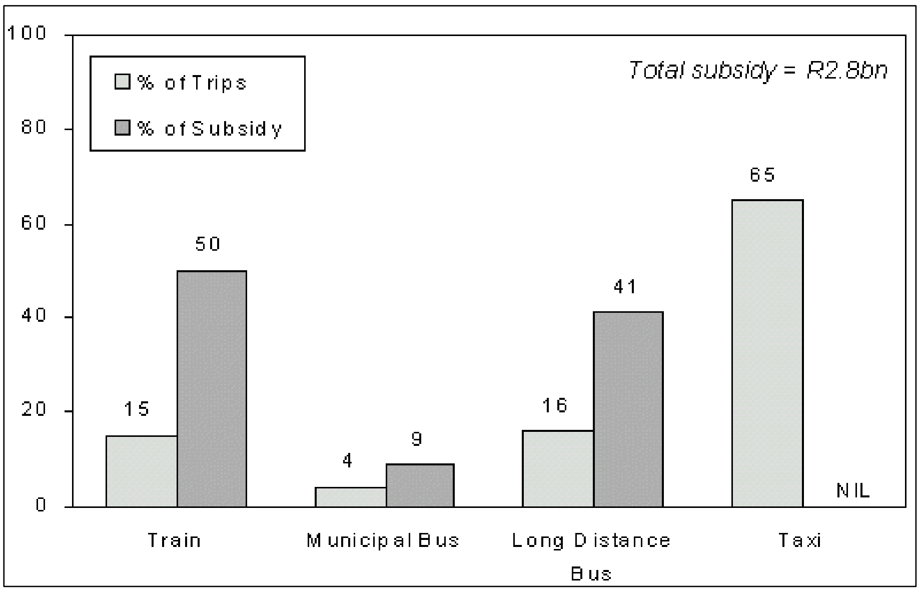
The ineffectiveness of subsidy targeting is a major concern. Over R4 billion in subsidy funding is spent annually on less than 40 percent of commuters using public transport.

The Government is spending R 2.8 billion (annually) on subsidies for long-distance commuter buses, municipal buses and commuter rail services. Of the total bus subsidy amount, 20 percent of bus subsidies are allocated to municipal services in higher-income suburbs. Minibus-taxis are most accessible to the poorest and transport more than 60 percent of commuters, do not receive any operating subsidy. When considering the stranded segment, 78 percent have access to a minibus taxi, but only 21 percent have access to commuter rail services, which have the lowest prices and are the most subsidised mode (MSA, 1999).

Minibus-taxi passengers are charged a fixed cash fare for a route, irrespective of the distance travelled on that specific route. As mentioned, minibus-taxi operators do not receive direct formal subsidies from the government. Minibus-taxi drivers and operators' seldom declare their income or profit levels and the tax losses to government could be seen as a form of hidden subsidy. The new IRT-system will introduce competitive tendering for subsidised routes and will encourage minibus-taxi operators to compete for public transport services eligible for subsidies (Cape Metropolitan Transport Plan: 2, 1999).

Figure 1-3 demonstrates the misallocation of subsidies.

Figure 1-3: Comparison of Subsidy Level with Market Share of Commuter Trips



Source: MSA, 1997:31

A decrease in transport investment in the 1980s as well as the escalation of private transport ownership leading to increases in congestion costs and rising costs of public transport rolling stock, impacted negatively on the economy. This negative impact resulted in a decline in public transport use.

In November 2008, the Department of Transport (DOT) had a budgetary shortfall of R1.2 billion. The Golden Arrow Bus Company has since been forced to find substantial amounts of bridging finance while it awaits outstanding subsidies from the DOT. Other embattled bus operators (Putco, Algoa Bus Services, etc.) across the country have also indicated that if the DOT does not pay the outstanding subsidies shortly, bus services will cease.

The decline in commuter numbers and increasing fuel prices are the main elements that have contributed to a state where bus operators cannot provide a service unless they receive government support. This is problematic as subsidies are not meant to sustain transport operators, but are intended as financial assistance to commuters.

1.3.1.4 PUBLIC TRANSPORT SYSTEM ACCESSIBILITY

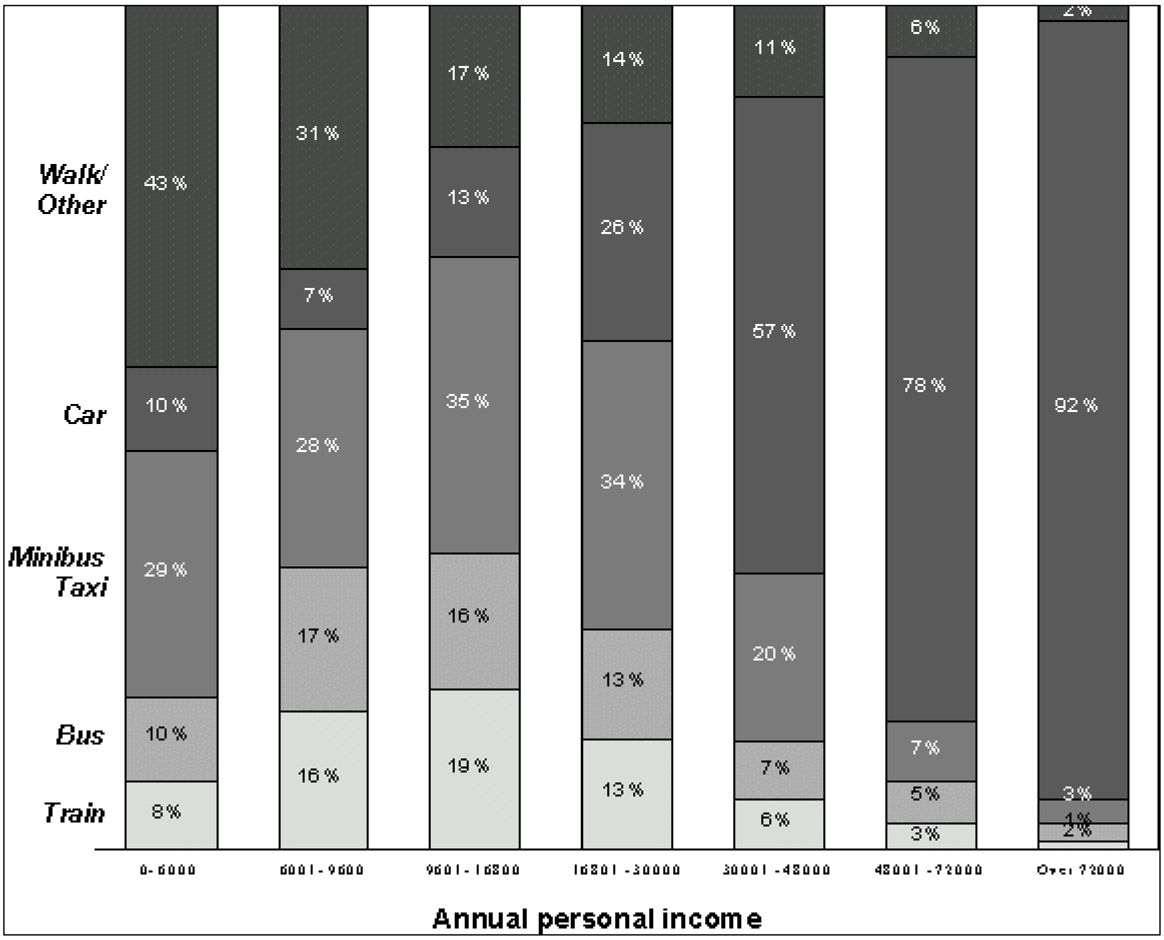
Results obtained from the National Household Travel Survey (Stats SA, 2005) indicate that two-thirds of South Africa households do not have access to public transport. The following statistics illustrate the current state of the UPTS:

- Of the 2.5 million public transport commuter trips, minibus taxi commuter trips present 67.9 percent, bus commuter trips present 22 percent and train commuter trips present 10.1 percent.
- In addition to the basic 2.5 million public transport commuters, another 325 000 commuters use minibus taxis as a feeder mode for other public transport.
- In South Africa, 30 percent of households spend more than 10 percent of their income on public transport.
- Minibus taxis represent an informal transport system that accounts for 67.9 percent of the total number of all commuter trips.

1.3.2 INCREASING PRIVATE TRANSPORT OWNERSHIP

Figure 1-4 indicates the percentage modal choice of travel according to household income. In South Africa private transport becomes dominant when household income rises above R 30 000 per annum. Compared to other developing countries, a much higher average vehicle ownership per capita is prevalent among middle to high income groups (MSA, 1997).

Figure 1-4: Percentage Modal Choice by Income (National Commuters)



Source: MSA, 1997:28

The table above indicates where problems in public transport are currently being experienced with reference to the influence of income on private transport ownership. The outcome is listed below:

- R 0 - R 9 600 Annual personal income (Strider and Stranded) – The high percentage of pedestrians in this group (43 percent) is a concern. Especially if considered that this income group normally resides on the outskirts of urban areas and at great distances from employment, schools, and other facilities.

- R 9 601 – R 16 800 Annual personal income (Survival) – Considering the graph above, a balanced split between all types of transport modes is prevalent among this income group.

- R 16 801 – R 30 000 Annual personal income (Sensitive) – In this group the increase in private transport ownership can be identified as an impediment towards a balanced transport system. High minibus taxi commuter usage, compared to usage of other public transport modes, is of similar concern in terms of a balanced transport system.

- R 30 001 – R 48 000 Annual personal income (Selective) – This income group indicates how an increase in income leads to increased private transport ownership. This trend is of concern for a balanced IPTS.
- R 48 001 – R 72 000+ Annual personal income (Stubborn) – This group currently constitutes the greatest obstacle towards creating a balanced IPTS for urban areas. This group's transport demand is price inelastic which complicates the transfer of this group onto public transport modes.

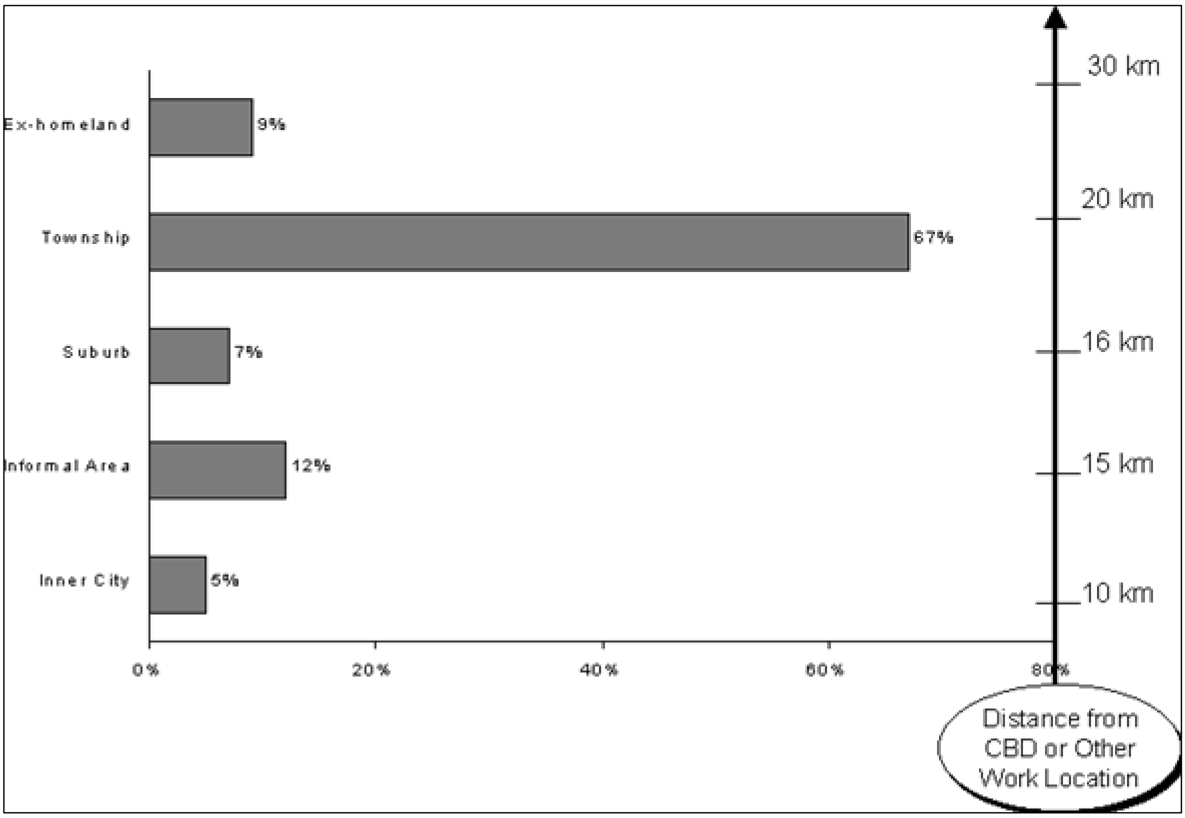
If private transport ownership steadily increases in the next decade, all metropolitan cities in South Africa will respectively be facing the following possible scenarios (MSA, 1999):

- additional road space
- additional anti-congestion costs of R 250 million per annum
- ten extra parking garages in the CBD
- escalation in environmental damage
- accidents costs of R 6 million per day

1.3.3 SUB-OPTIMAL SPATIAL PLANNING

Apartheid, urbanisation, urban sprawl, increasing private transport ownership, people behaviour and several other factors have led to the current land usage patterns. Low-income residents have to travel great distances to the CBD and employment opportunities elsewhere. The demographic distribution patterns and distances travelled by residential area are indicated in Figure 1-5.

Figure 1-5: Distribution of Commuters by Settlement Type



Source: MSA, 1997:30

The average South African commuter trip is 20 km. South African commuters spend almost 40 percent longer travelling this distance than in Asian countries (China, Japan, South Korea, etc.). A reduction of 10 km per trip will save commuters R 350 million annually in fares and 100 000 person years in travelling time. The state will save R 110 million in bus and rail subsidies (DOT, 2006).

Workforce mobility is restricted, creating problems for employment opportunity. The current land-use pattern forces commuters to travel great distances to reach key services and this inefficiency causes high subsidy requirements.

1.4 A VISION OF THE PROPOSED INTEGRATED URBAN PUBLIC TRANSPORT SYSTEM (IPTS)

The DOT has amended the NLTTA (it is now the National Land Transport Act, No 5, April 2009) to include the IPTS and other aspects of social development and economic growth. It has indicated that the areas to be focused on are: the 2010 FIFA World Cup, improvement of quality and access to transport, transformation of the minibus-taxi industry and fast tracking its recapitalisation programme, restructuring commuter rail, completion of the Gautrain project, integration of existing road networks, reforming the Road Accident Fund and reconsidering subsidies.

Some of the key principles of the (new) IPTS are: affordable public transport, quality service and commuter safety, integration of modes, environmentally-friendly services, effective law enforcement and integration with existing land uses.

An example of this initiative is he Nelson Mandela Bay Municipality's mission statement in preparing for a Public Transport Plan (PTP) is: "To provide an efficient, safe, affordable, sustainable and accessible multi-modal public transport system which supports social and economic development, ensuring optimal mobility and improved quality of life for the residents and users of the transport system in the metropolitan area" (NMBM PTP, 2006).

The strategies for developing public transport are based on important principles that have been laid out in government strategy plans, such as the MSA, the various ITP's and other public transport action plans in the long term. These principles are listed below:

- a customer-oriented transport system
- integration between public transport modes
- densification within transport corridors to improve utilisation of public transport
- a new contract for public transport operators
- phased introduction of co-operation between public transport modes
- developing a regulatory framework to support public transport

It is important here to give a short description of what BRT entails in order to facilitate understanding its role within the vision for IPTS:

- BRT is a high-quality bus-based transport system intended to deliver fast, comfortable and cost-effective mobility through the provision of dedicated bus lanes, frequent, scheduled operating services and sufficient marketing and customer service.

- BRT is composed of conventional bus and minibus-taxi operations, cycle ways, pedestrian and urban space upgrades, metered-taxi integration and park-and-ride facilities.

The technical and operational characteristics of the BRT are:

- dedicated bus lanes
- multiple doors for fast loading and alighting

- level boarding platforms
- accessibility for special needs commuters
- closed and secure stations (sheltered from the weather)
- payment on entering the stations
- high frequency operations (5-10 minutes in peak periods and 30 minutes during off-peak)
- operating hours of 16 – 20 hours a day, 365 days a year
- modern vehicles with large capacity (130 commuters)
- priority for buses at traffic signals
- high safety and security standards

The (new) IPTS will be thoroughly investigated and discussed in Chapter 3 (Section 3.3, p 35).

1.5 KEY STRATEGIC SHORTCOMINGS OF THE CURRENT PUBLIC TRANSPORT SYSTEM

To determine an IPTS and subsidy allocation for this system, it is necessary to comprehend fully what the past influence of these shortcomings was. Understanding how these shortcomings may be managed to develop and maintain a public transport system that will benefit the whole of society and the economy is paramount.

1.5.1 LACK OF ACCESSIBILITY TO AFFORDABLE TRANSPORT

Poor accessibility to affordable transport impedes reaching national goals such as employment creation and access to social services and education. Distance and insufficient disposable income are some of the contributors to the lack of accessibility. Previous land-use patterns and poor subsidy targeting are the main barriers to overcoming this challenge.

1.5.2 INEFFECTIVE PUBLIC TRANSPORT SYSTEM

The current UPTS does not meet commuter needs. Of the total number of commuters, 50 percent are dissatisfied with travel times and in many cases scholars have little or no use of the public transport system. South African public transport service costs are 32 percent higher than world averages because of higher average distances travelled (MSA, 1997). The above mentioned shortcomings have led to higher system costs, deteriorating infrastructure, higher user costs and inefficient services. Finally, ineffective public transport restricts labour mobility, decreases worker productivity and impedes social integration.

At present, the commuter rail, bus and minibus-taxi industries are spending too little to maintain assets and uphold acceptable levels of services. Decreases in the quality of service, frequent compulsory maintenance on vehicles and more incidents relating to safety lapses take place as a result of continued poor investment.

Poor management (planning, operation and regulation) of public transport is the second factor contributing to inefficiency in the UPTS. The inadequacy of planning, in particular, leads to current high system costs.

1.5.3 INCREASING PRIVATE TRANSPORT OWNERSHIP

The volume of private transport in South Africa has increased dramatically in the past two decades and projections indicate that this upwards trend will incline significantly towards 2020. Four factors drive increasing private transport ownership trends (MSA, 1997):

- low private transport operating costs
- inappropriate land-use patterns
- limited public transport alternatives
- infrastructure investment in roads

Current land-use patterns have led to excellent urban road networks, serving mostly the wealthier suburbs. Apartheid-era spatial planning created decentralised residential areas within the metropolitan areas, leading to excessive travelling distances. This, combined with the ineffectiveness of the alternative of public transport, has contributed to the escalation in private transport ownership.

1.5.4 SPATIAL PLANNING

The spatial planning dispensation determines distances to be travelled and population densities – the two main cost and service drivers for deciding the nature of urban public transport. Although policy and strategy emphasise densification, in reality current land-use planning and development are geared for locating new residential areas far from major business centres as well as rail and road networks. This is the result of a lack of co-ordination and/or integration at an institutional level. Each individual institution plans to develop for maximum profits, but does not consider what the impact on the greater cost system will be. This pattern does not necessarily suggest poor results on the part of government departments – it rather illustrates the need for a co-ordinated framework to consider spatial decisions.

Solving current spatial problems could have a positive impact on public transport and provide other services ranging from education and health transport, to affordable housing by the government.

1.6 CONCLUDING SUMMARY OF URBAN PUBLIC TRANSPORT AND SUBSIDY SYSTEMS

The second step of the system-based process includes evaluation of the background, problems, shortcomings and challenges of the current public transport and subsidy system.

South Africa's UPTS are not reaching DOT objectives (as identified in Chapter 2) or fulfilling commuter needs. The main shortcomings include: lack of accessibility, ineffectiveness of the UPTS, increasing private transport dependence and insensitive spatial planning.

The minibus-taxi industry, transporting more than 60 percent of public transport commuters, receives no operating subsidies. Bus and train services that transport fewer than 40 percent, however, receive approximately R 4 billion per annum.

The recent DOT subsidy payment shortfall has meant that bus companies could potentially have gone bankrupt. It is a major concern that bus companies cannot provide any service if operating subsidies are not provided. The objective of subsidies to an industry has, in this case, wrongly shifted from playing a supportive role to being a life-supporting role.

The BRT system is an example of how to mould urban public transport into a more efficient, reliable and lower-cost service. This system will be implemented to create symbiotic relationship for both operators and commuters.

The current UPTS has four main shortcomings and all four are interrelated. These four main shortcomings include: a lack of accessibility to affordable transport, an inefficient public transport system, increasing private transport ownership and insensitive spatial planning. Although this is true, Figure 1-4 (p 18) highlights South Africa's two main public transport shortcomings as lack of accessibility to affordable transport for the poor and increasing private transport ownership by the rich, which worsens congestion.

In the chapters that follow, research on a new subsidy approach will be focused mainly at addressing these two shortcomings.

2 INTRODUCTION AND METHODOLOGY

2.1 PROBLEM AND OBJECTIVES

For two decades now the South African government, commuters and general populace have experienced significant problems with the public transport system. South Africans are exposed to an inefficient and costly public transport system that is a burden to society.

For example, the current subsidy system, designed to make South Africa's public transport more affordable, has instead contributed to a worsening of the existent neglected state of transport affairs. Although subsidy policies are in place, misdirected allocation renders them mostly ineffective. Bus and train services receive operating subsidies, whereas the minibus-taxi industry, which transports more than half of the total commuter population, receives no operating subsidies.

The implementation of the new integrated public transport systems (IPTS) for metropolitan areas affords an opportunity to adopt a broad approach and initiate a redesigned and improved subsidy system.

The purpose of this study is to assess the South African urban public transport industry with the aim of finding, by means of a system-based process, a subsidy approach that will overcome the remaining inequities of the past. This study will consequently evaluate different subsidy theories and determine which one(s) will be best suited to the demands of a specific period. The final objective is to design a product which offers government a system-based process that will help it determine, every few years, whether the subsidy regime being applied is still relevant to the requirements of the market and/or what (new) approach is necessary to achieve social wellbeing.

2.2 BACKGROUND

The present urban transport problem in South Africa arose a few decades ago when cheap fuel and a growing economy encouraged private transport ownership. Rural to urban migration of citizens led to a significant increase in city populations and, together with growing private transport ownership, resulted in urban sprawl. Sprawling suburbs made it difficult to run effective public transport systems and prospective clients preferred to utilise privately-owned vehicles to commute to their desired destinations.

In 1986 four underlying factors making South African urban public transport problematic was identified (Floor, 1968). These factors included:

- All city corridors converged at the central business district (CBD).
- Activities started early in the day and ended in the late afternoon.
- Main traffic flow occurred during short periods in the mornings and afternoons.
- There had to be an upper limit for urban traffic capacity (lower than the demand that the private transport could provide for).

The key contributors to the urban public transport problem, as identified in "Introduction to Urban Transport" (Floor, 1968), are as follow:

- the growing economy that leads to growth in income per capita
- an increase in private transport ownership
- the dominance of low-density housing
- the concentration of traffic during peak periods
- the losses suffered by public transport
- financial constraints of local authorities
- the high density of employment in the CBD

The unforeseen shift of passengers to private transport and minibus taxis in the past decade has led to irregular public transport trips and the decline of quality of public transport services. The sub-optimal allocation of resources, together with limited capital investment, contributed to the result of misallocation of subsidies and the downward spiral of the public transport system.

2.3 THEORETICAL FRAMEWORK

Around the world the question is not whether subsidies are good or bad for urban public transport systems (UPTS) and commuters, but rather in which way the government should allocate financial resources to provide an integrated urban public transport system that will improve economic efficiency and realise social-economic objectives.

According to Stander (2004), "public transport subsidies should be used to enhance access and mobility needs of all people, where:

- Market failures result in service providers not being able to provide essential public transport services in a viable manner.
- Commercial fares for providing essential public transport services are not affordable.
- The benefits derived from any available assistance justify the subsidy costs incurred."

Stander (2004) further states, "Subsidies for public transport in urban areas, based on allocative efficiency arguments, should be considered where:

- The use of the most cost effective public transport services is promoted.
- Subsidised public transport services exhibit significant economies of scale and or scope, satisfy relevant user preferences and minimise the travel costs of specific targeted groups.
- The practice is an effective instrument in promoting a more efficient and overall effective transport system."

In the past financial year (2008/2009) subsidies spent on commuter rail amounted to approximately R2.4 billion, whilst R2.1 billion was spent on bus transport.

The minibus-taxi industry provides transport for 60 percent of all prospective public transport commuters. It provides the shortest travel time, best accessibility and the highest frequency of service during peak periods. Minibus taxis are regarded as the best possible form of public transport from the nearest point of original departure to the nearest point of final destination. Regardless of the minibus taxi's dominant market share, it does not receive formal operational subsidies from the government.

All spheres of the public transport system, including the minibus-taxi industry, comply with Stander's conditions - financial assistance must therefore be considered wherever the impact of support will make a positive contribution to achievement of an IPTS. Subsidies should not be seen as a burden by the government, but should be aimed at replacing inefficient practices and enhancing economic growth and social equity.

Considering the results obtained from the theoretical framework from a governmental viewpoint regarding the new IPTS in metropolitan areas in South Africa, it could be asked if a subsidy system is necessary as part of the new, integrated public transport system that is currently being introduced and, if so, how will the present subsidy policies be relevant? If the latter cannot be confirmed then it could be requested to determine, develop and implement a more efficient subsidy system.

A brief exposition of the Operating Licence Strategy (OLS) in terms of the National Land Transport Transition Act No.22 of 2000 (NLTTA) follows, as well as expositions of the Subsidy Strategy, the Public Finance Management Act No.1 of 1999 (PMFA), the *Moving South Africa* 20-year strategy and details concerning the Minibus-Taxi Recapitalisation Strategy.

2.3.1 OPERATING LICENCE STRATEGY (OLS)

In terms of the National Land Transport Transition Act No.22 of 2000 (NLTTA) the objective of the Operating Licence Strategy (OLS) is to achieve a balance that is both effective and efficient between public transport supply and utilisation. The OLS must contain and set out the planning authority's policy and strategies in relation to at least (South Africa, 2000: Act 22):

- The role of each public transport mode and identification of the preferred road-based mode or modes with regard to area, including transport into or from the areas of other planning authorities, as well as considering inter-provincial transport.
- The circumstances under which operating licences, authorising the operation of public transport within any part of its area, should be allowed.
- The use of public transport facilities within its area.
- The avoidance of wasteful competition between operators.
- The conclusion of commercial service contracts for unsubsidised public transport services.
- The conditions which should be imposed by the board in respect of operating licences.

2.3.2 SUBSIDY STRATEGY

The Minister of Transport, Mr Radebe (2004), summarised the status quo regarding the subsidy strategy as follows:

"Public transport must focus primarily on the needs of the urban poor and the rural disadvantaged and isolated communities. But our planning must also build a future where public transport is a viable alternative for all travellers. Currently financial support for public transport is applied in different ways. For example, the subsidy for rail commuter subsidies addresses historical backlogs and operational costs, whilst bus subsidies are operational in emphasis. Support for the minibus-taxi industry takes the form of recapitalisation as a step towards the integration of the minibus-taxi sector into a re-organised public transport system...."

The subsidy strategy, as stated above, has proven to be theoretically correct, but in practice the results are not as promising. This particular strategy should not be kept in place for decades; it needs to be revised every few years. The new IPTS allows an opportunity for this strategy to be revised and for the implementation to be allocated appropriately.

2.3.3 PUBLIC FINANCE MANAGEMENT ACT (PMFA)

The PFMA applies to national and provincial government, whilst the Municipal Finance Management Act is applicable to local government. These acts have similar requirements and introduce the same treasury norms and standards for the whole public sector in South Africa. This means that all transport operations, whether local government-driven or provincially driven, will operate within the same financial framework. The PFMA adopts an approach that focuses on responsibilities and outcomes (South Africa, 1999: Act 1).

The underlying principles of the Act are:

- Let managers manage, but hold them accountable.
- Introduce a broad view of financial management, including the management of revenue, expenditure, assets and liabilities.
- Focus on outputs that relate to policy priorities.
- Establish good systems for financial control.

2.3.4 MOVING SOUTH AFRICA (MSA)

Moving South Africa (MSA) is a transport strategy that was developed in 1997/8. The MSA was developed to strategise how the need, objectives and priorities, as the stipulated in the Transport White Paper of 1997, can be realised. These strategies are developed to simultaneously focus on meeting the basic needs, developing of a sustainable transport industry, serving the needs of urban commuters as well as other forms of passenger transport. This strategic framework further considers how limited resources, many diverse needs and other obstacles can be dealt with. The main objective can be summarised as follows:

"Provide safe, reliable, effective, efficient and fully-integrated transport operations and infrastructure, which will best meet the needs of freight and commuters, at improving levels of service and cost, in a fashion which supports government strategies for economic and social development, whilst being environmentally and economically sustainable" (South Africa, 2004).

South Africa has been striving to reach this objective, but has in many instances fallen short. One of the major shortcomings is the provision and allocation of an effective subsidy for public transport users. This study will focus particularly on identifying a sufficient approach, in order to reach MSA's objective.

2.3.5 MINIBUS TAXI RECAPITALISATION STRATEGY

The minibus taxi recapitalisation programme envisaged the scrapping of all unroadworthy minibus taxis over a 7 year period through the payment of a scrapping allowance of R50 000 per minibus taxi.

The OLS specifies that, in order for a public transport operator (minibus-taxi operator) to receive a new operating licence, the old vehicle has to be scrapped and a new vehicle has to be purchased.

The minibus taxi recapitalisation programme objective is to provide better vehicles to uplift the level of service and ensure a formalised operating industry, better law enforcement, increased safety and improved customer services.

The implementation of this strategy is very slow and only now (7 years later) can new minibus taxis be identified on the roads. The IPTS, currently being implemented, will speed up this process and may require revision of this particular strategy.

2.4 METHODOLOGY AND RESEARCH DESIGN

The importance of the first three steps of the system-based process cannot be over-emphasised. Step one determines the scope of the study, establishes the stakeholders and determines the main objectives that need to be realised. Step two investigates the background of the transport system, problems that are currently being experienced and identifies the gaps. Step three establishes the action plan that is proposed by strategies and policies. Once these steps have been completed and the objectives, goals and strategies have been determined, the objectives, goals and strategies should become the measurement criteria of the system-based process.

As stated in the problem statement and the discussion that followed, it is important to consider the identified shortcomings of the existing public transport system and current inefficient subsidy operations in place. Once sustainable alternatives to overcome these shortcomings have been identified, a new subsidy approach system should be decided on to enhance the clear objectives of the new IPTS.

Step four will consists of theoretical analysis. Step five in the system-based process will test different approaches with relation to the gaps identified.

Different subsidy system approaches will be evaluated to find a solution that focuses on the strategic challenges that South Africa is currently facing. The approach will be in accordance with the demands of the new Bus Rapid Transit (BRT) systems (also known as Integrated Rapid Transit (IRT) systems) currently being implemented in the major metropolitan areas.

The different subsidy approaches, such as, supplier-side subsidy, user-subsidy, tariff subsidy and capital subsidy, will be theoretically evaluated. Congestion pricing as a possible subsidy funding source will also be considered and discussed. This process will be completed once the most applicable subsidy approach, with regard to the public transport shortcomings, has been established.

The sixth step can be described as the performance measurement step. The subsidy approaches proposed at this stage will be tested in practice in order to determine if overall objectives of the stakeholders are being realised.

In consideration of the research results acquired from the strategy outlined above, the percentage impact for different financial subsidy approaches identified will be evaluated to ascertain what effect the new subsidy approach(es) will have on everyday public transport commuters, as well as their demands on the programmes of the South African government.

If the results obtained from step five and six are in line with the objectives, the approach(es) could be advised for implementation. Step seven is the acceptance of the proposed subsidy approach by all stakeholders.

The impact of the public transport system and the subsidy approach taken by other spheres of government on, for example, environment and socio-economic conditions, will be evaluated. This viewpoint will consider how to achieve buy-in for the new subsidy approach by all stakeholders involved.

Once the stakeholders have approved the subsidy approach, a subsidy policy will be developed and implemented (step eight) and the subsidy system should then be monitored (step nine).

The chapters contained in the study were researched by means of the system-based process. The chapters containing the background, current state of the public transport- and subsidy system, legislation and, gaps determined forms the basis for successive chapters. Chapter four to eight evaluated the different subsidy methods and approaches. Finally, considering the goals and objectives and the different subsidy methods, an appropriate subsidy approach was reached and recommendations were made accordingly.

This research project forms the basis for further research aimed at developing a new subsidy policy for South Africa's proposed IPTS, currently being implemented.

3 PROPOSED INTEGRATED URBAN PUBLIC TRANSPORT SYSTEM FOR SOUTH AFRICA

3.1 INTRODUCTION

In Chapter 2 the background to South Africa's current public transport system was discussed. Several challenges that South Africa is currently facing have now been highlighted. Step three of the system-based process is to investigate the policies, strategies, vision and goals the stakeholders already have (or are putting) in place to overcome these gaps (identified in Chapter 2) and reach the objectives (identified in Chapter 1).

The proposed IPTS (in the process of being implemented by the government) will also be discussed as a means to overcome public transport problems.

3.2 NATIONAL POLICIES, STRATEGIES, VISION AND GOALS

In order to evaluate the national objectives against the implementation and shortcomings of the proposed IPTS, it is necessary to align the system with national policies, strategies, vision and goals.

3.2.1 NATIONAL POLICY AND LEGISLATION

National transport policy culminated in the publication of the White Paper on the National Transport Policy in 1996. The White Paper, as summarised in (DOT, 1996), states the public transport policy's main principles as follows:

- Public transport services must be affordable to the public and responsive to commuter needs. They must be designed to: integrate different modes of public transport, be cost efficient, achieve service quality, use available resources optimally, use the most cost-effective modes (bearing in mind commuter needs), be safe and do the least possible harm to the environment.
- Subsidies must be aimed at assisting marginalised users and those with poor access to social and economic activity.
- An effective public transport system must be achieved through integrated planning, provision and regulation of services and infrastructure, with diligent, effective law enforcement.
- Law enforcement must be promoted as vital to managing and regulating land transport, while the efforts of all involved must be co-ordinated to prevent duplication.

- Public transport must be given higher priority than private transport, with all spheres of government promoting public transport.
- The needs of special categories of commuters (such as learners, tourists and people with disabilities) must be met, as far as possible, by the system provided for mainstream transport.

These policy principles were included in the NTLLA (2000) in order to ensure legal recourse. Principles became statutory planning obligations for all municipalities when they prepare their Integrated Transport Plan (ITP) as a sector plan of the Integrated Development Plan (IDP), required of them in terms of the Municipal Systems Act of 2000.

3.2.2 NATIONAL STRATEGY FOR PUBLIC TRANSPORT

The MSA's Action Agenda provides a 20-year strategic framework that includes various strategies for the respective transport aspects such as urban passenger transport, rural passenger transport, tourist and long-distance passenger, special need passengers and freight transport. The agenda also focuses on transport issues such as limited financial resources, decline in public transport quality of service, land use problems affecting travel patterns, and various other issues.

3.2.3 NATIONAL VISION FOR PUBLIC TRANSPORT

The vision for transport in South Africa by the year 2020, as identified by the DOT, can be summarised as follows:

"It will meet the needs of freight and passenger customers for accessible, affordable, safe, frequent, high quality, reliable, efficient and seamless transport operations and infrastructure. It will do so in a constantly upgrading, innovative, flexible and economically and environmentally sustainable manner. In so doing, transport will support and enable government strategies, particularly those for growth, development, redistribution, employment creation and social integration, both in South Africa and in the Southern African region" (MSA, 2004).

3.2.4 NATIONAL GOAL FOR PUBLIC TRANSPORT

The main goal of urban commuter transport, as identified by the DOT, is to prioritise public transport. The goal is to provide an affordable, safe, secure, fast and frequent public transport service. This goal envisions that by 2020 a city-wide public transport network will enable all urban transport customers to participate in various activities of city life (MSA, 1999).

Urban commuter transport's secondary goal is to densify land use patterns. The core public transport system will operate along a densified corridor which will have public transport as its priority mode. Densification along corridors will lead to high volume and high frequency public transport services, meeting commuters' needs of reduced trip duration and waiting times.

An improved public transport system, together with a mandatory reduction in private transport use, is intended. This should shift potential commuters away from private transports to public transport.

3.3 OVERVIEW OF THE PROPOSED INTEGRATED PUBLIC TRANSPORT SYSTEM

3.3.1 BUS RAPID TRANSIT (BRT) SYSTEM

The Bus Rapid Transit (BRT) is an initiative to transform the public transport sector by improving customer experience. This initiative will integrate all public modal options into a coherent package for the commuter. Among these modes to be integrated are: Metrorail services, conventional bus services, minibus taxi integration, feeder bus services, improved pedestrian and bicycle access, metered-taxi integration and park-and-ride facilities (NMBM PTP, 2006).

BRT offers the performance and comfort of a modern, rail-based transport system, but at a fraction of the cost (four to 20 times less than a tram or light-rail transport system and 10 to 100 times less than a rail system) (City of Cape Town: e, 2008).

The vision is that road-based public transport services will be transformed into the concept known as BRT. BRT is a high-quality, bus-based transport system designed to deliver fast, comfortable and cost-effective mobility through the provision of dedicated bus lanes, frequent scheduled operating services and sufficient marketing and customer service.

Dedicated bus lanes reduce customer travel times if effectively utilised. During peak periods more commuters are transported quickly to destinations, encouraging the switch from private transport to a public transport mode. Dedicated lanes reduce operating costs, ensuring affordable fare levels.

BRT systems have become a global phenomenon. The system has been successfully implemented in cities, such as Curitiba, Bogotá, Sao Paulo, Brisbane, Los Angeles, Ottawa, Rouen, Beijing, Delhi, Jakarta, Nagoya and Taipei (City of Cape Town: e, 2008).

In South Africa the BRT system is intended to operate as a joint venture between the bus and minibus-taxi companies to make the road commuter public transport industry more profitable and improve working conditions for employees within the industry. To achieve joint ventures, incentives offered to bus and minibus-taxi companies will be a major deciding factor. The different operators will need to understand their roles and how they will be affected. It is essential for all stakeholders to support the BRT system and to co-operate; otherwise it is doomed to fail.

Pedestrian walkways, bicycle lanes and park-and-ride facilities are some of the other aspects that are closely integrated with the BRT system. Pedestrian walkways and bicycle lanes will provide safe and secure ways for non-motorised public transport. Park-and-ride facilities, to facilitate vehicles of commuters, will be situated close to BRT-stations.

3.4 MAIN CHALLENGES TO IMPLEMENTATION OF THE PROPOSED URBAN PUBLIC TRANSPORT SYSTEM

The successful implementation and operation of the IPTS is dependent on overcoming two serious challenges:

- developing and managing the infrastructure
- obtaining the necessary buy-in and co-operation of all relevant stakeholders

The first challenge, by and large, is authorised and implemented by all government spheres (national, provincial and municipal level), thus allowing for little public influence and intervention.

The second challenge, to obtain buy-in and co-operation of the different stakeholders, is more controversial. Current resistance and strike actions from the minibus-taxi industry highlight the importance of incentive intervention. Without the support and co-operation of the minibus-taxi industry the BRT system will not be able to operate successfully.

3.5 CONCLUSION

The third step has now established goals, policies and strategies on how to overcome the gaps and achieve the objectives stated in the national legislation. The first three steps together form the essential base of the system-based process. Steps one to three can serve as measurement criteria against which both public transport and the subsidy approach can be measured.

The national objectives for an IPTS are to provide a more affordable public transport service that addresses commuters' needs; subsidies to improve social and economic activity; integrated planning and regulation of services; law enforcement; higher priority public transport and the accommodation of people with special needs.

BRT is a system that provides safe, reliable and affordable public transport services. It will integrate various public transport modes into a system that will be operated in an efficient and optimal way to provide transport services to the whole community. A BRT system, with dedicated bus lanes, will reduce travel times for commuters and convince private transport users to use public transport instead.

The main challenge that needs to be addressed in order to implement the BRT system successfully, is obtaining proper buy-in and co-operation by the different stakeholders. Central to this move is the introduction of a fair and equitable subsidy approach regarding the bus and – even more importantly – the minibus-taxi industry. Without a well-considered subsidy intervention the BRT system will not operate successfully.

Implemented subsidy approaches should have a direct positive influence on the two main shortcomings (lack of accessibility to affordable transport and increasing car ownership) and the main challenge of achieving buy-in from all stakeholders in the current public transport system. It is therefore an essential part of the successful implementation of the BRT system.

4 THEORETICAL TRANSPORT SUBSIDY EVALUATION

4.1 INTRODUCTION

Governments need to reconsider transport-related decisions regularly and monitor public transport performance continually. Questions such as: “Who will be transported, from where, to which destination, and how frequently?” and “Which mode should be used via which route?” should be posed. Each decision results from evaluating positives and negatives for each specific problem – or in economic terms – the relevant costs and benefits.

Chapter 4 is the fourth step in the system-based process toward an appropriate subsidy approach. A theoretical analysis regarding the different subsidy types is conducted and the relative merit of subsidy systems is discussed. All subsidy approaches/systems should comply with the broad measurement criteria required by the relative merit.

4.2 TYPES OF TRANSPORT SUBSIDIES

The following theoretical subsidy systems can be considered to be the main subsidy system approaches:

- Capital
- Loss
- Input
- Output
- Tariff

4.2.1 CAPITAL SUBSIDY

Operators need to make provision for the replacement of public transport vehicle fleets. The cost of this replacement will be carried by the commuter in the form of higher tariffs and therefore may have a negative effect on the public transport system. Knowing this, the operator might decide not to invest in new vehicles or maintain existing vehicle fleet (as is currently the case in South Africa). Capital subsidies are funds that are provided to operators to invest in their fleet to maintain an equitable public transport service.

The advantages are:

- new and properly-maintained vehicle fleets
- lower tariffs for commuters

The disadvantages are:

- too high a capital basis is created, making the subsidy itself a profit generator
- operators do not use subsidy funds to maintain or replace vehicle fleets

4.2.2 LOSS SUBSIDY

The primary objective of loss subsidies is to make up losses and finance the status quo (on a small scale). It also deals with the "symptoms" of the basic problems of the industry (mainly used in municipal services).

There are many uncertainties regarding loss subsidies and questions that arise are:

- Which combination of costs and revenue should be used to determine "losses"?
- Should only operating costs be considered, or should depreciation also be included?
- Should return on investment be included and, if so, at what rate?
- Should losses be measured against peak or off-peak routes?

The advantage of this subsidy is that it is the simplest and easiest type to administer. However, there are disadvantages. These can be summarised as follows:

- Loss subsidy does not encourage improvement of services nor achieve any other fundamental objective. Funds are too easily accessible for paying off any loss incurred.
- Loss subsidies are highly sensitive to all elements of costs and revenue. Losses have an immediate effect on tariffs charged and the service provided.
- Loss subsidies are only provided to non-profitable operators. The question that arises is: "Can it be assumed that operators that do not incur losses provide sufficient services and therefore do not need financial assistance?"

Although this system is easily administered (the system is, for example, simple, flexible and easily adjustable), the lack of proper supervision can lead to the abuse of the system. Management may not be sufficiently strict on expenditure, as losses stand to be automatically subsidised. This state of affairs has been confirmed in the case of South Africa (See Section 1.3.).

4.2.3 INPUT SUBSIDY

Input subsidies are funds intended to cover a portion of the total costs or a specific element of operating costs.

The disadvantages of this type of subsidy are:

- If the subsidy equals operating costs, management's attempts to increase efficiency may be inhibited.
- There is no guarantee that expenditure will be controlled, so that it will progressively contribute to inefficiency and thus greater subsidisation.
- If the primary objective of a subsidy is to counter-act loss, the input subsidy will be ineffective, because the greatest percentage of these is allocated to operators who are already in a profit-making position.
- If a subsidy is limited to a specific cost element, the operator might increase this subsidised factor, relative to the other factors which is misrepresentation of input cost expenditure.
- As in the case of loss subsidy, the automatic payment of a specific portion of a cost item does not encourage management to control cost expenditure.

4.2.4 OUTPUT SUBSIDY

Subsidies are paid according to the output of the operator. Outputs that are normally used to determine the payment of subsidies are commuter numbers and service level delivered.

The great advantage here (above that of input and loss subsidy) is that output subsidies encourage efficient operations and sufficient cost control.

The biggest disadvantage is that subsidies might decrease in proportionate to a commuter number decrease because of increased private transport ownership.

4.2.5 TARIFF SUBSIDY

This system provides to the subsidising entity (the government) an accurate and continuous image of commuter demand and productivity of the operator. According to the ground rules of this system, the commuter is subsidised when he/she does not have the income to pay for the service being provided by the operator. The subsidy amount is the difference between the official cost and the real economic cost of the trip. It is determined on the grounds of the operational results obtained by the operator during a specific financial period.

The advantages are:

- No other subsidy system can be controlled as successfully as this system.
- The subsidising entity (the government) is involved in determining the tariff that is being charged (the economic tariff).

4.3 RELATIVE MERIT OF SUBSIDY SYSTEMS

There are four main criteria to determine the suitability of a subsidy system, namely:

1. Degree of advancement of efficient public transport – It must encourage effective operations and optimisation of resources by operators.
2. Degree to which it promotes social objectives – It should strive to achieve social objectives.
3. Fairness – If a specific system is chosen above another because of its fairness, it should be clearly stated in which respect.
4. Cost of administration – The cost to determine the allocation of subsidies must be minimised.

When considering the above criteria and the different merits, it becomes apparent that it will be difficult for one subsidy system to achieve all these merits. A subsidy system must be chosen that will be most successful at allocating resources. The different criteria will be discussed and, should subsidy systems not meet these criteria, their disadvantages will be highlighted.

4.3.1 ADVANCEMENT OF EFFICIENT PUBLIC TRANSPORT

The main objective of the South African urban transport policy (like that in most other international cities) is to improve mobility and accessibility for people and the businesses who serve them. The impact of an efficient, effective and accessible transport system on society is the fulfilment of demand, efficient business co-operation, a dynamic economy, social inclusion and a responsive society.

Subsidised transport for the under-privileged seems to be a worldwide trend aimed at developing a common welfare. This rationale can, however, be misdirected. Indiscriminate cheaper transport can improve mobility and access to transport, but it can also lead to unwanted impacts, such as continued urban sprawl in the long run.

4.3.1.1 TRANSPORT AND URBAN SPRAWL

Housing subsidies, together with cheaper and faster transport, are main drivers of urban sprawl. Urban sprawl and less densely-populated areas influence the choice of transport modes. The biggest subsidy for public transport (cost-effective transport) should be provided in areas where population density is the highest. As population density lessens, public transport becomes less attractive for commuters. Public transport becomes more expensive and travelling times increase. Without funding from public budgets, fares will increase and/or service quality will reduce. Sustained public transport services become more expensive for the government when population density drops. Urban sprawl fosters a modal shift away from public transport, resulting in higher dependency on private transport (Puncher, 1988).

Decisions to move further away from the CBD changes commuting and travel patterns. Cheaper (subsidised) public transport leads commuters to travel longer distances more readily and, consequently, more transport is required. Subsidised public transport, however, has a negative effect on access to local shops, services and social contact. Relocation of retail and businesses to distant centres and malls reduces convenience for residential areas. This, in turn, increases dependency on expensive private transport for daily household necessities, leading to increase in road traffic, as more frequent trips over longer distances are called for. These facts finally lead to reduced mobility and limited access for those who cannot afford the spiralling cost of unsubsidised private transport (Puncher, 1988).

4.3.1.2 INDUCED TRANSPORT AND DECOUPLING

Induced transport increases congestion, with growing pressure on increased demand for new road construction, causing further environmental, health and urban spatial problems. Society and the economy also become increasingly more dependent on transport.

Increased spending on transport infrastructure is not always the best solution. On the one hand it can lead to temporary lessening of congestion, saving in travel time and easing traffic flow, but on the other hand, various studies* conducted in America have indicated that it will induce additional traffic and congestion as an end result (Puncher, 1988).

4.3.2 SOCIAL EQUITY AND FAIRNESS OF THE SUBSIDY SYSTEM

Low-income households are significant beneficiaries of public transport subsidies. Subsidies are distributed in three respects:

Firstly, transport subsidies paid to the poor are much larger than the tax payments they pay to finance these subsidies. Consequently, affluent households pay more taxes for transport than they receive in subsidies.

Secondly, the poor obtain more subsidised transport trips per rand of transport trip payments than do affluent households.

Thirdly, subsidising transport through tax rebates and exemptions is more progressive than raising transport fares and forcing passengers to bear a larger percentage of the tax burden.

Long-distance commuters are more subsidised than short-distance passengers. Peak hour commuters also receive higher subsidies than off-peak commuters and lastly, sub-urban commuters are more subsidised than commuters who live close to the inner city. Each of these cross-subsidies indicated a negative impact on low-income households and minority group commuters (Willett, 2003).

Distance-based fares, off-peak discount fares, discount transport passes for the poor, shifting subsidies from rail to bus and improved services in low-income neighbourhoods will all increase subsidy benefits to the poor.

4.4 CONCLUSION

There are five different types of subsidy approaches. These approaches form the basis for determining specific transport subsidies that should be considered for implementation in South Africa.

It is essential to consider the relative merits of each subsidy system, in order to implement a subsidy system (or a combination of a couple of subsidy systems) that will meet present subsidy objectives. The relative merits of a subsidy system includes: encouraging of effective operations, social objectives, fairness and cost administration.

The fourth step of the system-based process, discussing the theoretical subsidy methods and identifying the relative merit all subsidy approaches should comply with, has been completed.

5 DIFFERENT SUBSIDY APPROACHES

5.1 INTRODUCTION

The fifth step in the system-based process is evaluating different subsidy approaches in order to identify the best and most appropriate subsidy approach. This entails weighing up different subsidy methods against the desired improvement required in terms of the shortcomings and then finding means of overcoming the challenges identified. The relative merit of each subsidy system then needs to be evaluated.

Urban public transport is subsidised in most cities of the world. Different subsidy approaches are taken respective to the needs of individual countries and cities. There are countries/cities that have the same approach, but factors such as different demographics and city population densities lead to different outcomes. Reviewing different subsidy approaches in relation to the two major shortcomings and the main challenge identified in previous chapters, should lead to a broader understanding of the different subsidy systems and assist in selecting a new subsidy approach suitable for South Africa.

5.2 SUPPLIER-SIDE SUBSIDY

Supplier-side subsidy can consist of various types of methods. One of the types of subsidies most frequently used is a supplier-side subsidy paid directly to the operator.

One method of supplier-side subsidy is a tariff subsidy. Tariff subsidy refers to the transport operator receiving a direct tariff subsidy for offering specific services at fare prices that produce insufficient total revenues to cover costs.

Another method of supplier-side subsidy is a capital subsidy. This entails an amount paid to the supplier to replace (and/or maintain) vehicles. The most prevalent advantage of capital supplier-side subsidy is that it is easily administrated.

5.2.1 TARIFF SUBSIDY

Tariff subsidies are aimed at subsidising the price of the public transport fare paid by the commuter. An “economic fare” (for subsidised services) is determined for each ticket sold by the operator. This allows the operator to provide a profitable and efficient service. The difference between the economic fare and the commuter fare is equal to the subsidy. It is accepted that a private operator cannot provide the desired levels of transport services profitably without a subsidy. In some cases the commuter pays an even lower fare, this being determined by his/her financial position.

5.2.1.1 TARIFF SUBSIDY ADVANTAGES

There are two ways public transport commuters can benefit from fares at less than operating costs. Firstly, the actual fare can be reduced whilst maintaining the same level and quality of service (better known as "maintaining cost"). Secondly, fares can be held constant whilst increasing the level and quality of service (better known as "increasing cost").

Many believe that low public transport fares offer benefits such as reduction in private transport usage and correction of land-use pattern problems. Although this is believed to be so, the advantages and disadvantages will be compared to verify the plausibility of this statement. The advantages are listed below.

- Private transport is one of the most frequently cited problems. Governmental aid for road construction usually leads to increasing levels of private transport. Private transport usage is encouraged by government's failure to charge (private transport) users for the full costs of congestion, pollution and accidents. They are neither penalised for parking space occupied, nor for uneconomic energy consumption at the expense of society, economy and the environment. In the most effective public transport systems, subsidies can encourage a modal shift from private transport use to public transport.
- In many cases a more equal distribution of income and mobility is reached through lower fares. Subsidised low transport fares are beneficial to low-income households, the elderly and handicapped people who have limited access to private transport.
- Marginal cost pricing will improve the allocation of society's resources among competing users. Marginal cost is the additional cost incurred by producing one more unit of the service. The allocation of society's resources is improved if we produce only as much of a good as can be sold at the marginal cost. A decline in average cost as output increases, will lead to revenues collected from marginal cost pricing being less than total costs. Public transport exhibiting these declining average costs must be subsidised if it is to be priced at marginal cost.

5.2.1.2 TARIFF SUBSIDY DISADVANTAGES

The two disadvantages of tariff subsidies are the resulting inefficiency of the transport system and low fares:

- Operators of subsidised public transport contribute to the inefficiency of the public transport system. Operators tend not to strive to produce the level of service commuters need. Frequency, safety and waiting time are in many cases unsatisfactory and inefficient.
- Subsidised operators have no incentive to strive to achieve maximum profits. Operators know that the DOT will keep compensating them by providing funds to bridge the difference between operating costs and tariffs asked for the service.

5.2.1.3 TARIFF SUBSIDY ADVANTAGE VS DISADVANTAGES

Low fares do not always achieve the benefits as described under advantages. The next two points indicate that advantages are doubtful and unlikely.

Firstly, advantages such as improvement of land use, private transport and the furthering of equal distribution of income are subject to other elements (for example: organisational structures, allocation of resources, fuel prices, law enforcement and common perceptions). Effective subsidy systems can reduce private transport use, but other types of taxation or methods of subsidy allocation are normally required to optimise this outcome.

Secondly, the advantages do not imply indiscriminate subsidies, but rather subsidies that should be restricted to specific types of transport services. That low fares can reduce congestion and, through marginal congestion cost pricing, improve the allocation of resources, are well-grounded statements.

5.2.1.4 THE FEASIBILITY OF TARIFF SUBSIDY FOR SOUTH AFRICA

Lowering fares to reduce private transport use (thus curtailing private transport congestion) and instituting tariff subsidies by means of marginal cost pricing, are persuasive options that need to be debated in the South African context (Kirby & McGillivray, 1978).

The advantages and disadvantages of tariff subsidies need to be measured against the two main shortcomings of our urban public transport system (identified in Chapter 1, i.e. lack of accessibility to affordable transport and increasing private transport vehicle ownership leading to traffic congestion) and the main challenge of convincing all stakeholders to buy into the proposed South African IPTS. The relative merit of the subsidy should also be investigated.

A natural monopoly normally occurs when a non-profitable good or service has to be provided. Public transport in most cases needs the support of the government in the form of a subsidy in order for the service to be efficiently and cost effectively. Cases where the long run average cost declines over the entire output period, marginal cost pricing occurs.

Pricing public transport at marginal cost ensures the appropriate allocation of society's resources among competing users. The extent of marginal cost pricing depends on whether the average cost of providing a public transport trip declines when the number of trips increases. If this is the case, fares set at marginal cost will generate revenues below total costs and will necessitate a subsidy increase.

Table 5-1 indicates the feasibility measurement of tariff subsidies as a solution for lack of accessibility to affordable transport.

Table 5-1: Feasibility of Tariff Subsidies as a Correction for Addressing the Lack of Accessibility to Affordable Transport and Other Transport Challenges

SHORTCOMING/CHALLENGE	FEASIBILITY MEASUREMENT
Lack of accessibility to affordable transport	No impact
Private transport congestion	No impact
Buy-in of stakeholders	No impact

The above table indicates that marginal cost pricing to be a method that will not improve the shortcomings and challenge South Africa is currently experiencing. This method can thus be discarded as a possible subsidy approach for the South African public transport system.

a) TAXATION AND RESTRICTION

Whenever a vehicle enters a public road, the average speed of all other the vehicles on the road will be reduced. The resulting reduction in average speed leads to an increase in the cost of travelling, in terms of time for each occupant of individual vehicles. Each driver of an additional vehicle entering the road is oblivious of the cumulative time cost for all travellers on the road and does not take this into account. Perceived cost (the inability of transport users to determine and compute all elements of travelling costs such as fuel, lubrication, tyres, comfort, time, safety and risk) leads to private transport commuters under-estimating travelling costs in most cases.

Congestion occurs when the volume of traffic is close to the capacity of the road. This commonly occurs in larger metropolitan areas during morning or evening peak traffic periods.

Methods to reduce excessive congestion are:

- imposing a toll, as a form of taxation, during peak periods on congested roads (congestion pricing is discussed in Chapter 5)
- physically restricting access to roads that are at risk during peak periods

Although congestion pricing is not a subsidy, it is a method that cannot be discarded. The possibility of congestion pricing, as a combined strategy with a subsidy approach, needs to be researched. In South Africa the above-mentioned, direct congestion pricing methods are most likely to be too expensive and politically difficult to implement. Other pricing methods should be investigated and researched in order to charge private transport commuters for the external cost burden they cause the economy and society.

b) SUBSIDISATION

A subsidy which reduces fares for other competing modes has only a minor impact on minimising levels of private transport travel on congested roads. This small reduction can be substantially beneficial on roads where there is virtually no movement because of the severity of congestion. However, in most cases subsidies to reduce congestion are an insignificant method (Willet, 2004).

Table 5-2 indicates the feasibility measurement of tariff subsidies as a solution for private transport congestion.

Table 5-2: Feasibility of Tariff Subsidies Regarding Private Transport Congestion

SHORTCOMING/CHALLENGE	FEASIBILITY MEASUREMENT
Lack of access to affordable transport	No impact
Private transport congestion	Slight impact, but too inefficient to implement
Buy-in of stakeholders	No impact

5.2.1.5 CONCLUDING REMARKS ON TARIFF SUBSIDY

Table 5-3 illustrates the evaluation of tariff subsidy in relation to the relative merit of subsidies. When evaluating tariff subsidy in relation to these merits an indication is given of the appropriateness of the subsidy approach.

Table 5-3: Relative Merit of a Tariff Subsidy

RELATIVE MERIT	RELATIVE MERIT OUTCOME
Encouraging effective operations	No
Social objectives	Doubtful outcome
Fairness	Doubtful
Cost administration	Simple and inexpensive

From the above arguments and the outcome obtained from the relative merit, it is evident that tariff subsidies are not an optimal method for South Africa’s proposed IRTS. Other subsidy approaches that might have more direct and effective implications need to be considered. Therefore, for this research study, tariff subsidies can be safely ignored regarding further analysis.

5.2.2 CAPITAL SUBSIDY

As mentioned previously, capital subsidy is an amount paid (by the government) to the operator primarily to replace units of an existing vehicle fleet. The secondary motivation for capital subsidy is to encourage operators to maintain their vehicles at the level required to provide a sustainable high level of service. The advantages and disadvantages of capital subsidies will be discussed in the next section.

5.2.2.1 CAPITAL SUBSIDY ADVANTAGES

Easy administration of capital subsidies is the advantage most frequently emphasised. Another discernable advantage flows from reduction in commuter fares. This reduction is as a result of the fixed cost paid and dealt with once the capital subsidy is received. Fixed costs are not calculated into the final fares charged and therefore effectively reduce public transport fares.

5.2.2.2 CAPITAL SUBSIDY DISADVANTAGES

Capital subsidy, as the only means of compensation employed, may contribute to economic inefficiency for operators. Where capital subsidies are allocated in unregulated markets, unhealthy competition may lead to system failure. For example: although the allocation of capital subsidies is an effective way to remove rundown minibus-taxi vehicles from the road, the minibus-taxi industry, in order to make operational profit, is still unsafely and inefficiently run. Operators continue using obsolete vehicles at, what seem cheaper rates, preferring to ignore the inherent false economy at work.

Certain capital subsidies have contributed directly to inefficient provision of services, i.e.:

- Capital grants encourage premature replacement of equipment and inadequate maintenance.
- By restricting capital grants solely to public bus operators, the undesirable practice, of offering services that could be provided more cost efficiently by minibus taxis or other private operators, is promoted.

5.2.2.3 CONCLUDING REMARKS ON CAPITAL SUBSIDY

The concluding particulars concerning capital subsidy, as a form of supplier-side subsidy, is:

- Administration of subsidy funds is straightforward.
- Public transport fees charged to the commuter are reduced.
- Competition between operators decline and lead to a rapid increase in the costs of public transport services provided.
- Some operators may utilise their subsidies fully, while others will underutilise them.
- Operators become less responsive to public transport commuter needs.

Although the allocation of capital subsidies in unregulated markets has negative results, the new proposed IPTS system will be regulated and therefore capital subsidies allocated in this type of market can prove to be very effective. The feasibility measurement between capital supplier-side subsidy and the shortcomings and challenges are indicated in Table 5-4. The relative merit of capital supplier-side subsidy is illustrated in Table 5-5.

Table 5-4: Feasibility of Capital Supplier-Side Subsidy

SHORTCOMING/CHALLENGE	FEASIBILITY MEASUREMENT
Lack of access to affordable transport	Sufficient impact (if combined with another subsidy approach)
Private transport congestion	Little impact
Buy-in of stakeholders	Sufficient impact

Table 5-5: Relative Merit of Capital Supplier-Side Subsidy

RELATIVE MERIT	RELATIVE MERIT OUTCOME
Encouraging effective operations	Yes, operators compete for ridership of commuters
Social objectives	More encouraged to satisfy peoples' needs.
Fairness	More fair system
Cost administration	Still simple and inexpensive

Table 5-4 and Table 5-5 indicates that, considering the shortcomings, challenges and relative merit, capital supplier-side subsidy will have a sufficient impact (in a regulated market) and will therefore be analysed further in this study. The implementation of a capital supplier-side subsidy only will not be sufficient to overcome the shortcomings and challenges. If a capital subsidy can be integrated with another type of subsidy or form of compensation, it will encourage public transport usage. In this particular study capital subsidy will be evaluated as a possible form of supplier-side subsidy.

5.3 USER-SIDE SUBSIDY

User-side subsidy is paid directly to the commuter. User-side subsidy is a form of compensation passed on to the commuter for the use of public transport services.

User-side subsidy is an effective policy for narrowing inequalities, because it focuses exclusively on the poor. This subsidy encourages healthy competition among operators and promotes greater efficiency of public transport services. User-side subsidies ensure that scarce financial sources are allocated more efficiently and equitably.

In practice, this type of subsidy to public transport commuters will be in the form of discounted ticket cards sold to target groups, at a price less than the actual (monetary) value of the service provided. A user-side subsidy gives the commuters a choice of operator and mode of transport to suit their needs. In these instances, operators have an incentive to satisfy the needs of commuters, thus encouraging their future patronage. User-side subsidies guarantee that only trips that are actually taken are subsidised, in contrast with supplier-side subsidies where subsidies are paid without knowing what the money is used for (Kirby & McGillivray, 1978).

The main advantage of this approach is that subsidies are rendered to the most disadvantaged target group and also guarantees that only trips actually taken are subsidised. User-side subsidy is more difficult to administrate, but encourages operators to provide services to meet the people's needs and to deliver efficient and cost effective services.

There are three types of user-side subsidies: conventional user-side subsidy; organisationally-focused, user-side subsidy and corridor-focused, user-side subsidy.

5.3.1 CONVENTIONAL USER-SIDE SUBSIDY

Conventional user-side subsidy targets people (households) with limited, basic mobility needs. The biggest disadvantage of a conventional user-side subsidy is difficulty determining the exact way subsidy money is spent. Various methods of subsidy payment exist and it is important to determine the most effective payment method to prevent public transport subsidies being spent on essentials such as food, clothes and other consumer goods.

5.3.2 ORGANISATIONALLY-FOCUSED USER-SIDE SUBSIDY

Organisationally-focused, user-side subsidy includes the involvement of businesses or government organisations in the subsidisation of their employees' use of public transport. Involving such organisations can create many administrative and other difficulties (as found in Brasilia) (DOT, 1994). For example, all involved organisations have to agree to on the subsidy system being implemented, while certain organisations would want exceptions to be made for their own employees in terms of matters such as waiting time and drop-off zones. The other disadvantage is that potential subsidy recipients have to belong to, or be registered with, an organisation. Restricting subsidies to full time, formal sectors employees would be inequitable in respect of the unemployed or informal sector workers.

The only equitable possibility available to make organisationally-focused, user-side subsidy a viable proposition, is to combine it with a corridor-focused, user-side subsidy, (this will be discussed in the next section). The purpose would not necessarily be to use the organisation as a "screening mechanism" for selecting eligible subsidy recipients, but rather to promote and facilitate the establishment of a viable and accessible public transport system.

5.3.3 CORRIDOR-FOCUSED, USER-SIDE SUBSIDY

A corridor-focused, user-side subsidy can overcome the fraud problems of a conventional user-side subsidy system, while assisting directly with the implementation of a corridor-focused public transport plan. Users will be subsidised in being able to buy discounted travel cards, which can be used for a variety of other travel modes and options. The corridor-focused subsidy system will not only take into account the transport corridor, but also the distance commuters need to travel to reach their destination.

The current corridor-focused, user-side subsidy does not take into account the distance travelled by the commuter on a specific route. The new proposed IPTS requires that commuters' need to be compensated per kilometre travelled. The corridor-focused, user-side subsidy can be adjusted to take distances travelled into account on specific routes. This additional focus on distance travelled, as part of the corridor-focused, user-side subsidy, will assist in achieving the warranted objectives set by the current South African regime for public transport subsidisation.

5.3.4 CONCLUDING REMARKS ON USER-SIDE SUBSIDY

The advantage of compensating the commuter (as opposed to the operator) is that it will motivate operators to compete for maximum commuter trips and service levels rather than take subsidies for granted. User-side subsidies also have considerable flexibility. Subsidy targeted groups can be varied by such criteria as, among others, income, age, transport mode, class of service, and time of day travelled.

When user-side subsidies alone are considered, efficient use of transport resources are promoted. Placing subsidies in the hands of users encourages operators to function optimally in order to qualify for this income stream. Public bodies can thus ensure that commuter needs are being met and costs are controlled. User-side subsidies lower the effort levels necessary for public bodies to be able to monitor service and fares. Operators will, in most cases, be bound to provide service levels and fares that will best satisfy their commuters' needs.

Administration is the biggest disadvantage of a user-side subsidy approach. Commuters must be identified and reimbursed. Tickets must be handled in such a way as to minimise fraud. However, today different electronic systems and computer software programmes exist to assist with the administration of user-side subsidy.

The concluding aspects concerning user-side subsidies alone are:

- Commuters obtain higher-quality services from the operators.
- Different public transport alternatives can be offered to commuters more efficiently.
- Operators manage and provide services more efficiently.
- Administrative difficulties in distributing tickets and guarding against fraud may be experienced.

Finally, it is important to consider all three types of user-side subsidies and the feasibility measurement regarding their shortcomings and challenges. Table 5-6 indicates the measurement of the feasibility of a user-side subsidy.

Table 5-6: Feasibility of User-Side Subsidy

TYPE OF USER-SIDE SUBSIDY / **SHORTCOMING/CHALLENGE**	**CONVENTIONAL**	**ORGANISATIONALLY-FOCUSED**	**CORRIDOR-FOCUSED**
Lack of access to affordable transport	Some impact (but easily abused)	Slight impact	Significant impact
Private transport congestion	No impact	Significant impact	Significant impact
Buy-in of stakeholders	No impact	Some impact	Significant impact

Table 5-6 indicates how corridor-focused, user-side subsidy has an impact on the shortcomings and challenges. Corridor-focused, user-side subsidy, with additional distance travelled consideration for each corridor, indicates most promise for improving shortcomings and challenges. This option will be expanded on later in this study.

Table 5-7: Relative Merit of User-Side Subsidy

RELATIVE MERIT	RELATIVE MERIT OUTCOME
Encouraging effective operations	Definitely
Social objectives	Focuses on low-income commuters and takes distances travelled into consideration
Fairness	If managed correctly, fairness of the system will be achieved
Cost administration	Expensive and complex

The relative merit of user-side subsidies looks promising (see Table 5-7). However, fairness of the system can be doubtful. In the next section the combination between supplier- and user-side subsidies will be investigated, with a view of improving the fairness of the system.

5.4 COMBINATION OF SUPPLIER-SIDE AND USER-SIDE SUBSIDIES

Subsidy budgets can be disbursed by using a supplier-side technique, such as a capital grant, or user-side technique, such as reduced ticket price. These can be combined.

Combining supplier-side and user-side subsidies has both advantages and disadvantages. Administrative problems caused by user-side subsidies must be endured, while efficiency problems are created by supplier-side subsidies.

If one operator is favoured over another when supplier-side subsidies are disbursed, the favoured operator will have a competitive advantage at setting fares.

Capital (supplier-side) subsidies are easier and less costly to administrate than user-side subsidies, while the latter are more efficient. User-side subsidies rely on the operators to supply an adequate level of service.

The combination of the capital supplier-side and corridor-focused, user-side subsidy amalgamates the advantages of the respective subsidies and provides a strengthened approach. Once all the disadvantages (because of the combination of subsidy approaches) have been identified, the government can prepare itself to minimise the negative effects of these.

Table 5-8 indicates the feasibility measurement of the combination of supplier-side and user-side subsidy. Table 5-9 indicates the relative merit of the combination of supplier-side and user-side subsidy.

Table 5-8: Feasibility of Combined Supplier-side and User-side Subsidy

SHORTCOMING/CHALLENGE	FEASIBILITY MEASUREMENT
Lack of access to affordable transport	Very significant impact
Private transport congestion	Little impact
Buy-in of stakeholders	Very significant impact

Table 5-9: Relative Merit of Combined Supplier-side and User-side Subsidy

RELATIVE MERIT	RELATIVE MERIT OUTCOME
Encouraging effective operations	Encourages effective operations
Social objectives	Reaches social objectives
Fairness	Fairness of the system is reached through the combination of approaches
Cost administration	More complex. However, information systems exist to deal with this problem

It is evident that further analysis of (capital) supplier-side and (corridor-focused) user-side subsidies, as a combination subsidy approach for South Africa, is important. In the next chapter this combination's effect on the South African public transport system, as well as possible shortcomings and challenges, will be expanded on.

5.5 CONCLUSION

Step five of the system-based approach entails the testing of different subsidy approaches against the shortcomings, challenges and relative merit of each subsidy method identified. These elements mentioned form part of the measurement criteria.

Review of different subsidy approaches has indicated that some approaches work better than others, but an optimal subsidy system is almost never found. It is thus essential to consider a combination of subsidy approaches to obtain the most effective beneficial result for the subsidisation of the proposed IRTS.

In considering different subsidy approaches, some approaches have been discarded because of their insignificant impact on the shortcomings and challenges identified in previous chapters.

Capital, supplier-side subsidy and corridor-focused, user-side subsidy (with additional consideration to distances travelled by commuters on corridors) and congestion pricing are the subsidy-related approaches that showed most promise in relieving the public transport and subsidy problem in South Africa. These three approaches indicated the most effective and positive impact on the shortcomings and challenges of public transport.

These approaches will be researched, in the next chapters, in context of the shortcomings whilst focusing on the demographic needs of South Africa and the financial impact on both the government budget and the commuter's monthly income.

6 TRANSPORT SHORTCOMINGS - LACK OF ACCESSIBILITY TO AFFORDABLE TRANSPORT

6.1 INTRODUCTION

Chapter six and seven constitute step six of the system-based process. These two chapters will test the appropriate subsidy approaches against the demographics of the country and also against the financial performance measurements. In step six the subsidy approaches that comply with the above-mentioned measurements are tested in practice to determine if the financial, economic and socio-economic measurements are satisfied.

Increasing private vehicle ownership has been identified as the main contributory factor to traffic congestion amongst the middle- and high-income group. It is thus essential to separate these two deficiencies to determine where the accessibility problems occur and who the target groups for affordable transport are, so that an appropriate subsidy system to address this can be identified. The implementation of such a subsidy system is important for operating an efficient public transport system.

In the previous chapter capital supplier-side subsidy and corridor-focused, user-side subsidy and congestion pricing were identified as possible approaches to improve the public transport subsidy system. Congestion pricing will be considered in the next chapter (7) as it focuses directly on the increasing private transport ownership problem. Capital (supplier-side) and (corridor-focused) user-side subsidy will be considered in this chapter (6).

It is important to note that the subsidy approach to be researched is based on the transformation stage of the public transport system South Africa is currently experiencing (the implementation of the BRT systems in metropolitan cities). The main focus of the study approach is to make the public transport system more attractive for private transport commuters to transfer onto public transport systems. This approach might, however, not be the optimal approach once travel patterns, objective and/or challenges have changed. Once travel patterns have changed, commuter needs will differ and the subsidy approach (using the system-based process) should be re-evaluated in order to satisfy the newly established objectives, goals and needs.

6.2 MICRO-ACCESSIBILITY FACTOR

Subsidy systems need to comply with micro- and macro (income demographics and percentage income spent on transport) -accessibility factors. In this section micro-accessibility factors will be evaluated. These factors include:

- accessibility to public transport services
- implementation of the proposed IRTS to relieve accessibility problems

6.2.1 DEMOGRAPHICS OF SOUTH AFRICAN TRANSPORT ACCESSIBILITY

The DOT published the National Household Survey results on the demographics of transport commuters in South Africa, based on the national travel census completed in 2001 (statistics obtained from StatsSA).

Table 6-1 indicates the walking times to train stations. These times indicate an aspect of public transport service accessibility.

Table 6-1: Access to Train Stations by Households in RSA

Province	Walking time to nearest station Percentage of households			
	1 - 15 mins	16 - 30 mins	> 30 mins	No service
Western Cape	22.6	22.1	11.2	44.1
Eastern Cape	2.8	2.8	2.0	92.4
Northern Cape	5.0	6.3	8.4	80.2
Free State	3.7	7.8	13.2	75.2
KwaZulu-Natal	6.7	5.3	1.4	86.5
North West	2.1	4.8	5.3	87.8
Gauteng	20.4	16.9	8.5	54.2
Mpumalanga	1.6	2.4	4.2	91.8
Limpopo	3.1	3.2	1.8	91.8
RSA	**9.5**	**9.1**	**5.6**	**75.7**
Metro	20.9	17.7	8.2	53.2
Urban	6.4	8.5	8.1	77.0
Rural	0.9	1.1	1.2	96.8

Source: DOT: e, 2001

When considering the table above, it must be noted that if a household has access to a train station (or any other form of public transport service), it does not imply that any member of that household makes use of that service. In this section of the research study, only accessibility to public transport services as such is being considered.

According to the statistics obtained from StatsSA, the following conclusions regarding access to train stations may be drawn:

- Only 10 percent of South African households have access to train stations within 15 minute walking time.
- No train service is available to 76 percent of the population.
- Train accessibility in the Western Cape and Gauteng is the highest indicated. In both these provinces over 20 percent of households can access a train station within a walking time of 15 minute.
- In metropolitan areas only 21 percent of people can access a train station within 15 minutes. Over half (53 percent) of metropolitan households have no readily available train station or it is considered to be too far away to walk there.

Table 6-2 shows the accessibility of bus stops by households.

Table 6-2: Access to Bus Stops for Households in RSA

Province	Walking time to nearest bus stop			
	Percentage of households			
	1 - 15 mins	16 - 30 mins	> 30 mins	No service
Western Cape	49.8	5.1	5.1	40.1
Eastern Cape	34.7	6.8	4.9	53.6
Northern Cape	18.8	2.5	3.7	75.0
Free State	34.0	9.3	6.5	50.3
KwaZulu-Natal	52.8	11.5	6.6	29.1
North West	56.0	11.5	2.9	29.6
Gauteng	44.2	4.7	12.3	38.8
Mpumalanga	43.9	12.1	6.5	37.5
Limpopo	62.5	12.4	4.1	21.0
RSA	**47.0**	**8.4**	**6.9**	**37.7**
Metropolitan	61.0	7.0	8.0	24.0
Urban	32.1	5.6	7.0	55.4
Rural	44.4	12.2	5.6	37.8

Source: DOT: e, 2001

The following conclusions on the accessibility of bus stops can be drawn from the Table 6-2:

- Of the total number of households, 47 percent of households have bus stops within relatively close proximity.
- For 38 percent of households no bus-service at all exists.
- In certain provinces, bus service with access within 15 minutes, are better developed:
  - o 44 percent of households in Gauteng
  - o 63 percent of households in Limpopo
  - o 56 percent of households in North West
  - o 53 percent of households in KwaZulu-Natal
  - o 50 percent in the Western Cape
- Provinces with few or no available bus services are the Eastern Cape (54 percent of households), the Northern Cape (75 percent) and the Free State (50 percent).
- Metropolitan areas have the best access to bus stops with 61 percent of households claiming to be able to reach a bus stop within 15 minutes.

Finally, Table 6-3 indicates the access time to minibus taxi services.

Table 6-3: Access to Minibus taxi Services for Households in RSA

Province	Walking time to nearest taxi			
	Percentage of households			
	1 - 15 mins	16 - 30 mins	> 30 mins	No service
Western Cape	77.6	7.9	1.5	13.0
Eastern Cape	69.9	15.1	6.5	8.6
Northern Cape	58.1	7.1	1.7	33.1
Free State	74.6	12.2	3.5	9.6
KwaZulu-Natal	70.8	16.0	6.1	7.1
North West	74.5	12.9	3.3	9.3
Gauteng	81.3	10.5	1.8	6.4
Mpumalanga	65.6	18.1	7.2	9.2
Limpopo	75.1	15.6	4.3	5.0
RSA	**74.2**	**13.2**	**4.0**	**8.6**
Metropolitan	84.8	9.7	1.3	4.2
Urban	77.8	10.7	1.8	9.7
Rural	60.8	18.6	8.5	12.1

Source: DOT: e, 2001

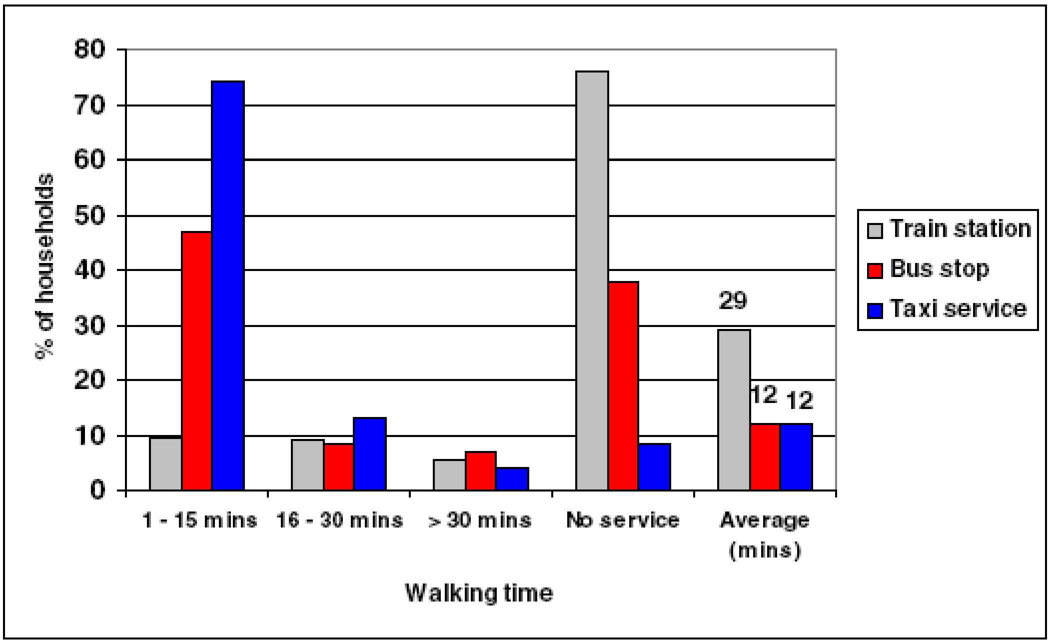
Accessibility to minibus taxi stops is considered according to the statistics obtained by StatsSA. The following results can be highlighted:

- Only 8,6 percent of households do not have access to a minibus taxi service. This constitutes a large number of people, considering that there are over 12 million households in South Africa.
- The Northern Cape has the least access to minibus taxi services (33 percent). This figure is perhaps evidence that the province has the lowest density of people per m².
- Of the total population, 74 percent can access minibus taxi services within 15 minutes from their homes.
- Gauteng has the highest accessibility to minibus taxi services (81 percent).
- Of total households in metropolitan areas of the RSA, 85 percent have access to a minibus taxi service within the generic 15 minute period.

6.2.2 OUTCOME

Figure 6-1 indicates the reported walking times to all modes of public transport and highlights the characteristics of the preceding tables.

Figure 6-1: Reported Walking Times to All Public Transport Modes



Source: DOT: e, 2001

The following conclusions, regarding accessibility to all public transport modes, can be drawn from Figure 6-1:

- Only 10 percent of households in South Africa have access to a train station within 15 minutes from home.
- Only 9,5 percent of households can access train stations within 16 to 30 minutes.
- Of the total number of households, 47 percent can reach a bus stop within 15 minutes, but a large portion (38 percent) of South Africans still have no access to bus services at all.
- Of the entire South African population, 91,4 percent have access to minibus taxi services. This shows the accessibility advantage that minibus taxis have over all other public transport modes.

The accessibility of minibus taxi services is superior to the accessibility of all other public transport modes. This is in comparison with train and bus services that are, in some cases, not available at all. Although improvements to the metropolitan transport infrastructure are taking place it is essential that the subsidy approach chosen supports better accessibility to the most appropriate public transport mode for commuters. If public transport remains too expensive for low income households, then the accessibility to public transport services could be regarded as pointless. For this reason the subsidy approach taken should provide financial support for public transport user to gain affordable access to public transport services.

The main aim of the proposed IRTS in South Africa is to make public transport services more accessible to commuters. Minibus taxi services should primarily provide feeder support for these services and, in so doing, enhance the total public transport system. It is also important to learn from international experience by ascertaining which approaches were successfully employed to overcome stated accessibility problems.

6.3 PROPOSED INTEGRATED RAPID TRANSPORT SYSTEM THAT ADDRESSES ACCESSIBILITY PROBLEMS

As indicated in the South African demographic statistics, the majority of prospective commuters struggle to obtain access to rail- and bus transport. Minibus-taxi transport is generally the most accessible mode in terms of proximity, connectivity, and mobility, but, as it does not receive an operational subsidy, it is more expensive.

The stated objectives of the BRT system envisage that BRT will relieve problems relating to accessibility of public transport. The proposed BRT system consists of a trunk service with minibus taxi feeder services. Public transport stations will be within walking distance from households.

Railway services and bus services will improve and extend to areas where these services are currently unavailable. The integration of bus and minibus taxi services, cycle lanes and pedestrian walkways will enhance passenger movements in and around the metropolitan areas.

Scheduled and frequent services, improved safety and security and the extension of public transport services into areas where demand is high, should enhance public transport accessibility in South Africa.

6.4 INTERNATIONAL EXPERIENCE REGARDING ACCESSIBILITY PROBLEMS

In the following sub-section Bogotá will be considered as reference for a similar BRT system approach that improved a city's public transport infrastructure and relieved accessibility problems. Transantiago, Chile, will act as another reference to indicate how BRT increased public transport commuter numbers, as well decreased accidents and waiting times.

6.4.1 BOGOTÁ, COLOMBIA

In Bogotá, Colombia, construction costs for the BRT system were between US$1 million to US$5 million/km, versus the US$90 million to US$100 million/km for an underground subway system over the same terrain and distance. In total US$280 million was invested in a 41 km busway. The operational costs, together with the lower capital cost, leads to passengers having to pay only between US$0.80 and US$1.90 per trip (Wright, 2001).

Bogotá's BRT system has developed into easily accessible public transport, where 85 percent of citizens are within 500 metres of the nearest public transport station. The integration of busways with non-motorised transport options such as cycle routes and pedestrian walkways, adds to improve accessibility and decongest traffic (Wright, 2001).

The implementation of infrastructure improvements to this extent requires large amounts of capital. Local government authorities in Bogotá could not afford to build and operate the system, so private partnerships were formed to help finance the system.

Today, Bogotá's BRT system receives minimal operating subsidies. However, the system had to overcome many obstacles to achieve the success it has today.

6.4.2 TRANSANTIAGO, CHILE

Another example of how the implementation of a system has improved accessibility, is the Transantiago system in Chile. With the new public transport system having been implemented, the Transantiago system's bus count has risen from 4 500 to 6 400 because of an increase in ridership. However, actual kilometres travelled have increased by 43 percent. A drop in accidents and a decrease in waiting times have been further positive aspects that resulted from the new public transport system (Wright, 2001).

6.4.3 CONCLUDING REMARKS ON INTERNATIONAL EXPERIENCE TO RELIEVE ACCESSIBILITY PROBLEMS

Bogotá's transport infrastructure is a functioning example of the type of systems currently being implemented in South African metropolitan cities. Bogotá's BRT system has addressed the accessibility problem successfully. The Transantiago also illustrated accessibility improvements in terms of increased ridership and decreased waiting times. Another improvement the Transantiago is credited for, is the decrease in vehicle accident rate.

Important lessons that South Africa can learn from Bogotá is that of public private partnerships (PPPs) that were established to finance implementation, as well as operations, of the system. Another important positive indicator is the prospect of a reduction of future subsidies if the South African system can be operated as effectively and efficiently as Bogotá's BRT system.

6.5 MACRO-AFFORDABILITY FACTORS

Macro-affordability transport factors, which the respective subsidy approaches, need to consider include:

- income demographics
- percentage income spent on transport

6.5.1 INCOME DEMOGRAPHICS OF SOUTH AFRICA

Data published by DOT from the 2001 census, gives one an overview of how many people are in each income group, as indicated in Table 6-4. Both Table 6-4 and Figure 6-2, indicate that most of the section of the population that have very little or no income is black African, whereas the white population group is more affluent.

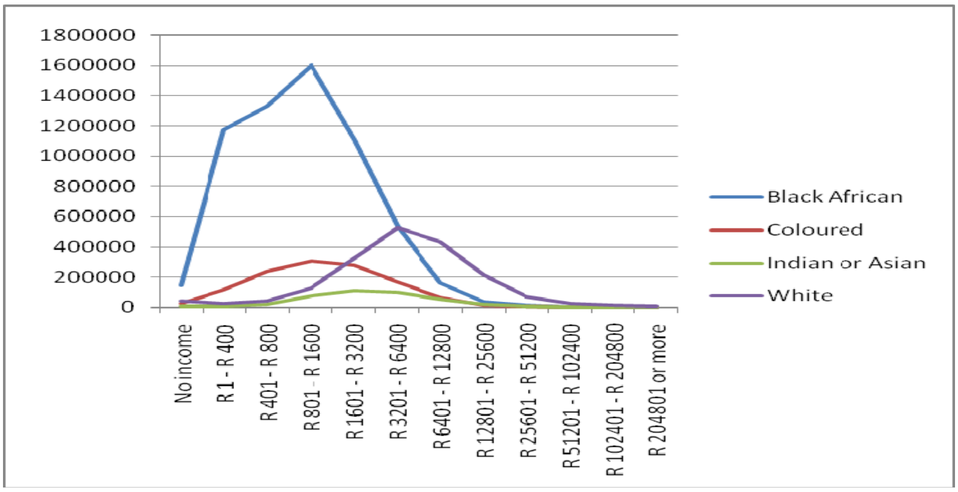
Table 6-4: Monthly Income levels

	Income Level	Black African	Coloured	Indian or Asian	White
SOUTH AFRICA	No income	144457	22656	6887	40377
	R 1 - R 400	1171379	114412	7881	26314
	R 401 - R 800	1326800	237089	20387	41273
	R 801 - R 1600	1598735	306171	73628	129538
	R 1601 - R 3200	1111541	276962	109992	322948
	R 3201 - R 6400	539800	170121	99517	527990
	R 6401 - R 12800	164375	61591	53350	437759
	R 12801 - R 25600	36816	12500	17600	216474
	R 25601 - R 51200	12522	3258	4571	73418
	R 51201 - R 102400	4854	1565	1787	27105
	R 102401 - R 204800	2573	732	903	12999
	R 204801 or more	1979	339	427	7412

Source: StatsSA, 2001

The following line diagram (Figure 6-2) was prepared from data extracted from the Table 6-4.

Figure 6-2: Monthly Income Distribution among Population Groups



Vertical axes: Number of people
Horizontal axes: Monthly income per household

Source: StatsSA, 2001

6.5.2 PERCENTAGE INCOME SPENT ON PUBLIC TRANSPORT

Percentage income spent on transport is a means of predicting how affordable a particular public transport mode is for a given group.

Table 6-5 indicates the monthly household expenditure on public transport by province and settlement type.

Table 6-5: Monthly Household Expenditure on Public Transport

Province	Percentage of households					
	Nothing	R1 - R50	R51 - R100	R101 - R150	R151 - R200	> R200
Western Cape	43.0	12.0	9.3	7.2	7.5	21.0
Eastern Cape	15.8	35.4	20.4	8.9	6.4	13.1
Northern Cape	53.2	23.6	7.9	5.5	3.5	6.3
Free State	27.7	31.7	12.8	8.7	5.8	13.3
KwaZulu-Natal	18.0	22.1	18.7	10.5	9.6	21.2
North West	26.0	23.3	12.5	8.8	6.7	22.7
Gauteng	33.8	12.6	9.6	7.6	8.3	28.0
Mpumalanga	18.2	24.3	19.4	10.1	8.6	19.4
Limpopo	10.4	37.3	25.0	10.1	6.6	10.6
RSA	**25.3**	**23.0**	**15.4**	**8.8**	**7.6**	**19.8**
Metropolitan	31.2	11.6	10.0	8.1	9.1	29.9
Urban	31.7	22.9	12.4	8.8	7.0	17.3
Rural	14.2	34.9	23.2	9.6	6.6	11.4

Source: DOT: e, 2001

Table 6-5, based on StatsSA statistics, elicits the following points to be noted:

- Of the total number of households, 25 percent of South African households spend nothing on public transport.
- A third of metropolitan and urban households spend nothing on public transport.
- Of the total number of households country wide, only 14 percent of households in rural areas spend nothing on public transport. This shows that rural areas are most dependent on public transport.

Table 6-6 gives a breakdown of the monthly household expenditure on public transport by public transport mode.

Table 6-6: Expenditure on Public Transport by Mode

Expenditure on:	Percentage of households					
	Nothing	R1 - R50	R51 - R100	R101 - R150	R151 - R200	> R200
Train	93.3	1.6	2.6	1.2	0.7	0.7
Bus	80.3	8.7	3.4	2.2	2.1	3.3
Taxi	32.3	27.5	13.0	7.8	6.3	13.1
Public transport	**25.3**	**23.3**	**15.4**	**8.8**	**7.6**	**19.8**

Source: DOT: e, 2001

The inaccessibility of train stations leads to the majority (93 percent) of South Africans spending nothing on train services. Of the total number of households, 80 percent spend nothing on bus services. However, only one third of the total population spend nothing on minibus taxi services. Thus the majority of households are served by minibus taxi services, while a relatively small proportion of households are served by bus and train.

Table 6-7 indicates the percentage of household income spent on transport in relation to total monthly household income.

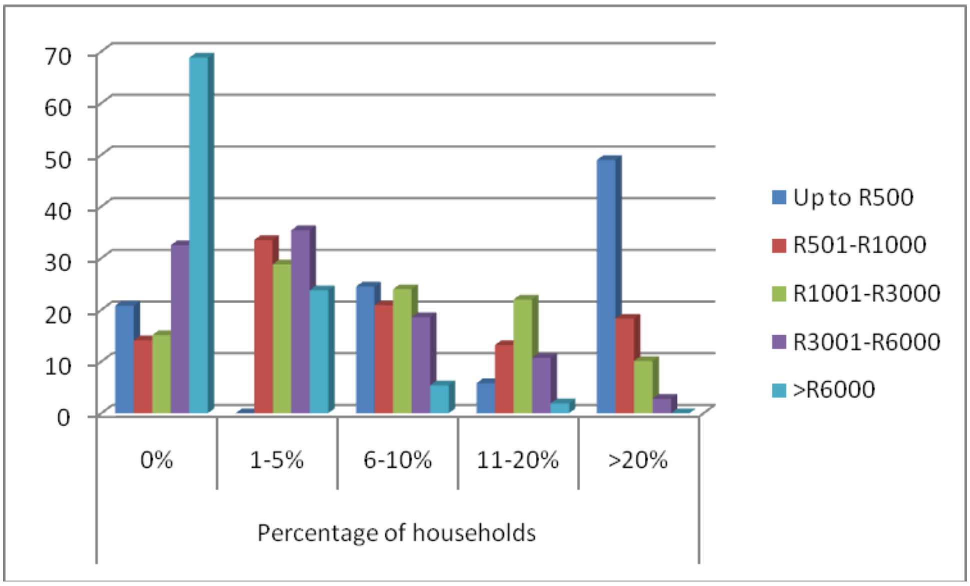
Table 6-7: Percentage of Household Income Spent on Public Transport in Relation to Monthly Household Income

Monthly household income	Percentage of households				
	0%	1 - 5%	6 - 10%	11 - 20%	> 20%
Up to R500	20.8	0.0	24.5	5.8	49.0
R501 - R1000	14.1	33.5	20.9	13.2	18.3
R1001 - R3000	15.1	28.8	24.0	22.0	10.1
R3001- R6000	32.5	35.4	18.6	10.7	2.8
> R6000	68.8	23.8	5.4	1.9	0.0

Source: DOT: e, 2001

Figure 6-3 illustrates the graphical presentation of the percentage of household income spent on transport in relation to total monthly household income.

Figure 6-3: Percentage of Household Income Spent on Transport in relation to Total Monthly Household Income

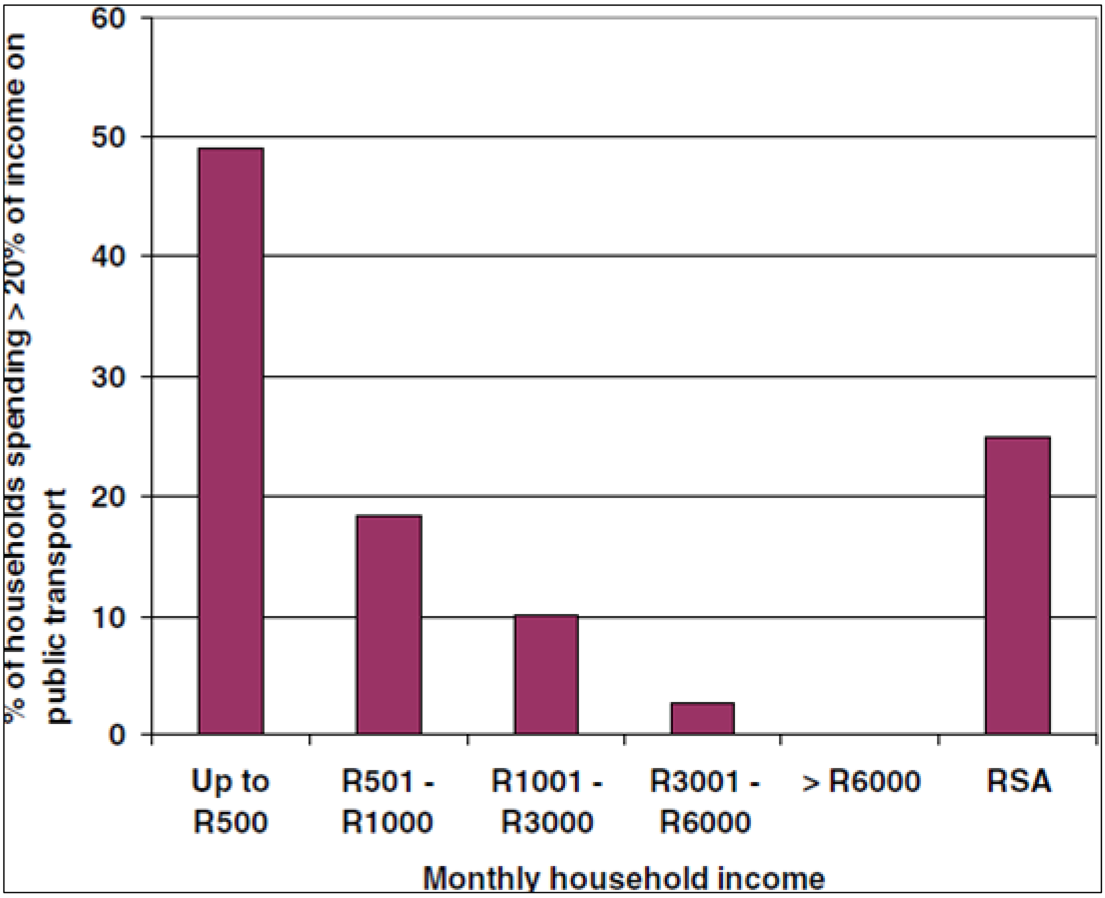


Source: DOT: e, 2001

The Table 6-7 and Figure 6-3 indicate that 50 percent of households earning less than R500 spend more than 20 percent of their household income on public transport. At the other end of the scale, nearly 70 percent of households earning more than R6 000 per month spend nothing on public transport. This is probably a true reflection of the current unbalanced state of public transport in South Africa.

Finally, Figure 6-44 shows the relationship between monthly household income and the group of households spending more than 20 percent of income on public transport.

Figure 6-4: Households Spending More than 20 percent of Income on Public Transport



Source: DOT: e, 2001

Figure 6-4 indicates the considerable impact that cost of public transport has on low-income groups in respect of the proportion of household income consumed by travel. For the whole of South Africa up to 18 percent of households spend more than 20 percent of their income on transport.

OUTCOME:

The amount of income being spent on use of public transport services is significantly high. In Chapter 2 it was identified, and it is again confirmed in the graph above, that the low-income group of South Africa's population is most vulnerable for not being able to afford public transport services or the public transport service of choice.

In order to create equity among all sections of the community, accessibility to affordable transport needs to be addressed by means of a subsidy approach that will counteract this misallocation of resources.

6.6 SOUTH AFRICA'S APPROACH TO AFFORDABLE TRANSPORT

In this section the practical implications of the findings will be evaluated. The proposed subsidy approach will be measured to establish if the entrenched problems of the past can be improved on and goals, set for the future, can be realised. If the findings in this sub-section are promising, the final step (the financial implications) will be taken into consideration to determine if the proposed subsidy system will have the desired effect.

South Africa's transformation to the new IPTS has made it imperative to consider only subsidy systems that will enhance and support public transport demand. Once the new IPTS has been successfully implemented, the proposed subsidy system needs to be re-evaluated in order to support transport demand and commuter needs at that particular, moment. Subsidy systems need to be continuously re-evaluated to address commuters' needs and transport changes.

Issues that need to be addressed include:

- the number of corridors on which subsidies will be paid
- the rate of subsidy in relation to trip operation costs
- the extent to which funding and administration of such a system will be a regional responsibility and local awareness of the opportunity costs of subsidies could therefore be increased

6.6.1 SUBSIDY APPROACHES SUITABLE FOR SOUTH AFRICAN CONDITIONS

In the previous chapter capital supplier-side and corridor-focused, user-side subsidy were identified as possible subsidy approaches to address the shortcomings and challenges of South Africa. A short summary of each of these approaches will be given and a final motivation will be mooted for the combination of these subsidy systems as the optimum approach to relieve public transport affordability problems in South Africa.

6.6.1.1 CAPITAL SUPPLIER-SIDE SUBSIDY

The current tariff subsidy, as a means of supplier-side subsidy, tends to compensate operators and therefore reduces operator initiative. This type of subsidy tends to incline operators toward providing unsatisfactory and unprofitable services. In order to prevent past mistakes being replicated, a different, more effective, supplier-side subsidy approach needs to be considered.

A capital subsidy, a form of supplier-side subsidy which tends to be more effective, is proposed. Capital subsidies are also much easier to administrate and monitoring to prevent fraud is easier. Operators are encouraged to maintain vehicle fleets and to uphold a satisfactory level of service. More important still is the buy-in of stakeholders which ensures successful implementation and takes into consideration that South Africa's operators are familiar with this type of system.

OUTCOME:

The implementation of a capital subsidy as a form of supplier-side subsidy system should, in most cases, encourage operators to maintain vehicle fleets, to uphold a satisfactory level of service and support the buy-in of stakeholders.

6.6.1.2 CORRIDOR-FOCUSED, USER-SIDE SUBSIDY

User-side subsidies can also be narrowed down to three more direct types of subsidies (as discussed in Chapter 4). To align South Africa's new public transport system with the commuter profile, only corridor-focused, user-side subsidies, with the additional focus on distances travelled, will be analysed.

A corridor-focused, user-side subsidy system should overcome the difficulties of a conventional user-side subsidy system by assisting the implementation of public transport plans. It can serve as a temporary relief system on designated corridors or travel areas exceeding, for example, 30 kilometres and could be phased out at a later stage when other, more direct forms of spatial-economic repositioning become available.

Focusing furthermore on distances travelled and compensating commuters not only by corridor but also by distance travelled, makes this subsidy approach a very promising one for South African metropolitan cities.

OUTCOME:

The implementation of a corridor-focused, user-side subsidy system will support a (mainly) smooth implementation of public transport plans. Focusing on the additional distances travelled by commuters will significantly improve the transport shortcomings and challenges South Africa is currently experiencing. One of the problems that might occur if a corridor-focused, user-side subsidy system is implemented, is low density living.

6.6.1.3 COMBINATION OF SUBSIDY APPROACHES TO RELIEVE THE AFFORDABILITY PROBLEM

As identified throughout the course of this study, accessibility is most important for modes of public transport that do not receive any financial assistance from the government to become financially independent. There are many reasons why minibus taxis are not subsidised, but these are beyond the scope of this study. This forces many households, especially those of low income, to spend high percentages of their income on transport.

The new BRT system promises to relieve the accessibility problem. BRT wants to include minibus taxis as part of a formal (regulated) industry and reduce the number of problems for minibus taxi owners who are not receiving government help.

The BRT system will be a scheduled service that operates in dedicated lanes. This service will operate at a much faster pace than it is currently operating. Although the capital cost of the BRT system is high, its remaining operational costs of BRT-buses are much less than for normal buses (NMBM PTP, 2006). One of the objectives of the BRT system is to determine which services will operate most effectively and inexpensively on which routes. By minimising operational costs, the actual travel costs paid by the passengers are reduced.

The implementation of a capital subsidy will lead to operators not having to include some or all of the capital costs of the system and vehicles in their fares. The exclusion of capital costs (or a portion of it) reduces costs to be incurred by the passengers.

Finally, because of South Africa's past, many low-income households have to travel great distances to job opportunities. By implementing a corridor-focused, user-side subsidy, in addition to consideration being given to distances travelled in these corridors, the passenger will be compensated directly for the distance travelled on a specific route.

The further the distance, the higher the cost of travelling will be for those travelling longer distances. Passengers travelling shorter and longer distances on respective corridors should pay a more equal fare than in the past. Subsidising fares based on the distance that is travelled, eliminates the discrepancy variation in distance.

The special focus on the low-income groups and the percentage of household income they spend on transport is to be welcomed, as it affects them more intensely and holds out a promise that a reduction to a more acceptable level is in the offing. The inequalities between the different income groups should also be reduced.

6.7 FINANCIAL IMPACT OF THE IMPLEMENTATION OF THE PROPOSED SUBSIDY APPROACH

In this section the important effect(s) of the subsidy approach will be evaluated. This testing process is still part of step five of the system-based engineering process. It is important to note that the percentage impact of a capital and user-side subsidy on public transport use will be investigated.

To simplify this study, operating costs for road-based public transport will only be evaluated and discussed. The reason for this is, firstly, that, according to the demographic analysis, train services in most areas in South Africa are not easily accessible. Secondly, the IPTS currently being implemented, is a road-based public transport service. Lastly, the subsidy approach is not determined for a specific mode, but the effect and the process of determining and allocating capital and user-side subsidies are illustrated. It is therefore more important to evaluate those modes that are most used in South Africa.

6.7.1 OPERATING COST PER KILOMETRE FOR BUS AND MINIBUS TAXI

To determine the financial implications of the identified subsidy approach, the operating costs of buses and minibus taxis will be calculated. The calculation of the operating costs is based on a number of assumptions intended to illustrate the process of determining the effect of the identified subsidy approaches. The following assumptions were made in order to determine operating costs:

- Minibus taxi services will operate on shorter routes (between 0-20 km).
- Bus services will operate on longer routes (more than 20 km).
- The replacement cost of a minibus taxi is equal to R 280 000.
- The replacement cost of a bus is equal to R 600 000. (Articulated buses will not be considered in this study. The reason being that the number of articulated buses to be used is unknown. Also, operating articulated buses will only improve the figures studied and it can be argued that the study should consider a worst case scenario.)
- The basic salary of a driver will be R 5 000 per month for either mode.
- The minibus taxi has a capacity of 16 passengers.
- Bus capacity is 65 passengers.
- Fuel price is fixed at R7.50 per litre.

Table 6-8: Operating Cost per Kilometre

TYPE OF MODE	*COST PER KILOMETRE (c/km) (a)	AVERAGE DISTANCE TRAVELLED (KM) (b)	*COST PER DISTANCE TRAVELLED	EXAMPLE OF ACCUMULATED TRAVEL COST (AVERAGE DISTANCE TRAVELLED = 42.5 KM) (c)
Minibus taxi	145.5	7.5	R 53.12	R 53.12
		15	R 27.16	
Bus	189.5	25	R 26.98	
		35	R 19.67	R 19.67
		45	R 15.61	
TOTAL				**R 72.79**

*Operating cost per kilometre (column a) and cost per distance travelled are determined by a model developed by Janse van Rensburg and Krygsman. (Annexure A illustrates the results obtained from the model that determined the costs indicated in the table above.)

The operating costs for both modes are quite significant. Many low-income households can simply not afford to pay high transport costs. It is important to note that, in the case where commuters have to travel longer distances, they will either have to walk to the station or use a feeder service (e.g. a minibus taxi). If the latter is the case, the cost per distance accumulates as indicated in the last column.

6.7.2 EFFECT OF IMPLEMENTING CAPITAL SUBSIDY

In South Africa a form of capital subsidy already exists in the minibus-taxi industry. The recapitalisation programme was initiated to provide financial support for the minibus-taxi industry in order to replace rundown vehicles. Infrastructure grants (capital subsidy) have been allocated to metropolitan cities (in South Africa) for implementing of the new IPTS. Bogotá, Colombia, is an international example where the same type of infrastructure subsidy was allocated.

The same approach is proposed for the capital subsidy. A capital subsidy will be provided to operators to replace old and ineffective public transport vehicles in order to enhance levels of service.

To be consistent, the recapitalisation programmes capital subsidy for minibus taxis is R 50 000. The capital subsidy for buses is R 100 000 per vehicle. The effects of the capital subsidy are illustrated in the Table 6-9.

In Table 6-9 it is important to note that the percentage change seems insignificant when only one kilometre is considered. However, the effect of the capital subsidy accumulates until it is too significant to ignore. A capital subsidy will lessen operating costs for the operator. In Table 6-9 the capital subsidy resulted in a 11 percent reduction in operating cost (travelling over an average distance of 42.5 km). In the long run this subsidy approach seems promising.

The only problem this subsidy creates, is that operators might use the subsidy for something else. However, this problem can be managed by the government by means of the issuing of operating licences. Operators have to apply for an operating licence and, in doing so, have to replace existing vehicles. Only when a new vehicle has been purchased to replace an old existing vehicle, will the capital subsidy to the specific operator be paid over.

6.7.3 EFFECT OF IMPLEMENTING A USER-SIDE SUBSIDY

As discussed earlier in this section, a corridor-based, user-side subsidy seems the most promising subsidy approach currently available to South Africa. To illustrate the effect, the following user-side subsidy percentages will be allocated to the respective distances. These percentages could vary further, according to the corridor travelled. However, for simplicity, only the distances travelled will be considered in the example.

- 0 – 10 km = 5% subsidy
- 10 – 20 km = 10% subsidy
- 20 – 30 km = 15% subsidy
- 30 – 40 km = 20% subsidy
- 40 – 50 km = 25% subsidy

Table 6-9: Impact of the Capital Subsidy

TYPE OF MODE	**COST PER KILOMETRE (c/km) (d)	PERCENTAGE CAPITAL SUBSIDY EFFECT ((a/d)-1*100)) = aa	AVERAGE DISTANCE TRAVELLED (km) (e)	**COST PER DISTANCE TRAVELLED (d*e)	EXAMPLE OF ACCUMULATED CAPITAL SUBSIDY EFFECT (f)	ACCUMULATED CAPITAL SUBSIDY PERCENTAGE EFFECT ((c/f)-1*100))
Minibus taxi	142.3	2.2%	7.5	R 47.85	R 47.85	
			15	R 24.49		
Bus	183.1	3.37%	25	R 23.79		
			35	R 17.39	R 17.39	
			45	R 13.83		
TOTAL					**R 65.24**	**11.57%**

**Operating cost per kilometre (column a) and cost per distance travelled are determined by a model developed by Janse van Rensburg and Krygsman. (Annexure B illustrates the results obtained from the model that determined the costs indicated in the table above.)

The effect of percentage subsidy allocated is indicated in Table 6-10. In Table 6-11 the monthly effect for the examples based on different distances travelled illustrates the percentage effect of a corridor-based, user-side subsidy for each commuter.

The monthly travelling costs are based on travelling the distance (return distance) five times a week for four weeks a month (thus 20 days).

In Table 6-11 the effect of a subsidy on the monthly income of a commuter is illustrated. It must be noted that, although the amounts seem small, the percentage effect of a 7 percent savings of income for a low-income households is significant.

6.7.4 THE OVERALL EFFECT OF THE COMBINATION OF SUBSIDY APPROACHES

To determine the overall effect of the combination of supplier-side and user-side subsidy approach, the financial effect must be tested. The final effect is illustrated in Table 6-12. The monthly overall effect is illustrated in Table 6-13.

The final result indicated that combining the two subsidy approaches has had a significant effect on operating costs and share of monthly income spent by commuters. It can also be observed that a supplier-side subsidy benefits the commuter. The reason for this is that initial operating cost is reduced by a capital subsidy. This reduction is already in the commuter’s favour, even though the commuter does not receive the actual subsidy. Although the operator receives this subsidy, the operator still has to seek commuters to obtain operating income.

Once the user-side subsidy is also allocated, the commuter benefits more. This compensation is directly allocated to the commuter and affects his/her monthly income position positively.

The final effect indicates that the percentage obtained in column gg (10-16 percent depending on distance travelled) is the percentage income saved per month on transport (given the subsidy approach taken). This percentage of income saved on transport can be used for other essentials pertaining to the particular household.

Table 6-10: Effect of Corridor-Based User-side Subsidy

TYPE OF MODE	***COST PER KILOMETRE (c/km) (g)	AVERAGE DISTANCE TRAVELLED (KM) (h)	***COST PER DISTANCE TRAVELLED (g*h) = (j)	PERCENTAGE CORRIDOR-FOCUSED USER-SIDE SUBSIDY (k)	COST PER DISTANCE INCLUDED IN THE ALLOCATED SUBSIDY (j-(j*k)) = l	EXAMPLE OF ACCUMULATED USER-SIDE SUBSIDY EFFECT (m)	ACCUMULATED USER-SIDE SUBSIDY PERCENTAGE EFFECT ((c/m)-1*100)
Minibus taxi	145.4	7.5	**(i)** R 53.12	5%	**(i)** R 50.46	R 50.46	
		15	**(ii)** R 27.16	10%	**(ii)** R 24.44		
Bus	189.5	25	**(iii)** R 26.98	15%	**(iii)**R 22.93		
		35	**(iv)** R 19.67	20%	**(iv)**R 15.74	R 15.74	
		45	**(v)** R 15.61	25%	**(v)** R 11.71		
TOTAL						**R 66.20**	**9.95%**

***Operating cost per kilometre (column a) and cost per distance travelled are determined by a model developed by Janse van Rensburg and Krygsman. (Annexure A illustrates the results obtained from the model that determined the costs indicated in the table above.)

Table 6-11: Monthly Effect of a Corridor-based, User-side Subsidy

EXAMPLE OF DIFFERENT DISTANCES TRAVELLED (KM) (n)	EXAMPLE OF ACCUMULATED TRAVEL COSTS (per person) ((j)/16or45) = o		MONTHLY TRAVELLING COSTS (per person) (o*20) = p	EXAMPLE OF ACCUMULATED CORRIDOR-BASED USER-SIDE SUBSIDY (per person per example distance) ((l)/16or45) = q		MONTHLY TRAVELLING COSTS – with user-side subsidy (per person) (q*20) = r	PERCENTAGE MONTHLY EFFECT OF A CORRIDOR-BASED USER-SIDE SUBSIDY ((p/r)-1*100) = bb
22.5	**(i+ii)**	R 5.02	R 100.40	**(i+ii)**	R 4.69	R 93.75	7.09%
32.5	**(i+iii)**	R 1.78	R 35.60	**(i+iii)**	R 1.63	R 32.66	9.00%
42.5	**(i+iv)**	R 1.62	R 32.40	**(i+iv)**	R 1.47	R 29.47	9.94%
52.5	**(i+v)**	R 1.53	R 30.60	**(i+v)**	R 1.38	R 27.68	10.55%

Table 6-12: Overall Subsidy Effect

TYPE OF MODE	****COST PER KILOMETRE(c/km) – with capital subsidy (s)	AVERAGE DISTANCE TRAVELLED (KM) (t)	****COST PER DISTANCE TRAVELLED – with supplier-side subsidy (s*t) = u	PERCENTAGE CORRIDOR-FOCUSED USER-SIDE SUBSIDY (v)	COST PER DISTANCE INCLUDED IN THE ALLOCATED SUBSIDY (u)-(u*v)	EXAMPLE OF ACCUMULATED USER-SIDE SUBSIDY EFFECT (x)	ACCUMULATED USER-SIDE SUBSIDY PERCENTAGE EFFECT (c/x)-1*100
Minibus taxi	142.3	7.5	R 47.85	5%	R 45.46	R 45.46	
		15	R 24.49	10%	R 22.04		
Bus	183.1	25	R 23.79	15%	R 20.22		
		35	R 17.39	20%	R 13.91	R 13.91	
		45	R 13.83	25%	R 10.37		
TOTAL						**R 59.37**	**22.60%**

****Operating cost per kilometre (column a) and cost per distance travelled are determined by a model developed by Janse van Rensburg and Krygsman. (Annexure B illustrates the results obtained from the model that determined the costs indicated in the table above.)

Table 6-13: Overall Monthly Effect of a Combination of Subsidy Approaches

EXAMPLE OF DIFFERENT DISTANCES TRAVELLED (km) (y)	EXAMPLE OF ACCUMULATED TRAVEL COSTS (without subsidies) PER VEHICLE/PER PERSON o = z		MONTHLY TRAVELLING COSTS (per person) p = cc	PERCENTAGE SUBSIDY PER DISTANCE TRAVELLED ((aa/2)+(bb) = dd	EXAMPLE OF ACCUMULATED TRAVEL COSTS (with subsidies) PER VEHICLE/PER PERSON ((z)-(z*dd)) = ee	MONTHLY TRAVELLING COSTS (with subsidies per person) (ee*20) = ff	PERCENTAGE MONTHLY EFFECT OF SUBSIDY ALLOCATION ((cc/ff)-1*100) = gg
22.5	**(i+ii)**	R 5.02	R 100.40	9.88%	R 4.52	R 90.48	10.96%
32.5	**(i+iii)**	R 1.78	R 35.60	11.79%	R 1.57	R 31.40	13.36%
42.5	**(i+iv)**	R 1.62	R 32.40	12.73%	R 1.41	R 28.78	12.58%
52.5	**(i+v)**	R 1.53	R 30.60	13.34%	R 1.33	R 26.52	15.38%

This subsidy approach focused mainly on the low-income groups. Although the percentages might seem fairly small, the real effect for low-income households should be significant. This percentage saving can, in the case of someone receiving minimal wages, be the difference between surviving or not, or getting to one's place of employment or not.

6.8 CONCLUSION

Continuation of the measures set down for step six of the system-based process, has led to testing of the identified subsidy approaches in practice. South African demographics were considered, as well as the financial impact of the approach taken.

The problem of lack of accessibility is being addressed by the implementation of the BRT system. Lack of affordability seems best relieved by a combination and integration of two different subsidy approaches. These two approaches are capital supplier-side and corridor-focused, user-side subsidies, with additional consideration to distances travelled.

The supplier-side subsidy approach will be in the form of a capital subsidy that, as indicated in the financial section, will have an immediate positive effect (reduction of operating costs) on operators and commuters alike. Operators, though, will still need to take the incentive to provide good levels of service in order to attract commuters.

The corridor-focused, user-side subsidy approach indicates that tariffs lowered even further and are what commuters need to pay. This form of subsidy is directed at each user of the public transport system. This approach considers each commuter who will use the public transport system and directly addresses the social equity problem.

A financial saving of 22 percent is reached once a distance of 42.5 km has been travelled and the combination of subsidy approaches implemented. The monthly saving on the commuter's income varies between 10 and 16 percent. This indicates that the combination of the two different subsidy methods promotes public transport use in the identified transport phase (transferring private transport commuters to public transport).

This step (step six of the system-based process) indicates that, in practice, considering the demographics, the subsidy approach promises good financial results and improved economic and socio-economic conditions for South Africa. Some of the main objectives (social equity, better allocation of resources and reducing spatial problems) have been reached, as well as addressing the lack of access to affordable public transport (by making it more affordable) and improving the subsidy relative merit (by encouraging effective operations, fairness and social objectives).

7 INCREASING PRIVATE TRANSPORT OWNERSHIP

7.1 INTRODUCTION

In Chapter 5 an increase in private vehicle ownership was identified as a tendency amongst the middle and high-income groups. The use of private transport has resulted in growing road congestion. The current congestion costs inflicted by private transport commuters have significant negative effects on the environment and on society as a whole. The consequential result is a public transport system that is being undermined by private transport commuters. Systems to reduce the unchecked use of private transport need to be established to obtain the desired outcome of uncongested roads. A remedy for changing the attitude and behaviour of private transport commuters should found, so that public transport may be promoted as a viable alternative.

This chapter forms part of step six of the system-based process where congestion pricing will be tested in practice in order to determine the effectiveness of achieving the overall objectives stipulated by government in legislation and policy documents.

7.2 CONGESTION IN SOUTH AFRICA

Main metropolitan cities in South Africa (and around the world) are currently experiencing traffic congestion as one of the most serious transport problems. As real monthly income per household increases, public transport deteriorates as more congestion is being generated by corresponding growth in private transport ownership.

“Transport infrastructure provides access and facilitates mobility. In areas that lack adequate accessibility and mobility, the supply of new transport facilities is therefore often used as an instrument of development by activating investment in and business interaction between economically dormant areas or regions. However, when transport facilities are built primarily with a view to improving existing mobility, the prime objective is to reduce user costs (i.e. vehicle running costs, accident costs and travel time, including any other disutility resulting from poor quality of service when travelling)” (CUTA, 2002: 2-7).

The above statement indicates how necessary it is to outline clearly what the different components of total transport cost are. Firstly, there is infrastructure cost, consisting of capital/investment cost, maintenance cost, administration cost, policing cost, traffic control cost and research cost. Infrastructure cost is paid for by the government through taxes collected and investments. Secondly, there is user cost, consisting of vehicle operating cost and overhead cost. Both infrastructure and user cost were considered in the calculations in the previous chapter. Lastly, there is external cost, consisting of accident cost, congestion cost and environmental cost. Most of these external costs have been ignored around the world for decades. Determining the full scope of external costs is extremely difficult and complex. However, these externalities are too important not to be properly considered.

The introduction of congestion pricing is relevant to congestion improvement and will be evaluated in the sections below. In this research study time cost and accident cost will be used. Pollution cost (because of its complexity) will not be calculated, but it is an element that will be taken into account theoretically.

7.3 CONGESTION PRICING

Congestion has become one of the major problems in metropolitan cities. A strategy that reduces congestion in the long run, is reducing demand for road space during peak periods. The alternative strategy is to provide more road capacity, but this strategy seldom works as it tends to increase demand exponentially. The appropriation of additional space in the CBD for traffic and parking purposes would merely succeed to contribute to reduced area for businesses and, consequently, would be counterproductive to the interests of the CBD. Less would be achieved by increasing road capacity than could be obtained by reducing the demand (for using roads at a specific period of time) through direct policies (Floor, 1968). Congestion pricing, as a means of reducing public transport problems, was previously identified as a method justifying consideration. Some of the key approaches to improve congestion are:

- no further building of new roads leading to the CBD
- changing some general traffic lanes to dedicated bus or public transport lanes
- reallocating government road funds for utilisation as public transport subsidies

7.3.1 THEORETICAL APPROACH OF CONGESTION PRICING

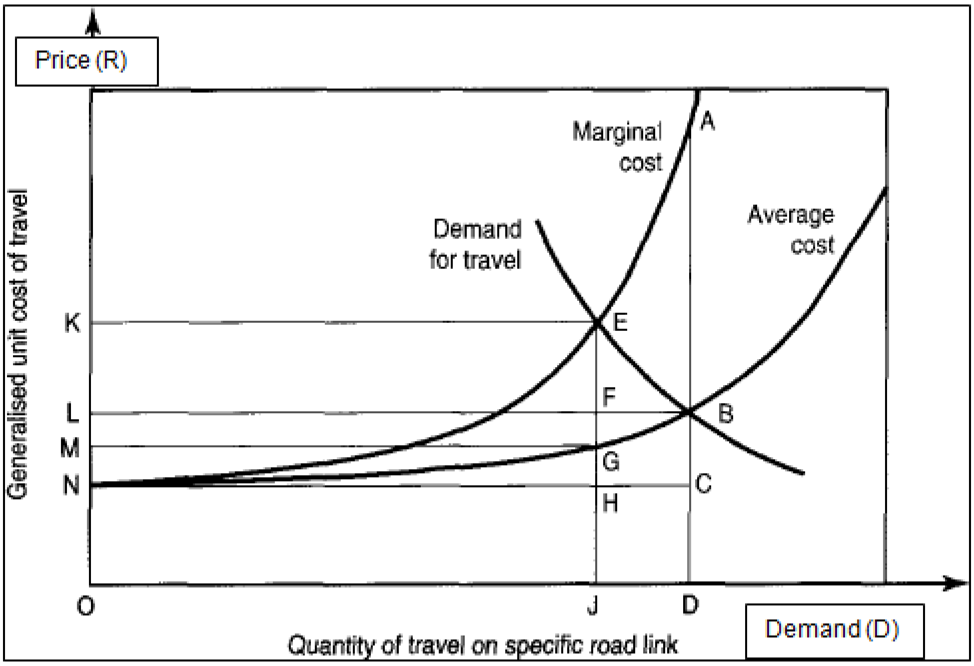
When a private transport commuter considers joining a busy traffic stream, he/she will normally only weigh up the private costs of doing so against the expected benefit of the trip. The additional congestion (hence delay) caused for other vehicles and their occupants as a result of this action, is ignored by the driver joining the traffic. The private transport commuter tends only to consider his/her own perceived cost and not the total cost he/she incurs for other road users.

A private transport commuter, who finds it worthwhile to travel only at the average cost imposes heavier costs on other commuters than the benefits he/she receives. If all these users receiving benefits less than the costs they impose on others could be charged to the extent of the difference between the average costs of travelling and the total additional costs they impose on other commuters, the degree of congestion would reach economic equilibrium when all users are prepared to pay this charge when on the road (Floor, 1968).

The community's welfare can be increased by charging private transport commuters the value of the extra congestion caused by their presence on a metropolitan road during peak periods (at a traffic volume corresponding to the point of intersection between the demand curve for using the road and the curve representing the marginal cost of adding vehicles to the traffic flow). The following graph illustrates the researched done by Dobes (1998) on congestion and congestion pricing theory.

Figure 7-1 represents congestion for a single road link. The vertical axis represents the generalised unit cost (or price) of travel, including fuel used, vehicle maintenance and value of time spent travelling. The horizontal axis represents the quantity of travel, measured in units of vehicle flow.

Figure 7-1: Economic Theory of Congestion Pricing



Source: Dobes: Externalities of the Transport Sector, 1998

In Figure 7-1, the average cost curve represents the unit cost of travel as perceived by individual road users. The unit cost includes vehicle operating costs (maintenance and fuel) and travel time costs. Multiplication of average cost by quantity of travel gives the total cost inflicted by all road users. The marginal cost curve is the derivative of total cost with respect to the quantity of travel (i.e. the contribution to total cost of an additional unit of travel). The vertical distance between the marginal and average cost curves are the additional costs imposed on other road users. This last cost is not taken into account by the marginal road user and forms the external cost (congestion cost). The demand curve represents the gross benefit of the marginal unit of travel.

The quantity of travel (OD) before congestion pricing is determined by the intersection of the demand and average cost curves. This results from road users who take only their own private costs into account. If the quantity of travel is OD, private costs are equal to the average cost (DB). Marginal external costs of BA, imposed on other road users, are not taken into account by individual drivers. Price needs to equal marginal cost.

The intersection of the demand and marginal cost curves represents the socially optimal quantity of travel (OJ). This quantity is optimal because it avoids travel beyond the point where social costs exceed benefits. A uniform charge of EG for all road users will reduce travel to the socially optimal level.

Congestion is not eliminated if an optimal road congestion price charge is levied. The total value is merely reduced from area LBCN to MGHN. Travellers in the range JD will no longer use the road because the price is too high and will suffer a loss in welfare. Remaining users gains from the reduced delay because of fewer vehicles using the road. The community gain the area ABE, which equals the cost to society if nothing is done to reduce congestion.

Some misconceptions regarding the calculations of the total cost of congestion (LBCN) has occurred. LBCN cost of congestion is irrelevant when measured relative to a hypothetical situation of zero congestion, a state that is not realistically attainable (i.e. that congestion can and should be reduced to zero). The more correct policy relevant to cost is the ‘cost of doing nothing about congestion’, area ABE. ABE is the opportunity cost of leaving congestion above the socially optimal level. (ABE = LFGM – EBF)

7.3.2 APPLYING CONGESTION PRICING

The complexity of applying the theory to urban road networks, has led to the estimation of ‘optimal’ road user charges by using average, city-wide figures. Such estimates tend to underestimate the charges required in more congested areas and overestimate them on uncongested roads (Dobes, 1998).

The degree of congestion on each road varies throughout the day, which leads to it that costs can only be estimated on an average basis. The demands of each road also vary from time to time. Congestion pricing can only represent an approximation of the ideal fee and the outcome would be to reduce traffic on some roads below economic level and induce extra traffic on other roads (Floor, 1968).

Congestion pricing to achieve better utilisation of road space includes three objectives (Pienaar & Nel, 2009). These are:

- preventing high travel demand with low occupancy in vehicles
- discouraging demand for commuter trips during a concentrated time period
- obtaining better value from roads by making efficient use of available road space

Pienaar and Nel (2009) also state four-requirements that must be met through congestion pricing:

- Commuter trips undertaken that are valued at less than the cost imposed should be discouraged, whilst trips valued at more than this should still be encouraged.
- Congestion pricing should be in relation to distance travelled and total time spent on the road.
- Congestion pricing should be simple, reliable, fraud-proof and publicly accepted.
- Implementation, administration and enforcement of congestion pricing charged should be within reasonable limits of effort and expense.

As determined in previous sections, subsidising public transport is not a cost-effective way to reduce congestion. It has a weak effect on private transport commuters during peak periods. Around the world it has been proven that huge public transport subsidies do not yield substantial cuts in the proportion of peak period private transport commuter trips (Dobes, 1998).

Applying congestion pricing during peak periods can encourage alternative travel times and modes and provide funds for public infrastructure facilities and services. Public transport attractiveness will increase, improving the viability (Willet, 2004).

An uneconomical public transport subsidy system that does not address all governmental issues such as political, social, strategic, economic and socio-economic issues, in many cases temporarily attracts private transport users towards public transport. Eventually private transport-inclined users are lured back to private transport and congestion conditions will be restored.

Congestion pricing offsets the tendency of road improvements to be self-defeating as a result of attraction of individuals from alternative modes, routes and times. It enhances the effectiveness of ring-roads in improving congestion. The result is better use of the existing road system and more efficient investment in transport infrastructure (Dobes, 1998).

Public transport subsidy systems, focusing on the whole society, tend to favour middle to higher-income groups. In South Africa, many of the middle-income groups use public bus and rail transport; the public transport services that receive operational subsidies. Low-income groups do not have access to the above-mentioned subsidised public transport services and therefore unsubsidised minibus taxis are the only available public transport services. High-income groups use private transport and do not consider the costs they incur on the government and society through matters such as congestion, pollution, road infrastructure development, road maintenance and accidents.

Congestion pricing is a much better decongestant to deal with high-income households. Congestion pricing should only apply to roads that are congested and thus their use to dissuade targeted high-income groups is indicated. Whilst free-flow traffic conditions persist, these charges will be zero and will incrementally increase as the road becomes more congested. This will force private transport commuters to take into account the costs they impose on other transport commuters when aggravating congestion. Congestion pricing will result in private transport commuters altering their travel behaviour according to the escalation of cost inflicted.

Congestion pricing will not solve the congestion problem but will reduce congestion until social costs of further reductions exceed extra social benefits. Revenue obtain from congestion pricing can help displace economically damaging taxes. The revenue obtained might be allocated to correct deficiencies in government transport facilities and services.

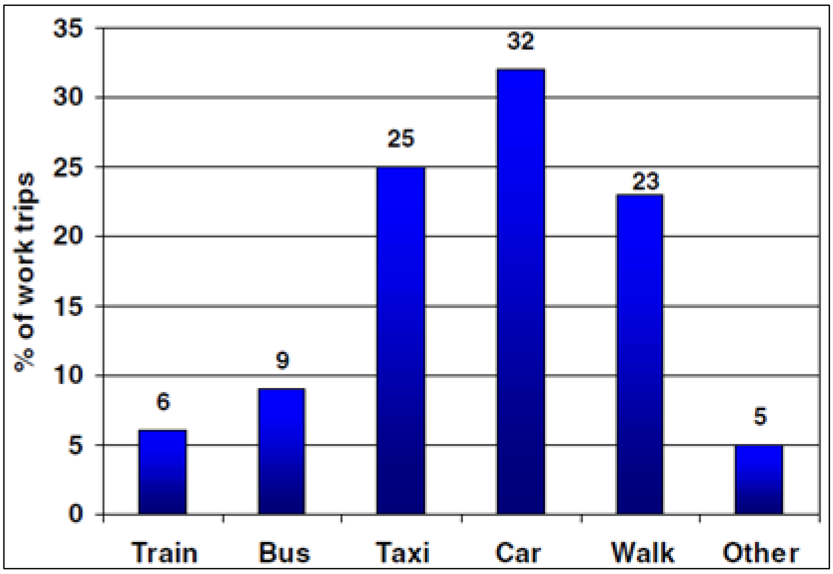
The argument against congestion pricing relates to distributional or equity considerations. This could well be argued, but the revenue from congestion allows off-setting tax cuts that favour the lower income groups (Dobes, 1998).

7.4 PRIVATE TRANSPORT CONGESTION DEMOGRAPHICS OF SOUTH AFRICA

This section will give a clearer view of how many South Africans use private transport to travel to work (and home) and at what times they travel. Considering the above mentioned, Section 7.2 can be used to determine which group to focus on when intending to relieve congestion in metropolitan cities.

Figure 7-2 shows the main mode of travel for people who travel to work regularly.

Figure 7-2: Main Mode of Travel to Work in the RSA



Source: DOT: I, 2001

Figure 7-2 indicates that private transport claims the largest share of commuters and accounts for almost one-third of all commuters (32 percent). Minibus taxis, claiming second, account for 25.1 percent of all trips to work.

Table 7-1 shows the different modes used for work trips in the various provinces. This table may be used to establish the number of trips that can be expected during specific periods of the day (normally the congested periods).

Table 7-1: Main Mode of Travel for People Who Regularly Travel to Work, by Province and Settlement Type

Province	Number	Main mode to work (Percentage of work trips)					
		Train	Bus	Taxi	Car [1]	Walk	Other [2]
Western Cape	1 592 000	14.0	6.1	15.9	35.6	20.5	7.9
Eastern Cape	796 000	1.8	5.7	27.7	28.2	32.3	4.2
Northern Cape	194 000	0.0	3.4	11.2	34.2	41.4	9.7
Free State	628 000	0.0	4.9	24.1	23.3	41.1	6.6
KwaZulu-Natal	1 622 000	2.8	14.2	30.4	30.3	18.0	4.4
North West	839 000	3.2	12.7	26.1	24.4	25.6	8.0
Gauteng	2 924 000	9.5	5.6	31.4	39.6	11.5	2.4
Mpumalanga	660 000	0.1	15.8	18.3	24.0	31.5	10.4
Limpopo	702 000	0.0	10.1	16.1	19.7	48.3	5.7
RSA	9 957 000	5.9	8.6	25.2	31.7	23.2	5.4
Number		589 000	856 000	2 509 000	3 157 000	2 310 000	536 000
Metropolitan	4 664 000	11.3	8.7	29.1	39.4	8.9	2.7
Urban	3 098 000	1.7	6.4	26.8	34.1	24.0	7.1
Rural	2 195 000	0.5	11.6	14.5	12.1	52.5	8.8

1. Car = car driver and passenger
2. Other includes bicycle, metered taxi, truck driver, motorcycle, company transport, truck, tractor, animal transport

Source: DOT: I, 2001

Private transport use is the highest in the metropolitan areas at almost 40 percent. Train and bus modes tend to be concentrated in specific areas. For example, most train trips to work are made in metropolitan areas, whereas bus services are more significant in rural areas.

The convenience of private transport and minibus taxis is revealed by the fact that, in the case of private transport, 47 percent of trips to work start between 07h00 and 08h00. For minibus taxis, the equivalent proportion is 28 percent.

In South Africa 2.5 million people use private transport to travel to work daily. Of the total amount, 1.5 million people live in metropolitan areas. In South Africa as a whole, more than 33 percent of people use private transport to get to work.

Roughly half of private transport users indicated that they do not need to use their private transport for any other purpose during the day, thus only needing private transport to get to and from work.

7.5 CONGESTION PRICING AS AN APPROACH

Congestion pricing, in London and modelled scenarios in various Australian cities, has in the past decade become an effective way to discourage commuters from travelling by private transport, encouraging them to transfer to public transport (Dobes, 1998). Applying punitive congestion pricing during peak periods encourages choosing alternative travel times and modes and provides funds for communal facilities. The fact that fewer people are now willing to travel by private transport (as a result the financial penalty to be paid) means that public transport's attractiveness has subsequently increased, improving its viability and reducing subsidy requirements.

Road congestion pricing rests on the assertion that the same economic principles that apply to the allocation of scarce resources should apply to road space. Each commuter payment should meet the incremental cost resulting from his/her use of the road space. The implication for congested roads is that if each user pays the costs arising from the use of the road, as well as its distribution in space and time, the result will be a movement towards an efficient use of available road space for all commuters who have to use it for good reason (Pienaar & Nel, 2009). This additional amount charged (congestion pricing) could be re-allocated towards public transport subsidies or the expansion of public transport infrastructure.

7.6 CONGESTION PRICING CONTRIBUTION TO THE IMPROVEMENT OF THE URBAN PUBLIC TRANSPORT PROBLEM

Cities around the world with similar conditions to those in South Africa have dealt with congestion problems effectively by introducing congestion pricing. Although congestion pricing is not a form of subsidy, the revenue earned can be reallocated as a form of user- or supplier-side subsidy.

The expected impact of congestion pricing on private transport commuters needs to be evaluated prior to implementation to determine if the desired outcome will be reached. Government expected income, earned from congestion pricing, will be calculated. The increased income impact from this source on public transport subsidies and/or public transport extensions and improvements also needs to be assessed.

Congestion pricing is not a subsidy; it is a way of discouraging private transport commuters from using that mode. Once the proposed BRT system has been implemented successfully, the motivation to use private transport is reduced significantly. Public transport services will have become accessible, frequent, reliable and safe. However, private transport users will not easily give up the comfort of their own private transport, thus some sort of charge or levy is a good enforcement to discourage these commuters and make them transfer their daily travel needs to public transport.

Charging the group of people that incur congestion costs will directly affect them. Other groups in society that do not use private transport are not penalised in any way. The target group will immediately feel the financial impact of congestion pricing and will start altering their travel patterns. Users who are more elastic to price will either start driving during off-peak periods or they will transfer onto public transport. Either of these changes will have a positive financial impact for the government; they will add the benefit of relieving the congestion problem at reduced costs to the basic income generated by the levy.

Price inelastic private transport users will keep driving during peak periods, but this group can be expected to be small enough so that congestion will still be relieved. However, if congestion still occurs, congestion pricing will have to be increased until the price inelastic private transport users do respond to the charge levied.

Congestion pricing will increase government income, because congestion costs are personally borne by commuters themselves. The government will have extra financial resources to allocate elsewhere. The government can allocate these windfall resources to help finance subsidies (as discussed in Chapter 6) or help to extend the public transport system.

7.7 INTERNATIONAL CONGESTION EXPERIENCE

In this section a short overview is given of a disaggregated network model developed to illustrate what Melbourne, Australia, would experienced if a congestion charge would be implemented.

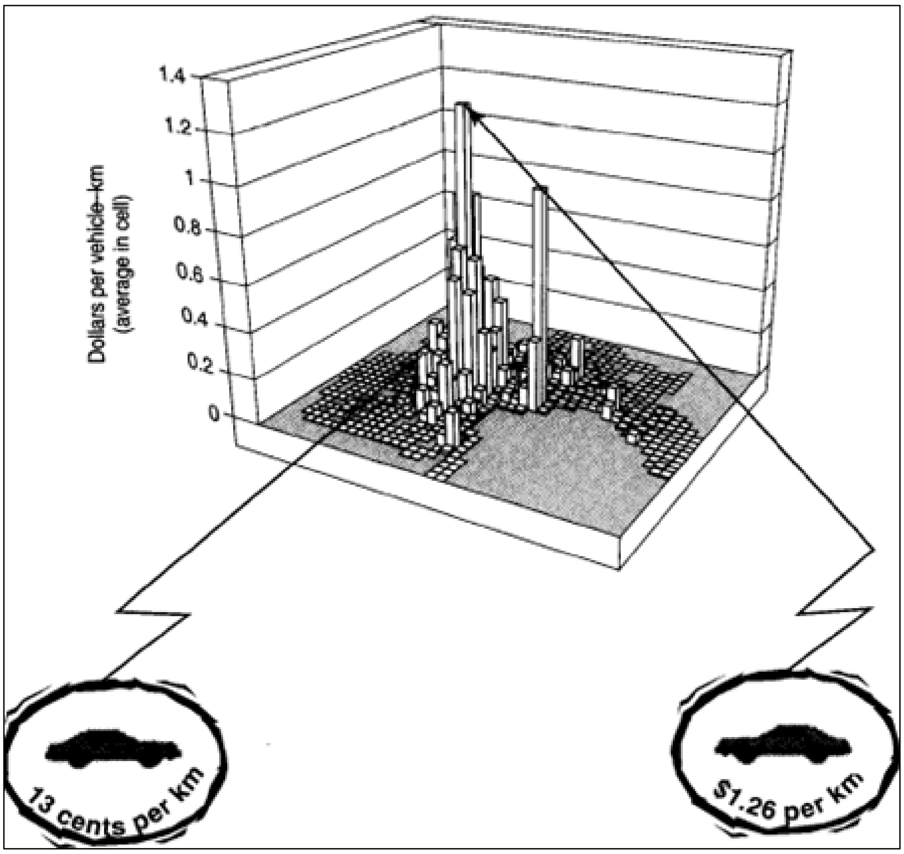
7.7.1 MELBOURNE - AUSTRALIA

The Bureau of Transport, Communications and Economics (BTCE) in Australia, developed a disaggregated network model. This model found that the potential benefit to Australia of controlling congestion would be about AUS$3 billion per year (area ABE in Figure 7-1, p 86).

During the morning peak period in Melbourne, congestion was concentrated in a relatively small, central area near the CBD. The costing model suggested that an economically efficient charge in this area (the central area near the CBD) of the city would be about AUS$1.26 per kilometre travelled. In the case of travelling a distance of 9 kilometres away from the CBD, the congestion charge would be as low as 13 cents per kilometre. Congestion pricing charged to private transport users travelling in the central area near the CBD had a significant financial impact for both the government and each private transport user. Figure 7-3 indicates the morning peak-hour congestion pricing in Melbourne CBD and outer suburbs.

Besides the positive financial effect, the model indicated other positive results such as a reduction of private transport vehicles during peak periods. Some of the private transport users either transferred onto public transport or travelled during off-peak periods. Although the model did not test the environmental effects, further positive environmental effects can be expected because of the reduction in emissions and energy as people transferred onto public transport.

Figure 7-3: Morning Peak-Hour Congestion Pricing in Melbourne CBD and Suburbs



Source: Dobes: Externalities in the Transport Sector, 1998

7.8 FINANCIAL IMPACT OF THE IMPLEMENTATION OF CONGESTION PRICING

Congestion pricing is not a subsidy, but a way of holding private transport commuters accountable for the external cost they impose on other road users and the community as a whole. In this section the percentage effect of congestion pricing for private transport commuters will be established. Furthermore, the effect on government income, once private transport commuters are charged this cost, will be discussed. Finally, the effect on the government budget will be discussed to establish if the income received from congestion pricing is being proportionally reallocated for subsidies and public transport infrastructure maintenance and development.

A model (developed by the author in 2008) will be used to determine the operating, time and accident cost. These costs will form the basis of further calculations. The specifics of the model fall outside the scope of this study. The model takes the following aspects into consideration:

- vehicle capital cost (depreciation)
- tyre cost
- fuel price
- maintenance cost
- lubrication cost
- accident cost
- time costs

The following assumptions were made for using the model:

- Vehicle capital cost equals R 190 000 (on average, vehicles are priced above or below this amount).
- The petrol price is fixed at R 7.50.
- Time cost for commuters is R 100.
- The speed of travelling is 20 km/h (resulting from congestion during peak periods).
- Vehicle per road section is 30 000 during peak periods.
- 90 percent of vehicles are light vehicles.
- The road length is fixed at 25 km.

7.8.1 OPERATING, TIME AND ACCIDENT COST FOR PRIVATE TRANSPORT COMMUTERS

Private transport commuters only consider the perceived cost of using their own private transport. However, there are a number of other costs that private transport commuters impose on the environment and the rest of the community. These costs include:

- time cost
- accident cost
- environmental cost

In this study environmental cost is not considered, as calculating this cost is too complex. The time cost and accident cost are to be focused on and discussed.

Table 7-2 indicates the operating cost of private transport at a specific speed. Time- and accident cost indicated, as well as the percentage effect of not considering these costs.

Table 7-2: Operating-, Time- and Accident Cost

SPEED (km/h) (a)	*OPERATING COST (c/km) (b)	*ACCIDENT COST (c/km) (c)	*TIME COST (c/km) (d)	TOTAL COST OF USING A PRIVATE TRANSPORT (per km) (b+c+d) = e	TIME- AND ACCIDENT COST AS A PERCENTAGE OF TOTAL COST (c+d)/e*100 = f
80	201	22	44	R 2.67	24.72%
70	203	22	51	R 2.76	25.45%
60	210	22	59	R 2.91	27.84%
50	226	22	71	R 3.19	29.15%
40	250	22	89	R 3.61	30.75%
30	286	22	118	R 4.27	32.79%
20	355	22	178	R 5.54	**(vii)** 36.10%

* A model is used, developed by the author, in 2008, to determine the operating, accident and time cost. The model is not primary to the study and merely forms the basis for related calculations. (Annexure C illustrates the results of how operating, accident and time cost are calculated.)

Table 7-2 indicates that accident cost remains constant. The operating cost increases as the speed reduces. It must also be noted that as speed reduces, the increased escalation of operating cost is exponential. As speed reduces, time cost increases significantly. Furthermore, once speed has reduced to 20 km/h (which is the speed during congestion) time cost increases and contributes 36 percent to total costs. This 36 percent of the cost is currently endured by the entire society as nobody is being held accountable for these costs. If a percentage of time and accident cost can be charged to each commuter, the complete (or percentage of) this charged amount can be allocated to the government budget to be reallocated for public transport subsidies.

7.8.2 INCOME FROM CONGESTION PRICING VS SUBSIDY PAID BY THE GOVERNMENT

In Chapter 6 the subsidy effect of applying capital (supplier-side) and user-side subsidy was discussed. In this section the amount of income the government receives from charging private transport users during peak periods will be measured against the amount of subsidy the government pays. By doing this the difference between the charge and the subsidy can be identified and that amount is what the government will have to budget for in order to provide public transport for everyone.

The examples of distances travelled in Chapter 6 are used in Table 7-3 to illustrate at what level congestion pricing should be. The congestion pricing charge will be measured against the subsidy allocated for this distance. For the purpose of this example the assumption is made that peak-hour traffic travels at an average speed of 20km/h. An occupancy level of 75 percent is allocated to public transport vehicles. The government charges private transport users only 50 percent of the total external cost (time and accident cost) of what they actually incur. Finally, the allocation of money charged for projected accident and time costs is as follows:

- 10 percent to the government to be reallocated in support of subsidies
- 10 percent for public transport infrastructure development (illustrated in Table 7-4).

The concluding results indicate that, in the case where a conservative approach is taken, (only 50% of congestion pricing is charged and only 10% of this charge is allocated to the government subsidy budget) the subsidy required for 10 000 public transport commuters can be covered by the congestion charge paid for by 10 000 private transport commuters in this scenario.

If more users travel shorter distances, the congestion pricing does not cover the total subsidy amount needed. When users travel greater distances, the inverse is true and congestion pricing properly covers the subsidy amount needed for the longer distances travelled.

Table 7-3: Subsidy Paid vs. Congestion Pricing Charged

DISTANCE TRAVELLED	VEHICLE OCCUPANCY LEVEL (g)	COST PER DISTANCE TRAVELLED BY PUBLIC TRANSPORT (without subsidy per person) ((Table 6-8, a*b)/g*0.75) = h	COST PER DISTANCE TRAVELLED BY PUBLIC TRANSPORT (with subsidy per person) ((Table 6-12, u-(u*v))/g*0.75) = i	TOTAL SUBSIDY PER DISTANCE (per person) (h-i) = j	**COST OF TRAVELLING BY PRIVATE TRANSPORT (model) = k	**CONGESTION PRICING ONLY (50% of total congestion pricing inflicted) (model)= l
7.5	16	R 4.43	R 3.79	R 0.64	R 33.19	R 5.99
15	16	R 2.26	R 1.84	R 0.42	R 17.49	R 3.163
25	65	R 0.55	R 0.41	R 0.14	R 11.21	R 2.02
35	65	R 0.40	R 0.29	R 0.11	R 8.52	R 1.54
45	65	R 0.32	R 0.21	R 0.11	R 7.02	R 1.27

** The model to determine column k was developed by Janse van Rensburg and Krygsman. (Annexure C illustrates the results of how column k is calculated as well as column l).

Table 7-4: Government Budget Effect

DISTANCE TRAVELLED	SUBSIDY (j) = m	TOTAL OF SUBSIDIES (10 000 public and 10 000 private transport users per example distance) (m*10 000) = n	CONGESTION PRICING (l) = o	CONGESTION PRICING ALLOCATED FOR TRANSPORT SUBSIDY (10%) (o*0.1) = p	TOTAL OF PEAK-HOUR PRICING CHARGE (10 000 public and 10 000 private transport users per example distance) (p*10 000) = q
7.5	R 0.64	R 6 400	R 5.99	R 0.60	R 6 000
15	R 0.42	R 4 200	R 3.16	R 0.32	R 3 200
25	R 0.14	R 1 400	R 2.02	R 0.20	R 2 000
35	R 0.11	R 1 100	R 1.54	R 0.15	R 1 500
45	R 0.11	R 1 100	R 1.27	R 0.13	R 1 300
TOTAL		**R 14 200**			**R 14 00**

7.9 CONCLUSION

Although congestion pricing is not a subsidy, the income the government receives by charging private transport commuters for the costs they incur on society can be reallocated to serve as subsidies and public transport infrastructure funding.

If a conservative approach is taken and only 50 percent of congestion cost is recouped, of which 10 percent is reallocated for public transport subsidies, the government will save on its (subsidy) budget by reallocating congestion pricing toward public transport subsidy. The scenario that was tested (10 000 public transport commuters versus 10 000 private transport commuters over a specific distance) indicated that shorter distances travelled result in subsidy amounts exceeding the congestion price charged. Longer distances travelled will result in congestion price charged exceeding the subsidy amount.

The empirical analysis conducted in this chapter forms part of the sixth step of the system-based process. Results obtained in this chapter indicate that congestion pricing complies with practical demographic and financial performance measurements. Other objectives that congestion pricing satisfies, is the discouragement of private transport users to use their vehicles in peak periods and the encouragement of these commuters to transfer onto public transport.

The financial incentive also provides the government with greater income to spend on subsidies and extend its ability to realise its social objectives. Congestion pricing has the potential to satisfy the direct objective that the South African metropolitan transport system becomes more sustainable.

Once all these regulating and supportive practices are in place, public and private transport will take their rightful place. Promise to overcome social inequalities by providing affordable and accessible transport to available employment opportunities that, in turn, could advance the economy.

8 POSSIBLE BUY-IN OF STAKEHOLDERS AND OPERATIONAL REQUIREMENTS

8.1 INTRODUCTION

The seventh step of the system-based process is to determine if the stakeholders will approve of the subsidy approach proposed. In this chapter the buy-in of stakeholders will be investigated and the operational requirements established.

The financial implications of planning, design, formulation, construction and implementation of a new public transport system are often unaffordable. In Latin America, the governments of cities such as Bogotá, Curitiba and Sãu Paolo, formed partnerships with the private sector, i.e. public private partnerships (PPPs) to implement their public transport systems.

A supplier-side subsidy may lead to satisfied operators, but commuters will, in most cases, be dissatisfied and equality goals will not be achieved.

The implementation of an effective user-side subsidy will address equality problems and public transport commuters will be satisfied, but it may pave the way to misuse of received compensation by would-be commuters and unhappy operators.

From a financial perspective South Africa cannot afford the implementation of only one subsidy system.

8.2 BUY-IN OF STAKEHOLDERS

The optimal solution lies in transport congestion relief mechanisms as well as a combination of supplier-side (capital subsidy) and user-side subsidy. This combination will need to be adjusted regularly to ensure continued buy-in from all stakeholders. These initiatives should ideally create an environment where:

- Operators will be satisfied with capital compensation.
- Commuters who have to travel longer distances will feel satisfied as their fare will be subsidised.
- Commuters will have access to a choice of modes of transport and be able to use the mode that suits them best.

- Inequalities will be addressed by rectifying existing shortcomings of the public transport system.
- Commuters will receive satisfactory services that are safe, on schedule and frequent.
- The private sector is satisfied because they have a stake in the market (system).
- The government will gain the support of the public by introducing a satisfactory and affordable transport system for all citizens.
- The total cost of operating the system will be less than what the government are spending on urban transport at this stage.
- Roads in metropolitan areas will become less congested and improve the quality of life of the entire society.

8.3 OPERATIONAL REQUIREMENTS FOR A COMBINATION OF CORRIDOR-FOCUSED, USER-SIDE AND CAPITAL SUPPLIER-SIDE SUBSIDIES

Low-income households, living far from job opportunities, will receive subsidies according to the distances and corridor travelled. These kinds of subsidies (compensating for the actual distance travelled) deliver greater benefits for this disadvantaged group. This type of subsidy focuses on each individual commuter's transport needs and he/she, in most cases, should benefit directly from this compensation.

In practice the system allows users to buy discounted travel cards to be used on bus or rail services, as well as minibus taxis, even if the subsidy rates differ. It has to be mentioned that there will be several institutional and technical prerequisites that will have to be met by all modes, minibus taxis in particular, in order to be eligible for subsidisation. These prerequisites may include:

- Operators are expected to join a route association and need to enter into a contract with the regional transport authority to operate in a certain corridor, under certain conditions that will be binding on both parties.
- Operators must have an operating licence and must comply with all contract conditions of the operating licence board.
- Smart card registering and receipt-issuing machines must be fitted in every transport operating vehicle.

A further important prerequisite for such a system is that it must form part of an integrated information- and fare collection system. This means that automated trip registering and smart card ticketing systems that can determine the distance travelled should be implemented on minibus taxis and bus and rail services operating along a designated corridor.

In this respect the corridor-focused, user-side subsidy system may be seen as a similar system to that currently being used for the bus services. The crucial differences between the current and proposed systems are that (DOT, 1994):

- Loopholes for claiming unlawful subsidy by inflating passenger numbers will be closed down by subsidising the commuter for the trip made and the distance travelled.
- It will not be limited to the bus service, thus users will have a wider choice of subsidised transport modes or mode-combination, but in a more restricted set of corridors.
- A better integrated- and managed system at a regional level will be in place to allow for sustainable monitoring and management of public transport trends.

8.4 CONCLUSION

Motivation for buy-in by the different stakeholders is summarised below:

- Government will gain acceptance by and support from the public for introducing an affordable transport system, offering satisfactory service to all citizens. The implementation of congestion pricing holds a significant financial advantage for the government, as congestion pricing will probably cost less than money being spent on travel subsidies at this stage.
- The system provides a management tool for a sustainable public transport system. The subsidy approach, taken further, enhances management tools to uphold good levels of service and better financial allocation and ensures upliftment of the public transport industry, ensuring a sustainable public transport system.
- Tax payers will be satisfied that they do not get taxed for services they do not use. A satisfactory plan to rectify the inequalities of the past will be in place.
- Commuters will have a wider choice of subsidised transport modes or mode combinations. Commuters receive a satisfactory transport service that is accessible, affordable, safe, scheduled and frequent.
- The private sector will be satisfied because they have a stake in the market. Operators will be amenable to cooperate and obtain the capital compensation on offer.

- Private transport commuters will consider public transport as an attractive alternative if it proves to be affordable, safe, scheduled and frequent: especially for those who do not need their vehicle on hand during office hours.
- Private transport commuters, who opt to remain dependent on private transport, will have to face the consequences of congestion pricing. These commuters may be dissatisfied in the beginning, but, in due course will weigh up their options: change to public transport or pay corrective congestion pricing. The sweetener will be the advantage of travel in less congested corridor in peak periods. Commuters whose demand tends to be inelastic to price will still be able to experience the comfort and benefits of private transport, if they so wish, but will have to pay a levy for this privilege.

The seventh step of the system-based process indicates that the proposed subsidy approaches will probably win the support of the majority of stakeholders. During this step, the stakeholders will raise questions and concerns and, if anything should need re-evaluation, the steps will be retraced until the stakeholders are satisfied with the product on offer. Once the proposed plan (in this case the subsidy approach) has been approved, the plan can be expected to be implemented and monitored. These two steps, however, will not be discussed in the case study covered in the next chapter.

9 CASE STUDY

9.1 INTRODUCTION

The research conducted in this study evaluated a system-based process designed to determine a more appropriate subsidy approach for the proposed IPTS system in South African metropolitan cities. Although this approach might be common to other areas of business it has not yet been used as a formal procedure to determine a suitable subsidy approach. This research study proposes that the steps identified become established and that this system-based process be repeated whenever needed.

As this system-based process is the first conventional design intended to determine the effectiveness of a subsidy approach, a local case study cannot be used. After some research it was further found that this type of process, specifically focusing on determining a better subsidy approach, could not be found internationally. However, a study was conducted in China where the public transport system was evaluated in a similar way as proposed in this study.

For the purpose of this study the case study will consist of a discussion of the Chinese study, as well as the empirical analysis of the system-based process and the proposed subsidy approach intended for application in the City of Cape Town.

9.2 PUBLIC TRANSPORT AND SUBSIDY OBJECTIVES

The first step of the system-based process is establishing the scope of the problem and determining the stakeholders as well as the main objectives that need to be realised. In each section that follows, the empirical analysis of the City of Cape Town's proposed study will be conducted first, after which the Chinese case study will be discussed.

9.2.1 CITY OF CAPE TOWN

Briefly summarised, the description of the state of transport in the City of Cape Town would be as follows: high private transport occupancy, unsatisfactory levels of public transport service, and ineffective resource allocation.

The stakeholders include the municipality, local officials, the private sector, private transport users, public transport users and the rest of Cape Town's population.

The objectives stipulated in the Integrated Transport Plan (ITP) read as follows:

“The Integrated Transport Plan provides for and manages future transport demands towards a more balanced sustainable transport system that promotes and gives priority to public transport and other alternative modes of transport and relates to, reinforces and completes the spatial plan, economic development strategies, long-term environmental management strategies and other plans for the City” (ITP, 2006).

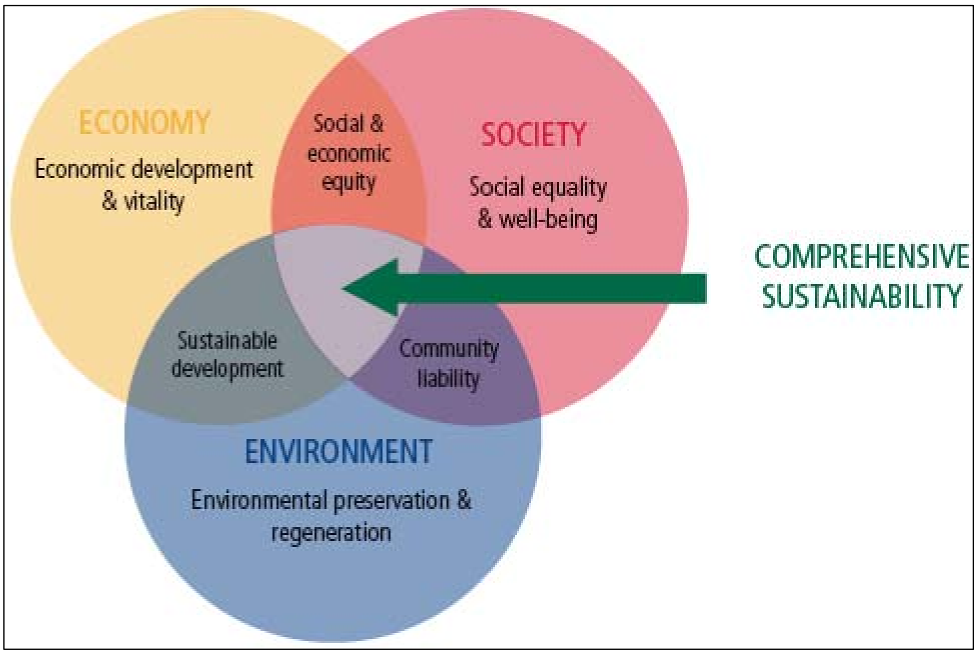
The strategic objectives, as stipulated in the ITP (2006), include:

- to strive towards a complete and balanced, sustainable transport system
- to promote public transport over private car travel
- to promote travel demand management measures to influence the choices made by commuters, in order to reduce the overall number of vehicular trips
- to align transport and land use planning to bring about a land-use pattern where the necessity to travel, especially by car, is minimised
- to promote non-motorised transport by encouraging walking, cycling and public spaces
- to promote and incorporate the principles of universal access in design and construction of transport infrastructure
- safe and efficient road networks that enhances the efficiency of public transport
- efficient and safe movement of freight within the City

Sustainable transport is one of the main objectives that the City of Cape Town would like to reach. “Sustainable transport is defined as the ability to move people and goods effectively, efficiently, safely and most affordably without jeopardising the economy, social matters and the environment, today and into the future” (ITP, 2006) .

Figure 9-1 illustrates the different components in achieving sustainable transport. These components become measurement criteria that must ultimately be reached by the subsidy approach taken.

Figure 9-1: Sustainable Transport



Source: ITP, 2006

The financial objectives that were established are (ITP, 2006):

- funding public transport system improvements
- influencing travel behaviour to encourage sustainable choices
- achieving a balance between delivery of infrastructure and service improvements
- developing innovative and new funding sources

9.2.2 CHINA

China has been struggling with urban public transport development and a system-based process was followed in order to evaluate the conditions of e.g. supply level and environment of public transport.

The stakeholders involved were the government at a national, provincial and local level, as well as the citizens of China. The main objectives that the Chinese government wanted to reach were (Feng, Jiang, Peng & Wu, 2007):

- improved environmental conditions
- sustainable transport
- better social and economic conditions

9.3 BACKGROUND RESEARCH INTO PUBLIC TRANSPORT IDENTIFICATION OF GAPS

The second step of the system-based approach is researching the background of the existing public transport system and then identifying what shortcomings the system has in terms of the objectives identified in step one.

The subsidy system applied in South Africa is determined on a national level. The current subsidy system has already been evaluated in Chapters 5, 6 and 7. The subsidy findings established in previous chapters will be measured against the transport findings in this chapter.

9.3.1 CITY OF CAPE TOWN

In the early 1900s public transport in Cape Town was up and running, with a network of tram lines serving the community. The commuters used trams to get around the city and then walked some distance to reach their destinations (Bucher, 2006).

After the world wars public transport became a predominately rail and bus service, providing good and efficient transport for the majority of white population, but the under privileged were often excluded (either by default or design).

Between the 1950s and 1980s, household members used public train and bus services to travel to, in and around the CBD. Both train and bus service were booming and frequent, safe and reliable services were being provided. The government also focused many of its resources on both these industries, resulting in an effective and efficient public transport service for the city and most of its suburbs around the Peninsula (Cape Metropolitan Transport Plan, 1998).

When apartheid laws were implemented, other ethnic groups were forced to settle on the outskirts, outside the CBD area, leading to ever-increasing spatial (urban) crawl. The more privileged and higher-income groups searched for bigger plots and greater space to raise their families. As spatial planning was insufficient and poor, it increasingly allowed and caused more people to settle far outside the city centre. Furthermore, in the early 1990s, with the arrival of the end of the apartheid era, the South African economy grew enormously. This resulted in high levels of private transport ownership growth for the next two decades. With no concomitant investment in public transport infrastructure during this period to meet growing demand, services levels deteriorated. The multitude of rural households moving to, and settling in and around, the Cape Town metropolitan area, also contributed to the public transport system not being able to deal properly with the fast growing urban population living in ever-expanding settlements (Cape Metropolitan Transport Plan, 1998).

In the last two decades, little planning attention was given to public transport in South African metropolitan cities. Subsidies allocated were never reviewed or compared to productivity levels of operators. Operators came to depend on financial help from the government, instead of themselves seeking to acquire profitable levels of income from their operations.

Currently the City of Cape Town's entire road transport system consists of a network of 8500 km. Traffic volumes on these roads have been increasing at approximately 3 percent per annum and the network carries about 90 million vehicle kilometres of travel (ITP, 2006). Today the Cape Town metropolitan city finds itself with:

- increasingly congested roads
- high pollution
- poor, unsafe, overcrowded and limited public transport services
- unsafe roads – high accident figures
- limited walking and cycling options – poor non-motorised transport conditions
- living environments of poor quality
- declining natural environments
- overloading causing damage to current road infrastructure
- lack of infrastructure maintenance
- a number of unlinked roads in the road network

There is a clear gap between where the system is at and where it should be. Congested roads, high pollution, unsafe public transport services, high accident figures, lack in non-motorised transport and poor environmental conditions are all elements could be improved upon. In the next step strategies will be discussed that are in place, or that should be put in place, to overcome these gaps and achieve the objectives stipulated in step one.

9.3.2 CHINA

China has very rapid economic growth which has led to urbanisation and motorisation. The system is now facing significant challenges of traffic congestion, environmental pollution and energy shortage. All of these elements suppress citizens' quality of life.

Studies conducted indicate that vehicle emission contributes as much as 60 percent of the total urban air pollution in China. Oil consumption in China in 2005 amounted to 300 million tons, of which motor vehicles accounted for 33 percent. Traffic congestion has become one of the biggest problems in Chinese cities. Shanghai suffered an approximate GDP loss of 10 percent through traffic congestion (Feng, Jiang, Peng & Wu, 2007).

The gaps that have been identified by Feng, Jiang, Peng & Wu (2007) include:

- insufficient investment in and input for urban public transport funds
- lack of a scientific and stable public transport subsidy mechanism
- non-adaptive institutional systems of urban public transport
- contradiction/confusion between urban and suburban commuter transport needs
- non-normalised market operating management of urban public transport
- incomplete regulation and standards system

9.4 STRATEGIES AND GOALS IN PLACE

The third step of the system-based process is to develop or/and use an action plan. This action plan consists of strategies and goals already in place (or that should be developed to put in place).

9.4.1 CITY OF CAPE TOWN

The ITP is a strategy that is currently in place to achieve the objectives, as indicated in step one. A short overview of these strategies will be given in this section.

It is important to explain where the ITP is in terms of the bigger scheme of things. The ITP focuses directly on transport. It is part of a mobility improvement strategy that in turn forms part of the Integrated Development Plan (IDP). The objectives the IDP have in mind include:

- creating integrated settlements
- economic growth and job creation
- Improving accessibility and mobility
- building strong communities
- equitable and effective service delivery

Table 9-11 illustrates how the ITP programmes fit into the IDP strategies (ITP, 2006).

Table 9-1: Relationship between ITP Programmes and IDP Strategies

TRANSPORT PROGRAMMES	IDP STRATEGIES
Well-planned transport	Focusing on the urban core/ economic backbone
Safe, integrated transport	Improving existing settlements; Building cohesive self-reliant communities
Accessible transport	Improving existing settlements; Building competitive advantage; building cohesive self-reliant communities,
Productive transport	Sustainable job creation for all; Service infrastructure maintenance, replacement and improvement
Intelligent transport	Building competitive advantage

Source: ITP, 2006

All of the above ITP programmes have to be completed successfully in order for the greater system to be considered functional and objectives to be reached.

9.4.1.1 THE VISION AND GOALS OF THE CITY OF CAPE TOWN

The vision of the City of Cape Town can be summarised as follows: “To provide a world-class sustainable transport system that moves all its people and goods effectively, efficiently, safely and affordably” (ITP, 2006).

The transport goals set by the City of Cape Town are to be employed to measure and improve the identified sustainable transport indicators and to achieve the following modal split targets as envisaged (see Table 9-2):

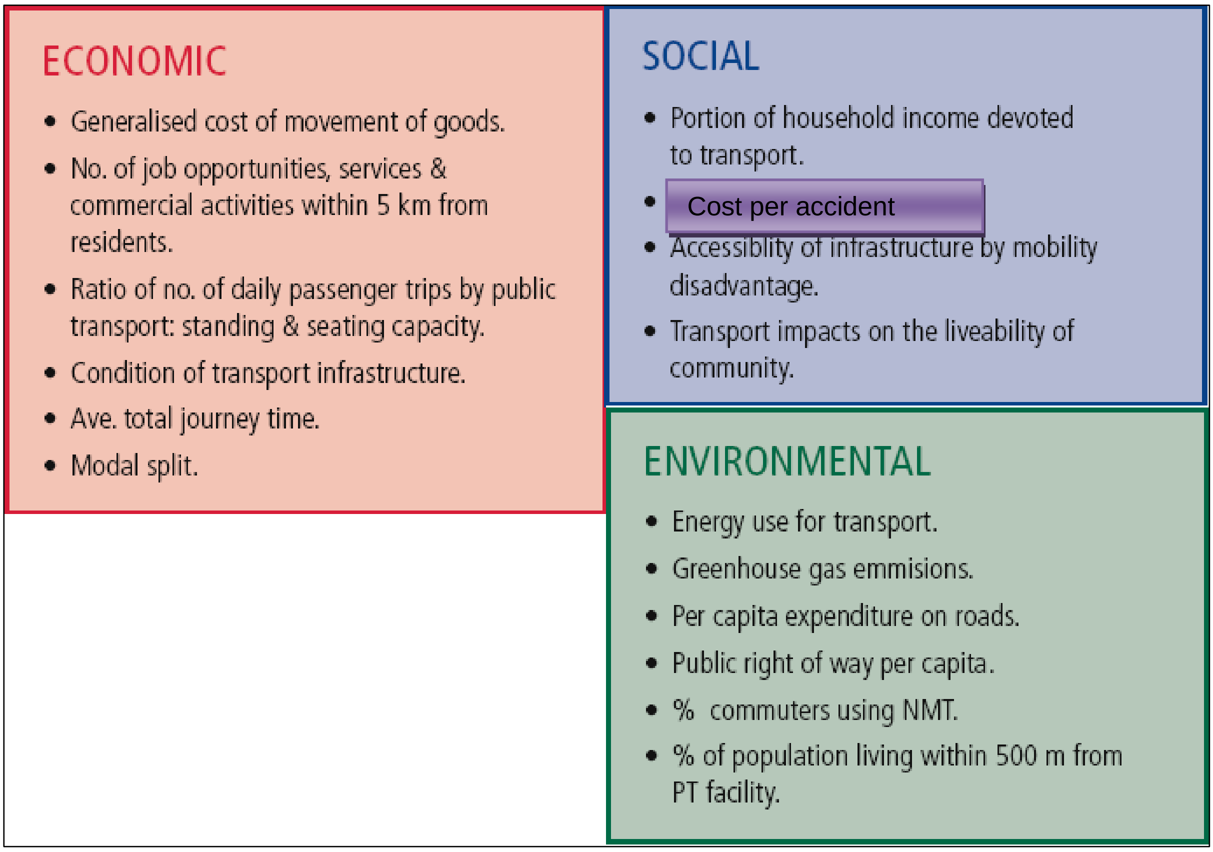
Table 9-2 : Modal Split Targets set by the City of Cape Town

YEAR	% PRIVATE TRANPORT	% PUBLIC TRANSPORT
existing	52%	48%
2010	50%	50%
2015	47%	53%
2020	43%	57%

Source: ITP, 2006

The sustainable indicators for the City of Cape Town are illustrated in Figure 9-2.

Figure 9-2: Measuring Sustainable Transport



Source: ITP, 2006

To achieve all of these goals, a range of strategies would need to be implemented. These strategies (as identified in the ITP, 2006) include the following:

- sustainable investment in the rail system
- major improvement to the road-based public transport system
- enhancement of safety and security to and on public transport
- investment in walking and cycling environments
- provision and enforcement of public transport priority lanes and dedicated lanes
- travel demand strategies
- parking strategies
- improve affordable transport
- improve allocation of financial resource for public transport

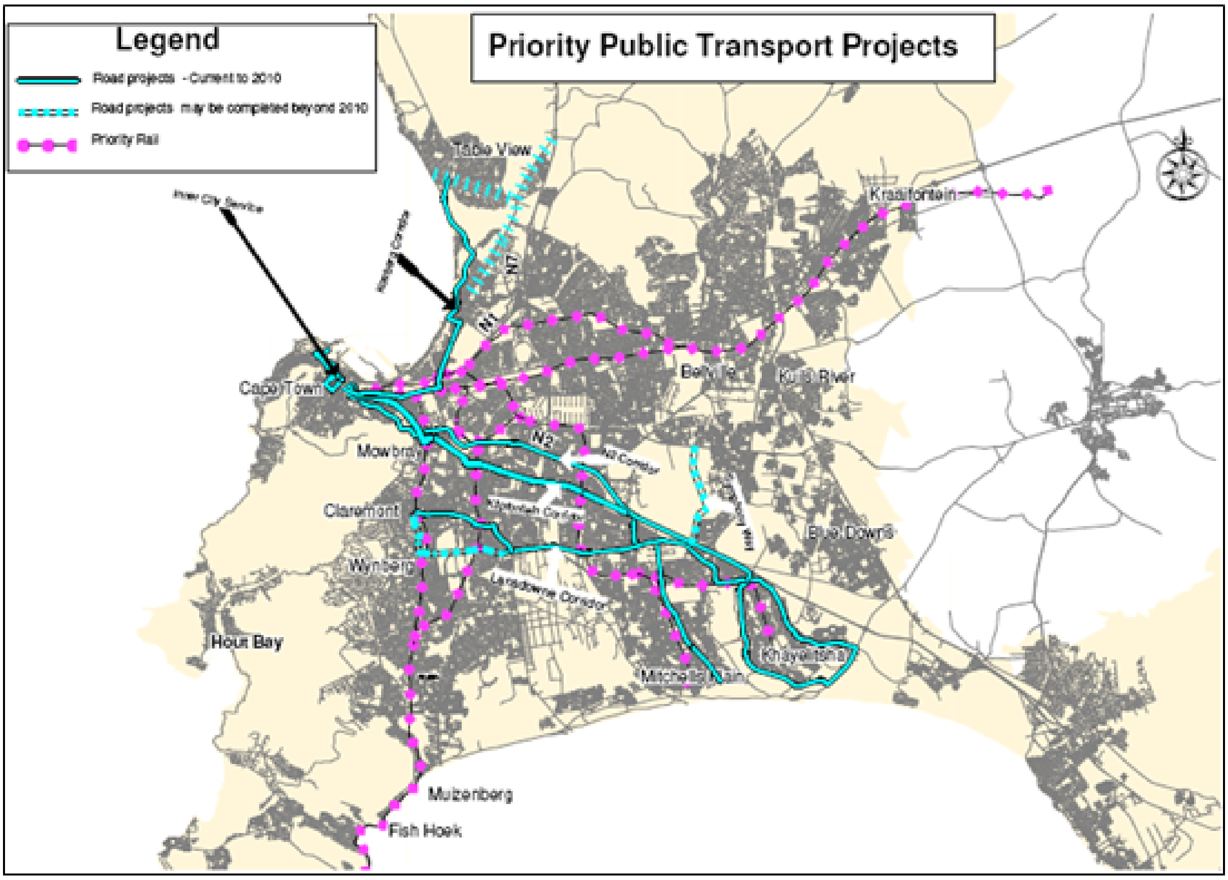
9.4.1.2 INTEGRATED RAPID TRANSIT SYSTEM

The IRT system is one of the major strategies being implemented in order to reach the goals and objectives.

The Cape Town IRT system will integrate the following modes: Metrorail services, road-based services on trunk routes, conventional bus services, minibus taxis, feeder bus services, improved pedestrian and bicycle access, metered taxi and park-and-ride facilities. Cape Town's IRT system will be implemented in phases (City of Cape Town: d, 2008).

Figure 9-3 indicates the prioritised public transport projects, of which the IRT forms part.

Figure 9-3: Prioritised Public Transport Projects



Source: ITP, 2006

The IRT system is to provide bus-based transport services that deliver fast, comfortable, and cost-effective urban mobility with segregated right-of-way infrastructure. Rapid and frequent operations and excellence in marketing and customer services are the order of the day.

Dedicated, median busways provide reduced travel times for commuters. Vehicles (buses) will move quickly and efficiently during peak periods and encourage people to switch over from private transport use to public transport. Furthermore, dedicated lanes also reduce operating costs and result in lower fare levels and affordable transport (City of Cape Town: f, 2008).

The system will be operated through a concession contract. Existing bus and minibus-taxi operators will be participating fully. Operators will be compensated on the basis of pre-determined vehicle-kilometres and a range of performance-based indicators (City of Cape Town: f, 2008).

Currently the City of Cape Town is in the process of establishing PPPs to help capitalise and operate the system. Not only is the new system likely to be profitable for the operators, but those employed in the industry will benefit from formal salaries, health and pension benefits, and an improved working environment.

Each individual phase of Cape Town's system has been designed to be financially sustainable, independent of future development. Furthermore, no operating subsidies are expected once the system has been successfully implemented and is fully operational.

9.4.2 CHINA

The Chinese government has set out goals that include:

- public transport development
- improved investment in public transport

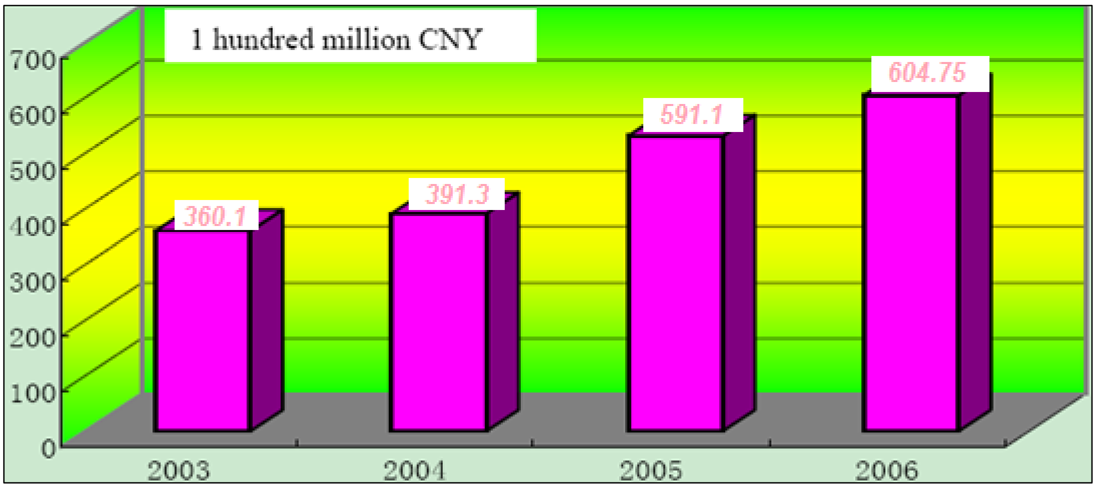
Beijing issued a strategy document (Opinions on the Development of Public Transport Priority). This strategy has two determining factors: to decide the strategic position of public transport in the city's development and determine the social public welfare orientation of public transport. This strategy stipulates four further priorities: land for public transport facilities; infrastructure investment; right-of-way allocation and priority for finance and taxation support (Feng, Jiang, Peng & Wu, 2007). The Beijing urban public transport system has mass commuter transport as its backbone, conventional public transport as the main body and as its limbs multiple transport modes and the supplementary services.

The above strategy was developed into an action plan namely the Action plan of Shanghai for Public Transport Priority Development in three years. This action plan's main objective was to invest funds to quicken mass transport construction as well as comprehensive transport transfer junction infrastructure in order to promote the progress of public transport (Feng, Jiang, Peng & Wu, 2007).

9.4.2.1 PUBLIC TRANSPORT IMPROVEMENTS MADE TO ACHIEVE GOALS

Investment in urban public transport increased and reached 60.4 billion Yuan in 2006 (exchange rate 1.11 to the ZAR), which amounted to a 68 percent increase since 2003 (Figure 9-4). This increased investment enhanced public transport operations continuous improvement (Feng, Jiang, Peng & Wu, 2007).

Figure 9-4: Public Transport Investment in Chinese Cities



Source: Feng, Jiang, Peng & Wu, 2007

The increase in investment improved the public transport operational environment continuously and service delivery improved significantly. This led that routes and equipment were also improved and, by 2006, operating buses and trolleys increased by 38.44 percent (since 2000), standard vehicles increased by 66 percent (since 2001) and city taxis increased by 12.57 percent (since 2000) (Feng, Jiang, Peng & Wu, 2007).

The rail and BRT systems were improved in Chinese cities. All of these improvements led to service level improvements. In 2007, the daily average commuter transport capacity of public transport in Beijing increased by 17 percent over the preceding year. During 2006 and 2007 11 million (average) daily transactions were made for public transport trips.

9.5 APPLICATION OF THE PROPOSED SUBSIDY APPROACHES FOR THE CITY OF CAPE TOWN

Step four of the system-based process is the theoretical analysis of the different subsidy methods. The subsidy approach of the combination of a capital supplier-side subsidy with corridor-focused, user-side subsidy will be taken with the additional congestion charging. However, this evaluation process will not be conducted again in the case study, as information obtained in Chapter 4 will remain unchanged and will therefore be suitable to be used accordingly.

Step five of the system-based process will also not be completed in the case study. The reason for this is that the objectives of the City of Cape Town have to comply with the objectives at national level. Legislation is set at national level, as are the types of subsidy approaches that will be followed. For these reasons the combination of a capital (supplier-side) and (corridor-focused) user-side subsidy approach, in addition to congestion pricing, will be used for further investigation and testing.

The Chinese case study does not consider different subsidy approaches. Thus, for the next section the Chinese case study will not be discussed.

Step six of the system-based process tests the subsidy approach against the demographics and assesses the financial impact. This analysis method will be focused on the City of Cape Town's demographics.

9.5.1 DEMOGRAPHICS OF THE CITY OF CAPE TOWN

In 2007 the statistics for Cape Town were as follows (StatsSA, 2001):

- Total area: 2 461 km²
- Population size: 3.4 million
- GGP: R 130 Billion
- Percentage unemployed: 16.9 percent

Table 9-3 shows the variation in household income of Cape Town residents.

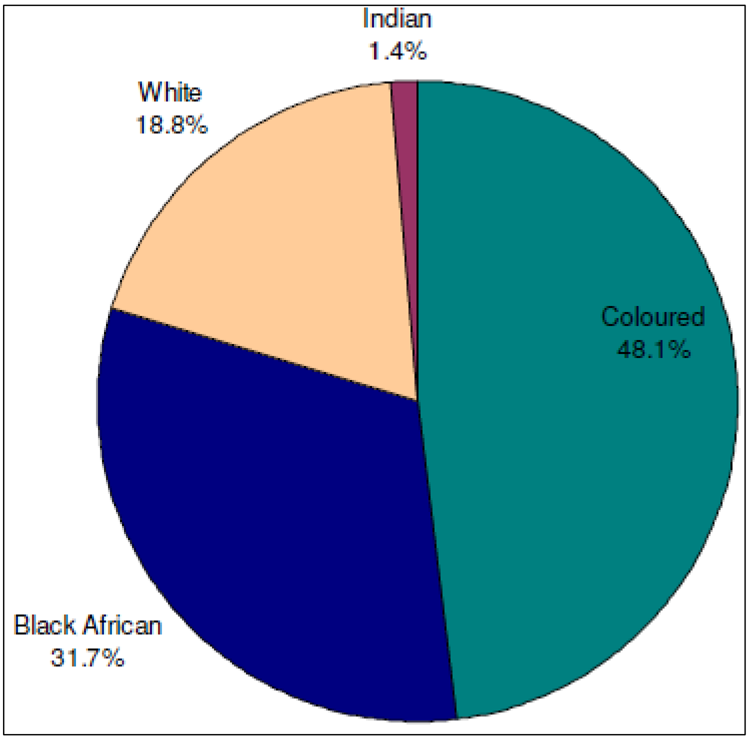
Table 9-3: Variation in Annual Household Income for the City of Cape Town, 2008

CITY OF CAPE TOWN		
HOUSEHOLD INCOME (PER ANNUM)	Number	%
0 - R19 200	302,141	38.87
R19 201 - R76 800	264,594	34.04
R76 801 - R307 200	177,124	22.78
R307 201 - R1 228 800	28,617	3.68
R1 228 801 and more	4,917	0.63
Total	*777,393*	*100.00*

Source: City of Cape Town: e, 2008

Distribution of population groups in Cape Town is indicated in Figure 9-5.

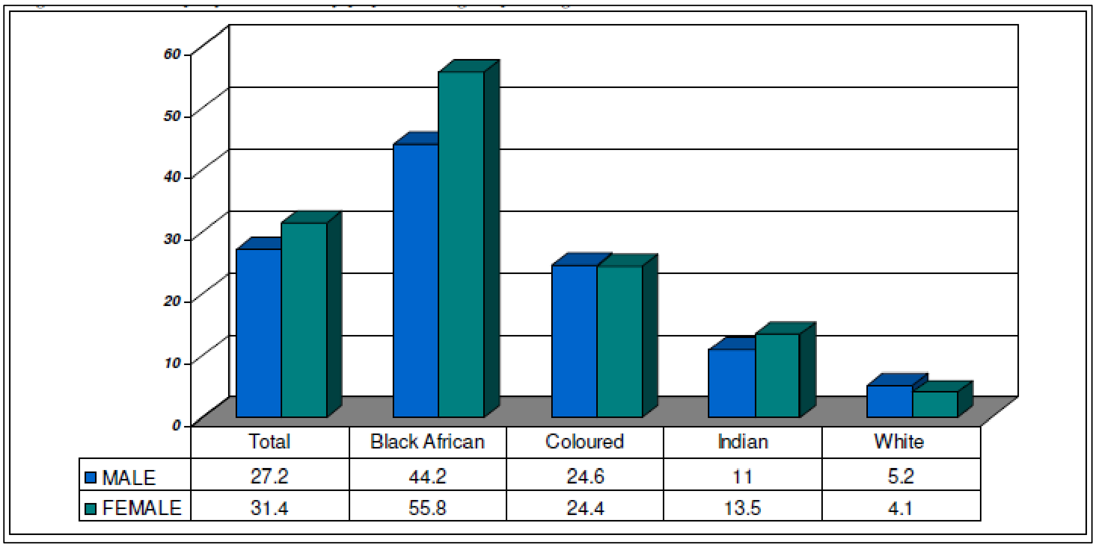
Figure 9-5: Population Group Distribution, Cape Town, 2003



Source: City of Cape Town: a, 2003

The unemployment rate, by population group and gender is indicated in Figure 9-6.

Figure 9-6: Unemployment Rate by Population Group and Gender, 2003

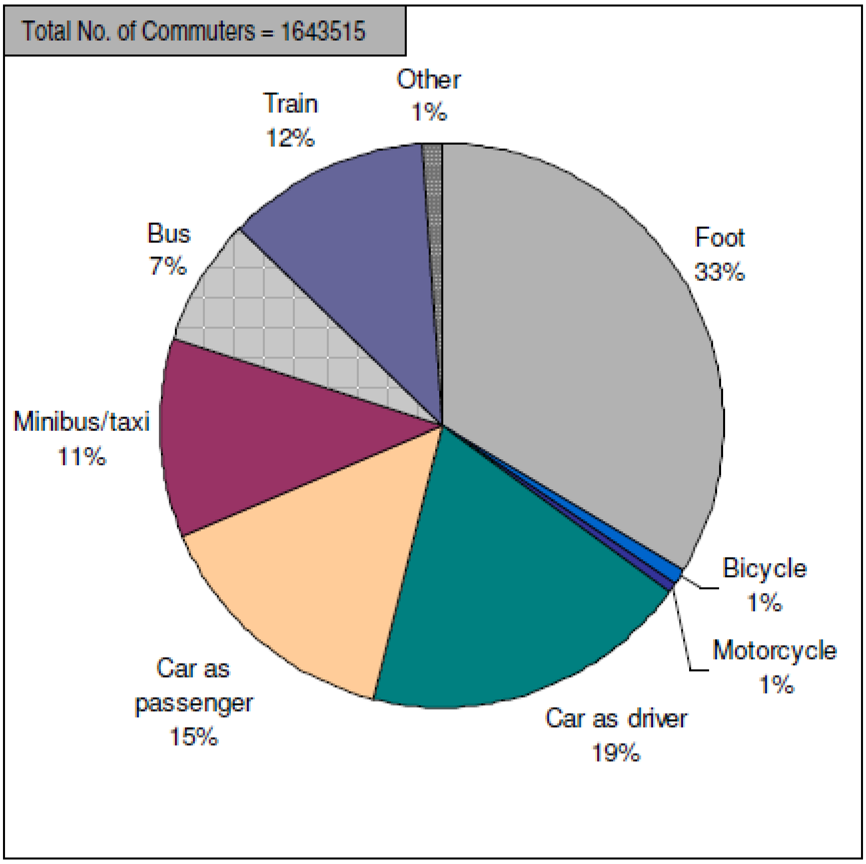


	Total	Black African	Coloured	Indian	White
MALE	27.2	44.2	24.6	11	5.2
FEMALE	31.4	55.8	24.4	13.5	4.1

Source: City of Cape Town: a, 2003

The transport mode distribution is indicated in Figure 9-7.

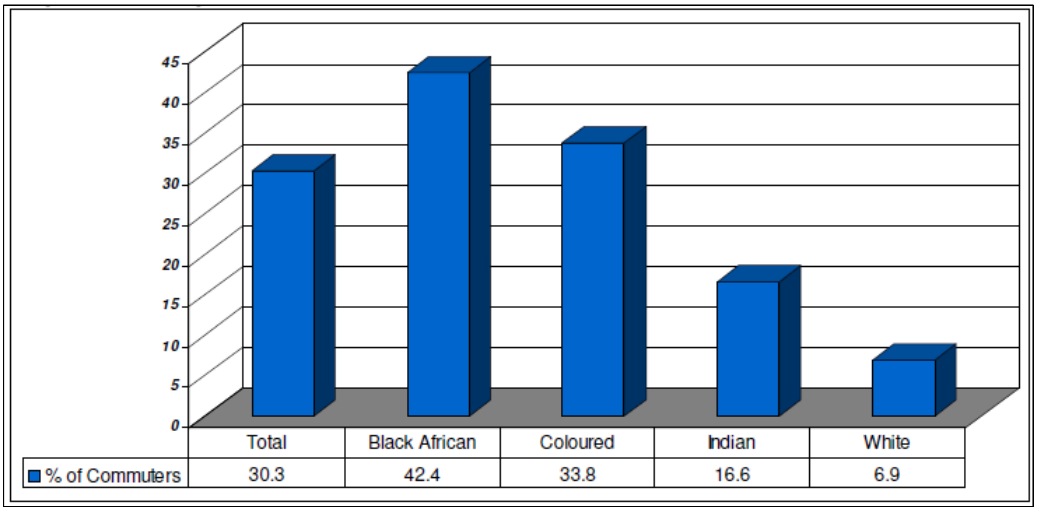
Figure 9-7: Transport Mode Distribution



Source: City of Cape Town: a, 2003

The percentage of various citizens using public transport to school or work is indicated in Figure 9-8.

Figure 9-8: Percentages of Population Using Public Transport



Source: City of Cape Town: a, 2003

The demographic break-down of Cape Town in Figure 9-8 indicates that most citizens have access to transport and, in many cases, specifically to public transport. The implementation of the IRT system will improve accessibility as well as mobility in and around the city.

9.5.2 FINANCIAL IMPLICATIONS OF THE PROPOSED SUBSIDY APPROACHES

In Chapters 6 and 7 the percentage effects of the different subsidy approaches have been evaluated and discussed. In this section the overall subsidy effect of the combination of capital, user-side subsidy and congestion pricing on the N1 (from Bellvillel to the CBD) and on the N2 (from Khayalitsha to the CBD) will be discussed. Furthermore, the private transport congestion cost on these two corridors will be evaluated. Finally, the percentage financial implication for the local government will be discussed.

Table 9-5 indicates how much it will cost a commuter who has to travel on either of the two proposed routes. The distance for a round trip is equal to 30 km (Cape Metropolitan Transport Plan, 1998). Initially the current modal split will be tested and then the modal split once the new IRT system is operational, will be assessed. From Khayalitsha (low income) area currently 75 percent of commuters use public transport and 25 percent use private transport (Cape Metropolitan Transport Plan, 1998). From Bellville (high income household area) 20 percent of commuters currently use public transport and 80 percent use private transport (Cape Metropolitan Transport Plan, 1998). According to the Cape Metropolitan Transport Plan as well as taking the proposed estimated effect of the IRT system, on the N2 (from Khayalitsha), 85 percent of commuters will use (road-based) public transport and 15 percent will use private transport. On the N1 (from Bellville) 40 percent will use (road-based) public transport and 60 percent will use private transport Cape Metropolitan Transport Plan, 1998). The Cape Metropolitan Transport Plan illustrates the estimated number of trips generated from Khayalitsha (low income household areas) to be approximately 577 000 by 2015. For the purpose of this study, to illustrate the proposed subsidy effect, a sample size of 200 000 production trips (from Khayalitsha to the CBD with a distance of 30 km) will be analysed. Estimated number of trips generated from Bellville (high income households areas) to be approximately 351 000. For the purpose of this study, to illustrate the proposed subsidy effect, a sample size of 200 000 production trips (from Bellville to the CBD with a distance of 30 km) will be analysed.

Assumptions made in previous chapters remain the same. To highlight two of the assumptions:

- Bus capacity is 65 seats (articulated buses are not considered).
- Buses run at 75 percent occupancy rates.

Current public transport subsidy is estimated at 30 cents (Cape Argus, 2009) and will be used in Table 9-5 for the current subsidy per commuter. It must be stressed that over and above this small amount (30 cents), the allocation of the subsidy is ineffective and many commuters do not receive this subsidy.

It must further be considered that, as soon as the IRT system is implemented and more people travel by public transport, congestion conditions will improve with fewer vehicles on the roads. It is assumed that average speed travelled during congestion periods will increase to 50km/h and commuters will lose less time travelling. Table 9-4 indicates the subsidy paid vs. congestion pricing charged at a speed travelled of 50 km/h by private transport.

Table 9-4: Subsidy Paid vs. Congestion Pricing Charged

DISTANCE TRAVELLED	VEHICLE OCCUPANCY LEVEL (g)	COST PER DISTANCE TRAVELLED BY PUBLIC TRANSPORT (without subsidy per person) ((Table 6-8, a*b)/g*0.75) = h	COST PER DISTANCE TRAVELLED BY PUBLIC TRANSPORT (with subsidy per person) ((Table 6-12, u-(u*v))/g*0.75) = i	TOTAL SUBSIDY PER DISTANCE (per person) (h-i) = j	*COST OF TRAVELLING BY PRIVATE TRANSPORT (model) = k	*CONGESTION PRICING ONLY (50% of total congestion pricing inflicted) (model)= l
7.5	16	R 4.43	R 3.79	R 0.64	R 16.44	R 2.97
15	16	R 2.26	R 1.84	R 0.42	R 9.12	R 1.65
25	65	R 0.55	R 0.41	R 0.14	R 6.19	R 1.11
35	65	R 0.40	R 0.29	R 0.11	R 4.93	R 0.89
45	65	R 0.32	R 0.21	R 0.11	R 4.23	R 0.76

* The model to determine column k was developed by Janse van Rensburg and Krygsman. (Annexure D illustrates the results of how column k is calculated as well as column l).

Finally, in Table 9-66, the financial implications for the government, between the subsidies paid and the congestion pricing charged, are indicated.

For the purposes of the study the specific amount is not of great concern. The importance is the effect on commuter patterns of the subsidy and congestion pricing in conjunction with one another and what financial implications this will hold for government budget.

Table 9-6 indicates that the following can be inferred:

- In the current situation a total of R 31 500 of private transport user costs negatively affects the economy.
- If the subsidy amount is to be paid by the government as well as the cost endured by society, the total amount spent on public transport is R 52 400 (given the scenario of 200 000 commuters on the corridors identified).
- The new subsidy that the government has to initiate is higher than the current illustrated subsidy amount (R 20 900). However, it is important to note that all commuters who use public transport receive this compensation (and not like the current subsidy which only compensates bus and train commuters). The new subsidy amount of R 27 500 to be spent (per 200 000 commuters) is much better distributed and improves the equity problem.
- The congestion pricing that will be charged (R 13 500) does not cover the entire subsidy amount needed for the case study example. The government will need an extra R 14 000 to pay for planned subsidies.

Table 9-5: Operating Costs on Proposed Routes

AREA (a)	COST PER DISTANCE TRAVELLED BY PUBLIC TRANSPORT (without subsidy per person) (Table 6-8,a*b)/(65*0.75) = b	COST PER DISTANCE TRAVELLED BY PUBLIC TRANSPORT (with subsidy per person) (Table 6-12, u-(u*v))/(65*0.75a)) = c	TOTAL SUBSIDY PER KILOMETRE (per person) (b– c) = d	TOTAL SUBSIDY PER KILOMETRE (200 000*a)*d = e	COST OF TRAVELLING BY PRIVATE TRANSPORT (PER KILOMETRE) (Table 7-3, k) and (Table 9-4, k) = f	CONGESTION PRICING ALONE (50% of total congestion pricing incurred) (Table 7-3, l) = g	CONGESTION PRICING ALLOCATED FOR TRANSPORT (10%) (g*0.1) = h	TOTAL OF PEAK HOUR PRINCING CHARGE (200 000*a)*h = i
Khayalitsha (current – 75/25)**(i)**	R 0.40	R 0.29	R 0.11	**(i)**R 16 500	R 8.52	R 1.54	R 0.15	R 7 500
Bellville (current – 20/80) **(ii)**	R 0.40	R 0.29	R 0.11	**(ii)**R 4 400	R 8.52	R 1.54	R 0.15	R 24 000
TOTAL				**R 20 900**				**R 31 500**
Khayalitsha (new – 85/15) **(iv)**	R 0.40	R 0.29	R 0.11	**(iv)**R 18 700	R 4.94	R 0.89	R 0.09	R 2 700
Bellville (new – 40/60) **(iii)**	R 0.40	R 0.29	R 0.11	**(iii)**R 8 800	R 4.94	R 0.89	R 0.09	R 10 800
TOTAL				**R 27 500**				**R 13 500**

Table 9-6: Financial Implication for the Government

AREA	TOTAL OF SUBSIDIES GOVERNMENT HAS TO PAY (e) = j	TOTAL CONGESTION PRICING CHARGED (i) = k	
Khayalitsha (current split – 75/25)	R 16 500	R 7 500	
Bellville (current split – 20/80)	R 4 400	R 24 000	
TOTAL	**R 20 900**	**R 31 500**	***R 52 400**
Khayalitsha (projected split – 85/15)	R 18 700	R 2 700	
Bellville (projected split – 40/60)	R 8 800	R 10 800	
TOTAL	**R 27 500**	**R 13 500**	****R 14 000**

*In the current transport system, government has to spent R20 900 on transport subsidies and society has to endure the congestion cost of R 31 500 = R 52 400.

** In the future transport system, private transport commuters will be charged a percentage of the congestion cost, which will be reallocated to the government subsidy budget, and therefore the budget is R 27 500 – R 13 500 = R 14 000.

9.6 BUY-IN OF STAKEHOLDERS

Once promising results have been obtained from step six of the system-based process, step seven can be introduced. This step entails the buy-in of stakeholders and approval of the subsidy approach. In Chapter 8 it was illustrated how the buy-in of stakeholders at national level was achieved, but in this section the subsidy approach taken and the results obtained from step six will be measured against the objectives and goals specifically for the City of Cape Town. The Chinese case study will also be discussed and cognisance taken of how they achieved buy-in and approval of their public transport development approach.

9.6.1 CITY OF CAPE TOWN

To determine if the objectives and goals have been reached, the results obtained from the last step will be measured. Table 9-7 indicates the results measured against the objectives and goals.

Table 9-7: Objectives and Goals vs. Results Obtained

OBJECTIVES/GOALS	SATISFIED BY
Sustainable transport system	The implementation of the new infrastructure and the proposed subsidy approach in combination with congestion pricing should establish a sustainable system.
Promoting public transport over private transport	Congestion pricing and the subsidy approaches are focused to make public transport more attractive.
Travel demand management (TDM) measures	Congestion pricing is a form of TDM.
Aligning transport and land use planning	The new infrastructure focuses on the alignment as well as distance-focus subsidies (as part of the proposed subsidy approach).
Safe and efficient road network	The new infrastructure focuses on a safe and efficient road network. Congestion pricing also discourages peak-period travelling and this should make the roads function more efficiently during those periods.
Influencing travel behaviour towards sustainable choices	The subsidy approach and congestion pricing together will encourage a transfer from private to public transport.
Balance between delivery of infrastructure and service improvements	The implementation of the new infrastructure, in combination with the proposed subsidy approach, should bring a balance.
Innovative and new funding sources	The proposed reallocation of congestion pricing to help fund subsidies can be seen as innovative sourcing of funds.

Equitable and effective service delivery	The new subsidy approach promises to support both the operator and commuter and would become an equitable and effective service delivery system.

Table 9-7 indicates that most of the objectives and goals related to the proposed subsidy approach set are to be reached. It can be assumed that most of the stakeholders would be satisfied with the proposed subsidy approach. Minor changes could be required and should be addressed before final implementation. Private transport commuters might need convincing that being charged during congested periods is for the common good. However, the government must develop a congestion pricing policy in such a manner that these commuters will buy into the system. The private sector and big business should remain focused on the transport issue. As they have a strong influence on society, they, together with local government, could encourage acceptance of and, buy-in into, the proposed subsidy approach.

9.6.2 CHINA

The Chinese government's main objectives were to improve urban public transport development and offer better investment options. The implementation of a better infrastructure, as discussed in Section 9.4.2, indicated how a significant improvement of the urban public transport system was immediately seen as a benefit to all. Improvements in investment options have also been achieved.

9.7 CONCLUSION

It is important to understand the exact nature of the system-based steps prescribed for determining the new proposed subsidy approach. These steps must be retraced and reapplied every few years. This is to determine if the current approach is still effective and efficient at that juncture, and, where necessary see what new approach may have become available that will solve the shortcomings and challenges identified. This will also afford an occasion to include any altered objectives the government of the day may want to initiate. In the case study a clear overview of all possible steps was given in both a South African (City of Cape Town) scenario as well as for a similar process followed by the Chinese government.

The case study proves that the subsidy approach to be taken reaches objectives and goals that were set and indicates how the subsidy approach can be of benefit and serve as a solution for the current shortcomings and challenges imbedded in South Africa's ageing public transport system.

Firstly, the case study indicates that the subsidy amount will increase once the new system has been implemented. However, this subsidy is to be distributed between all public transport users (minibus taxi commuters included). Although the subsidy amount is larger, the equity problems of the previous subsidy system are to be vastly improved on.

Secondly, the congestion pricing to be charged to private transport users for the externality they impose on the economy and other citizens, when they cause serious congestion in metropolitan areas, is a sufficient approach. The approach taken in the study is a conservative approach, where the private transport commuter is only to be charged 50 percent of the total congestion cost inflicted. Furthermore, 10 percent of this congestion price charged is reallocated for public transport subsidies. Even with the conservative approach, a reduction in the projected government subsidy budget would be achieved. This saving in subsidy budget enables the government to provide better support for public transport commuters by upgrading and extending the public transport infrastructure or by increasing subsidy amounts allocated to operators and commuters.

10 COMBINED LIST OF CONCLUSION

The research study developed and conducted a system-based process to suitably evaluate the current public transport subsidy system and determine its effectiveness. One of the most important conclusions drawn from the study is that a subsidy system must be re-assessed and adjusted once the travel patterns (commuter needs), objectives and/or challenges have changed. This means that with regular intervals, as circumstances demand, the proposed system-based process of subsidy systems needs to be evaluated.

Commuter transport in South Africa is currently in a transition phase, with new public transport infrastructure being implemented in the metropolitan areas of our cities. The current transition towards a new public transport system at a time of economic recession (when people's demand is more elastic to prices) is well-suited for conducting the system-based process and determining the optimum subsidy approach.

The first step in the system-based process is to determine the scope of work and to establish the stakeholders. Once stakeholders have been identified, overall objectives should be determined.

The Department of Transport has recently amended some of these objectives to accommodate the newly-envisaged Bus Rapid Transport (BRT) system. BRT provides safe, more reliable and affordable public transport services. It will integrate various public transport modes into a system that will be operated efficiently and optimally providing transport services to the whole community. A BRT system, with dedicated bus lanes, will reduce travel times for commuters and convince private transport users that public transport offers a preferable option.

The second step is to determine the gaps between the objectives and the performance of the current system. In order to determine these gaps, the background and problems of the current system were investigated and the main shortcomings and challenges highlighted. The study has indicated that current South African urban public transport systems (UPTS) are neither reaching DOT objectives nor fulfilling commuter needs.

Four main interrelated UPTS shortcomings have been identified. However, Figure 1-4 (p. 18), indicates that lack of accessibility to affordable transport for the poor and increasing private transport ownership by the rich, which increases congestion, are the two major deficiencies.

The third step stated the action plan of policies, strategies and goals on how the objectives could be reached. The first three steps together form the essential base of the system-based process to determine an appropriate subsidy approach. These three steps also form the basic measurement criteria against which the different subsidy approaches are to be tested to.

The fourth step in the system-based process to a better subsidy approach is to evaluate different theoretical subsidy approaches. The review of different subsidy approaches has indicated that some approaches work better than others, but an optimal subsidy system is almost never found. It is essential to consider different subsidy approaches, or a combination of subsidy approaches, to obtain the most effective and beneficial result for the subsidation of the public transport system.

Step number five is evaluating the different subsidy approaches by considering their impact on the main shortcomings and challenges identified.

In this specific study the proposed subsidy approaches should have a direct positive influence on the two main shortcomings: lack of access to affordable transport and increasing car ownership and resultant congestion. The main challenge of achieving buy-in from all stakeholders and judging the relative merit of the intended different subsidy methods, compared to the current subsidies, are an essential part of the successful implementation of the BRT system.

The problem of lack of accessibility is being addressed by implementing the BRT system. Lack of affordability promises to be best relieved by a combination of capital supplier-side and corridor-focused, user-side subsidies, with additional consideration to distances travelled. These subsidy approaches address some of the equity and spatial problems experienced in South Africa and aim to improve fairness and encourage effective operations.

The income the government receives by charging private transport commuters for the costs they impose, can be reallocated to serve as subsidies and a source for public transport infrastructure funding. The main objective of congestion pricing is to charge private transport commuters for the cost that they impose on others.

Step number six is the performance measurement step. This step tests proposed subsidy approaches against the demographics and financial implications to determine if the overall objectives will be reached.

The supplier-side subsidy approach is proposed to be in the form of a capital subsidy that will have a positive effect on operators and commuters (offering a reduction in operating costs). Operators are given the incentive to provide good levels of service in order to attract commuters. The corridor-focused, user-side subsidy approach will further lower tariffs that are needed to be paid by commuters. This form of subsidy is to be aimed directly at each user of the public transport system.

If the combination of subsidy approaches is implemented, a positive financial saving of 22 percent has been reached, once a distance of 42.5 km has been travelled. The monthly saving on the commuter's income ranges between 10 and 16 percent. This indicates that the combination of the two different subsidy methods promote public transport use in the identified transport phase (transferring private transport commuters to public transport). The improvement of social and economic activity (such as accessibility to affordable transport, reduced travelling costs, access to job opportunities and equitable distribution of subsidies), a system that addresses the commuter's needs, the fairness of the system, operational levels of services and social upliftment are some of the objectives that will be reached.

One of the objectives for the stakeholders to observe is to reduce the attractiveness of private transport. Private transport commuters are not at present penalised for the congestion costs they incur to the detriment of society.

Step seven follows once promising results in steps five and six have been obtained. Part of step seven will be to test how the proposed subsidy approach will affect stakeholders and determine if buy-in from them will be achieved.

The study indicated that the motivation for the buy-in of the different stakeholders is as follows:

- Government will gain acceptance by and support from the public for introducing an affordable transport system, offering satisfactory service to all citizens. The implementation of congestion pricing holds a significant financial advantage for the government, as congestion pricing will probably cost less than it is spending on travel subsidies at this stage.
- The system provides a management tool for a sustainable public transport system. The subsidy approach, taken further, enhances management tools to uphold good levels of service, better financial allocation and upliftment of the public transport industry for establishing a sustainable public transport system
- Tax payers will be satisfied that they do not get taxed for services they do not use. A satisfactory plan to rectify the inequalities of the past will be in place.
- Commuters will have a wider choice of subsidised transport modes or mode combinations. Commuters receive a satisfactory transport service that is accessible, affordable, safe, scheduled and frequent.
- The private sector will be satisfied because they have a stake in the market. Operator will be amenable so as to obtain the capital compensation on offer.
- Private transport commuters will consider public transport as an attractive alternative if it proves to be affordable, safe, scheduled and frequent: especially for those who do not need their vehicle on hand during office hours.

- Private transport commuters, who opt to remain dependent on private transport, will have to face the consequences of congestion pricing. These commuters may be dissatisfied in the beginning, but, in due course, will weigh up their options: change to public transport, or pay corrective congestion pricing. The sweetener will be the advantage of travel in uncongested, free-flow corridor in peak periods. Commuters whose demand tend to be inelastic to price will still be able to pay for the comfort and benefits of private transport, if they so wish.
- The system-based process used will act as a tool for simple, cost-effective and formalised re-evaluation of the effectiveness of a subsidy approach taken.

The case study gives an overview of the system-based process. This empirical analysis indicated that, following these steps, a subsidy approach will be achieved that will satisfy the objectives and goals set by the stakeholders.

The case study indicates that the subsidy amount should increase once the new system has been implemented. Although the subsidy amount is larger, the equity problems of the previous subsidy system are improved on. Even with the conservative congestion-pricing approach, the government will save on the transport subsidy budget. This saving in subsidy budget enables the government to provide better support for public transport commuters by either upgrading and/or extending public transport infrastructure or by increasing subsidy amounts allocated to operators and commuters.

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ANNEXURE A

Table 1 illustrates all the costs considered in determining the operating cost of minibus taxis. Table 2 illustrates the results obtained from the model which indicates the operating cost of a minibus taxi per kilometres travelled. Table 3 illustrates all the costs considered in determining the operating cost of buses. Table 4 illustrates the results obtained from the model which indicates the operating cost of a bus per kilometres travelled.

Table 1: Operating Cost of Minibus Taxis

	MINI-BUS COST CALCULATION		
	B Group New		
VEHICLE	**Up to 16 Pass**		
New	**Minibus**		
	AANNAMES		
	Replacement cost (VAT excl)	(R)	280000
4x2	Finance cost	(%)	12.50%
Minibus	Depreciation	(Yrs)	5
	Residual value	(%)	25.00%
	Insurance (% of cost) OR	(%)	7.50%
	Insurance: Total (Rand/yr)		0
	Licence (1250-1500kg - Tarra)	(R)	456
	Number of tyres	(No)	4
	Price per tyre: New	(R)	600
	Price per tyre: Retread	(R)	0
	Number of tyres (front)	(No)	2
	Number of tyres (rear)	(No)	2
	Tyre life (front)	(Km)	50000
	Tyre life: Rear	(Km)	50000
	Tyre life: Retread: Front	(Km)	0
	Tyre life : Retread : Rear	(Km)	0
	Number of steering axles	(No)	1
	Number of other axles	(No)	1
	Number of retreads: Front	(No)	0
	Number of retreads: Rear	(No)	0
Trailer	Replacement cost (VAT excl)	(R)	0
(if applicable)	Finance cost	(%)	12.50%
	Depreciation	(Yrs)	10
	Residual value	(%)	0.00%
	Insurance (% of cost) OR	(%)	5.00%
	Insurance: Total (Rand/yr)		0
	Licence (kg - Tarra)	(R)	0
	TR 1: 0kg - Tarra	(R)	0
	TR 2: 0kg - Tarra	(R)	0
	Number of tyres	(No)	0
	Price per tyre: New	(R)	0
	Price per tyre: Retread	(R)	0
	Number of retreads	(No)	1
	Tyre life (New)	(Km)	0

	Number of axles	(No)	0
	Tyre life (Retread)	(Km)	1
Drivers	Number of	(No)	1
	Monthly salary of driver	(R)	5000
Assistents	Number of	(No)	0
	Monthly salary of assistant	(R)	0
		(R)	
Overhead cost	Per year OR	(R)	
	% of fixed cost	(%)	10.00%
Maintenance	% of Fixed cost	(%)	0.00%
	% of Running cost OR	(%)	0.00%
	Variable maintenance cost	(c/km)	32.60
Fuel	Usage (l/100km)	(l/100km)	10
	Cost per litre (Petrol)	(c)	750
Lubrication	% of fuel cost	(%)	2.50%
Other variable operating costs		(R)	0
Additional provision for tyres per year		(R)	0
Average distance per return trip		(km)	140
Average distance per single trip		(km)	70
Return trips per day		(No)	1
Working days per week		(No)	5
Return trips per week		(No)	5
Weeks per year		(No)	40
Return trips per year		(No)	200
Learners per trip (return)		(No)	16
Learners transported per year		(No)	3200
Yearly kilometres		(Km)	500000
Working days per year		(Dae)	200

COST CALCULATION: SUMMARY

-					
		(R/yr)	**(C/KM)**	**(%)**	**(%)**
Fixed Cost					
Cost of Capital		17500.00	3.5	11.21%	2.41%
Depreciation		41520.00	8.3	26.60%	5.71%
Insurance		21000.00	4.2	13.45%	2.89%
Vehicle personel		60000.00	12.0	38.44%	8.25%
License		456.00	0.1	0.29%	0.06%
Fixed maintenance		0.00	0.0	0.00%	0.00%
Overhead Cost		15608.44	3.1	10.00%	2.15%
Total Fixed Cost R/yr)		156084.44	31.2	100.0%	21.5%
Variable cost					
Fuel		375000.00	75.0	65.63%	51.55%
Lubrication		9375.00	1.9	1.64%	1.29%
Variable Maintenance		163000.00	32.6	28.53%	22.41%
Tyres		24000.00	4.80	4.20%	3.30%
Other		0.00	0.0	0.00%	0.00%

Total Variable Cost (c/km)	571375.00	114.3	100.0%	78.5%
TOTAL COST	727459.44	145.5		100%
Single trip distance	70			
Return trip distance	140			
FIXED COST PER DAY	780.42			
FIXED COST PER YEAR	156084.44			
TOTAL COST PER YEAR	727459.44			
RETURN TRIP LEARNERS P/YR	3200			
TOTAL COST: RETURN TRIP	**940.41**			
RATE RETURN TRIP	**1081.47**			

Table 2: Operating Cost of a Minibus-Taxi per Kilometre Travelled

							15% profit		15% profit						15% profit
Distance (km)				**Cost R per trip**	**Cost R per Lrn**		**Rate R per Lrn**	**Cost R per Lrn/km**	**Cost R per Lrn/km**		**Fixed Cost R per trip**	**Variable Cost R per trip**	**Total Cost R per trip**	**Total Cost R per km**	**Total Cost R per km**
	Avg Distance (km)	**Return distance**	**Trips per day**	**New**	**New**		**New**	**New**	**New**		**New**	**New**	**New**	**New**	**New**
0-10	7.5	15	1	797.56	49.85		57.32	3.323	3.822		780.42	17.14	797.56	53.17	61.15
11-20	15	30	1	814.70	50.92		58.56	1.697	1.952		780.42	34.28	814.70	27.16	31.23
21-30	25	50	1	837.56	52.35		60.20	1.047	1.204		780.42	57.14	837.56	16.75	19.26
31-40	35	70	1	860.41	53.78		61.84	0.768	0.883		780.42	79.99	860.41	12.29	14.14
41-50	45	90	1	883.27	55.20		63.49	0.613	0.705		780.42	102.85	883.27	9.81	11.29
51-60	55	110	1	906.12	56.63		65.13	0.515	0.592		780.42	125.70	906.12	8.24	9.47
61-70	65	130	1	928.98	58.06		66.77	0.447	0.514		780.42	148.56	928.98	7.15	8.22
71-80	75	150	1	951.83	59.49		68.41	0.397	0.456		780.42	171.41	951.83	6.35	7.30
81-90	85	170	1	974.69	60.92		70.06	0.358	0.412		780.42	194.27	974.69	5.73	6.59
91-100	95	190	1	997.54	62.35		71.70	0.328	0.377		780.42	217.12	997.54	5.25	6.04
101-110	105	210	1	1020.40	63.77		73.34	0.304	0.349		780.42	239.98	1020.40	4.86	5.59
111-120	115	230	1	1043.25	65.20		74.98	0.283	0.326		780.42	262.83	1043.25	4.54	5.22
121-130	125	250	1	1066.11	66.63		76.63	0.267	0.307		780.42	285.69	1066.11	4.26	4.90
131-140	135	270	1	1088.96	68.06		78.27	0.252	0.290		780.42	308.54	1088.96	4.03	4.64
141-150	145	290	1	1111.82	69.49		79.91	0.240	0.276		780.42	331.40	1111.82	3.83	4.41
151-160	155	310	1	1134.67	70.92		81.55	0.229	0.263		780.42	354.25	1134.67	3.66	4.21

Table 3: Operating Cost for Buses

	MINI-BUS COST CALCULATION		
	B Group New		
VEHICLE	**Up to 16 Pass**		
New	**Minibus**		
	AANNAMES		
	Replacement cost (VAT excl)	(R)	600000
4x2	Finance cost	(%)	12.50%
Minibus	Depreciation	(Yrs)	5
	Residual value	(%)	25.00%
	Insurance (% of cost) OR	(%)	7.50%
	Insurance: Total (Rand/yr)		0
	Licence (1250-1500kg -Tarra)	(R)	800
	Number of tyres	(No)	6
	Price per tyre: New	(R)	2400
	Price per tyre: Retread	(R)	0
	Number of tyres (front)	(No)	2
	Number of tyres (rear)	(No)	4
	Tyre life (front)	(Km)	50000
	Tyre life: Rear	(Km)	50000
	Tyre life: Retread: Front	(Km)	0
	Tyre life : Retread : Rear	(Km)	0
	Number of steering axles	(No)	1
	Number of other axles	(No)	1
	Number of retreads: Front	(No)	0
	Number of retreads: Rear	(No)	0
Trailer	Replacement cost (VAT excl)	(R)	0
(if applicable)	Finance cost	(%)	12.50%
	Depreciation	(Yrs)	10
	Residual value	(%)	0.00%
	Insurance (% of cost) OR	(%)	5.00%
	Insurance: Total (Rand/yr)		0
	Licence (kg - Tarra)	(R)	0
	TR 1: 0kg - Tarra	(R)	0
	TR 2: 0kg - Tarra	(R)	0
	Number of tyres	(No)	0
	Price per tyre: New	(R)	0
	Price per tyre: Retread	(R)	0
	Number of retreads	(No)	1
	Tyre life (New)	(Km)	0
	Number of axles	(No)	0
	Tyre life (Retread)	(Km)	1
Drivers	Number of	(No)	1
	Monthly salary of driver	(R)	5000
Assistents	Number of	(No)	0
	Monthly salary of assistant	(R)	0
		(R)	
Overhead cost	Per year OR	(R)	
	% of fixed cost	(%)	10.00%
Maintenance	% of Fixed cost	(%)	0.00%
	% of Running cost OR	(%)	0.00%
	Variable maintenance cost	(c/km)	32.60

Fuel	Usage (l/100km)	(l/100km)	10
	Cost per litre (Petrol)	(c)	750
Lubrication	% of fuel cost	(%)	2.50%
Other variable operating costs		(R)	0
Additional provision for tyres per year		(R)	0
Average distance per return trip		(km)	140
Average distance per single trip		(km)	70
Return trips per day		(No)	1
Working days per week		(No)	5
Return trips per week		(No)	5
Weeks per year		(No)	40
Return trips per year		(No)	200
Learners per trip (return)		(No)	65
Learners transported per year		(No)	13000
Yearly kilometres		(Km)	500000
Working days per year		(Dae)	200

COST CALCULATION: SUMMARY

	(R/yr)	(C/KM)	(%)	(%)
Fixed Cost				
Cost of Capital	37500.00	7.5	14.65%	3.96%
Depreciation	87120.00	17.4	34.03%	9.20%
Insurance	45000.00	9.0	17.58%	4.75%
Vehicle personel	60000.00	12.0	23.44%	6.33%
License	800.00	0.2	0.31%	0.08%
Fixed maintenance	0.00	0.0	0.00%	0.00%
Overhead Cost	25602.22	5.1	10.00%	2.70%
Total Fixed Cost R/yr)	256022.22	51.2	100.0%	27.0%
Variable cost				
Fuel	375000.00	75.0	54.24%	39.58%
Lubrication	9375.00	1.9	1.36%	0.99%
Variable Maintenance	163000.00	32.6	23.58%	17.21%
Tyres	144000.00	28.80	20.83%	15.20%
Other	0.00	0.0	0.00%	0.00%
Total Variable Cost (c/km)	691375.00	138.3	100.0%	73.0%
TOTAL COST	947397.22	189.5		100%

Single trip distance	70
Return trip distance	140
FIXED COST PER DAY	1280.11
FIXED COST PER YEAR	256022.22
TOTAL COST PER YEAR	947397.22
RETURN TRIP LEARNERS P/YR	13000
TOTAL COST: RETURN TRIP	**1473.70**
RATE RETURN TRIP	**1694.75**

Table 4: Operating Cost for a Bus per Kilometre Travelled

							15% profit		15% profit						15% profit
Distance (km)				**Cost R per trip**	**Cost R per Lrn**		**Rate R per Lrn**	**Cost R per Lrn/km**	**Cost R per Lrn/km**		**Fixed Cost R per trip**	**Variable Cost R per trip**	**Total Cost R per trip**	**Total Cost R per km**	**Total Cost R per km**
	Avg Distance (km)	**Return distance**	**Trips per day**	**New**	**New**		**New**	**New**	**New**		**New**	**New**	**New**	**New**	**New**
0-10	7.5	15	1	1300.85	81.30		93.50	5.420	6.233		1280.11	20.74	1300.85	86.72	99.73
11-20	15	30	1	1321.59	82.60		94.99	2.753	3.166		1280.11	41.48	1321.59	44.05	50.66
21-30	25	50	1	1349.25	84.33		96.98	1.687	1.940		1280.11	69.14	1349.25	26.98	31.03
31-40	35	70	1	1376.90	86.06		98.96	1.229	1.414		1280.11	96.79	1376.90	19.67	22.62
41-50	45	90	1	1404.56	87.78		100.95	0.975	1.122		1280.11	124.45	1404.56	15.61	17.95
51-60	55	110	1	1432.21	89.51		102.94	0.814	0.936		1280.11	152.10	1432.21	13.02	14.97
61-70	65	130	1	1459.87	91.24		104.93	0.702	0.807		1280.11	179.76	1459.87	11.23	12.91
71-80	75	150	1	1487.52	92.97		106.92	0.620	0.713		1280.11	207.41	1487.52	9.92	11.40
81-90	85	170	1	1515.18	94.70		108.90	0.557	0.641		1280.11	235.07	1515.18	8.91	10.25
91-100	95	190	1	1542.83	96.43		110.89	0.508	0.584		1280.11	262.72	1542.83	8.12	9.34
101-110	105	210	1	1570.49	98.16		112.88	0.467	0.538		1280.11	290.38	1570.49	7.48	8.60
111-120	115	230	1	1598.14	99.88		114.87	0.434	0.499		1280.11	318.03	1598.14	6.95	7.99
121-130	125	250	1	1625.80	101.61		116.85	0.406	0.467		1280.11	345.69	1625.80	6.50	7.48
131-140	135	270	1	1653.45	103.34		118.84	0.383	0.440		1280.11	373.34	1653.45	6.12	7.04
141-150	145	290	1	1681.11	105.07		120.83	0.362	0.417		1280.11	401.00	1681.11	5.80	6.67
151-160	155	310	1	1708.76	106.80		122.82	0.345	0.396		1280.11	428.65	1708.76	5.51	6.34

ANNEXURE B

Table 1 illustrates all the costs considered in determining the operating cost of minibus taxis if an R 50 000 capital subsidy is allocated. Table 2 illustrates the results obtained from the model which indicates the adjusted operating cost of a minibus taxi per kilometres travelled after the capital subsidy has been allocated. Table 3 illustrates all the costs considered in determining the operating cost of buses if an R 100 000 capital subsidy is allocated. Table 4 illustrates the results obtained from the model which indicates the operating cost of a bus per kilometres travelled after the capital subsidy has been allocated.

Table 1: Operating Cost of Minibus Taxis with Capital Subsidy

	MINI-BUS COST CALCULATION		
	B Group New		
VEHICLE	**Up to 16 Pass**		
New	**Minibus**		
	AANNAMES		
	Replacement cost (VAT excl)	(R)	230000
4x2	Finance cost	(%)	12.50%
Minibus	Depreciation	(Yrs)	5
	Residual value	(%)	25.00%
	Insurance (% of cost) OR	(%)	7.50%
	Insurance: Total (Rand/yr)		0
	Licence (1250-1500kg -Tarra)	(R)	456
	Number of tyres	(No)	4
	Price per tyre: New	(R)	600
	Price per tyre: Retread	(R)	0
	Number of tyres (front)	(No)	2
	Number of tyres (rear)	(No)	2
	Tyre life (front)	(Km)	50000
	Tyre life: Rear	(Km)	50000
	Tyre life: Retread: Front	(Km)	0
	Tyre life : Retread : Rear	(Km)	0
	Number of steering axles	(No)	1
	Number of other axles	(No)	1
	Number of retreads: Front	(No)	0
	Number of retreads: Rear	(No)	0
Trailer	Replacement cost (VAT excl)	(R)	0
(if applicable)	Finance cost	(%)	12.50%
	Depreciation	(Yrs)	10
	Residual value	(%)	0.00%
	Insurance (% of cost) OR	(%)	5.00%
	Insurance: Total (Rand/yr)		0
	Licence (kg - Tarra)	(R)	0
	TR 1: 0kg - Tarra	(R)	0
	TR 2: 0kg - Tarra	(R)	0
	Number of tyres	(No)	0
	Price per tyre: New	(R)	0
	Price per tyre: Retread	(R)	0
	Number of retreads	(No)	1

	Tyre life (New)	(Km)	0
	Number of axles	(No)	0
	Tyre life (Retread)	(Km)	1
Drivers	Number of	(No)	1
	Monthly salary of driver	(R)	5000
Assistents	Number of	(No)	0
	Monthly salary of assistant	(R)	0
		(R)	
Overhead cost	Per year OR	(R)	
	% of fixed cost	(%)	10.00%
Maintenance	% of Fixed cost	(%)	0.00%
	% of Running cost OR	(%)	0.00%
	Variable maintenance cost	(c/km)	32.60
Fuel	Usage (l/100km)	(l/100km)	10
	Cost per litre (Petrol)	(c)	750
Lubrication	% of fuel cost	(%)	2.50%
Other variable operating costs		(R)	0
Additional provision for tyres per year		(R)	0
Average distance per return trip		(km)	140
Average distance per single trip		(km)	70
Return trips per day		(No)	1
Working days per week		(No)	5
Return trips per week		(No)	5
Weeks per year		(No)	40
Return trips per year		(No)	200
Learners per trip (return)		(No)	16
Learners transported per year		(No)	3200
Yearly kilometres		(Km)	500000
Working days per year		(Dae)	200

COST CALCULATION: SUMMARY

-					
		(R/yr)	(C/KM)	(%)	(%)
Fixed Cost					
Cost of Capital		14375.00	2.9	10.26%	2.02%
Depreciation		34020.00	6.8	24.28%	4.78%
Insurance		17250.00	3.5	12.31%	2.42%
Vehicle personel		60000.00	12.0	42.82%	8.43%
License		456.00	0.1	0.33%	0.06%
Fixed maintenance		0.00	0.0	0.00%	0.00%
Overhead Cost		14011.22	2.8	10.00%	1.97%
Total Fixed Cost R/yr)		140112.22	28.0	100.0%	19.7%
Variable cost					
Fuel		375000.00	75.0	65.63%	52.71%
Lubrication		9375.00	1.9	1.64%	1.32%
Variable Maintenance		163000.00	32.6	28.53%	22.91%
Tyres		24000.00	4.80	4.20%	3.37%

Other		0.00	0.0	0.00%	0.00%
Total Variable Cost (c/km)		571375.00	114.3	100.0%	80.3%
TOTAL COST		711487.22	142.3		100%
Single trip distance		70			
Return trip distance		140			
FIXED COST PER DAY		700.56			
FIXED COST PER YEAR		140112.22			
TOTAL COST PER YEAR		711487.22			
RETURN TRIP LEARNERS P/YR		3200			
TOTAL COST: RETURN TRIP		**860.55**			
RATE RETURN TRIP		**989.63**			

Table 2: Operating Cost of a Minibus-Taxi per Kilometre Travelled with Capital Subsidy

							15% profit		15% profit						15% profit
Distance (km)				**Cost R per trip**	**Cost R per Lrn**		**Rate R per Lrn**	**Cost R per Lrn/km**	**Cost R per Lrn/km**		**Fixed Cost R per trip**	**Variabl e Cost R per trip**	**Total Cost R per trip**	**Total Cost R per km**	**Total Cost R per km**
	Avg Distance (km)	**Return distance**	**Trips per day**	**New**	**New**		**New**	**New**	**New**		**New**	**New**	**New**	**New**	**New**
0-10	7.5	15	1	717.70	44.86		51.58	2.990	3.439		700.56	17.14	717.70	47.85	55.02
11-20	15	30	1	734.84	45.93		52.82	1.531	1.761		700.56	34.28	734.84	24.49	28.17
21-30	25	50	1	757.70	47.36		54.46	0.947	1.089		700.56	57.14	757.70	15.15	17.43
31-40	35	70	1	780.55	48.78		56.10	0.697	0.801		700.56	79.99	780.55	11.15	12.82
41-50	45	90	1	803.41	50.21		57.74	0.558	0.642		700.56	102.85	803.41	8.93	10.27
51-60	55	110	1	826.26	51.64		59.39	0.469	0.540		700.56	125.70	826.26	7.51	8.64
61-70	65	130	1	849.12	53.07		61.03	0.408	0.469		700.56	148.56	849.12	6.53	7.51
71-80	75	150	1	871.97	54.50		62.67	0.363	0.418		700.56	171.41	871.97	5.81	6.69
81-90	85	170	1	894.83	55.93		64.32	0.329	0.378		700.56	194.27	894.83	5.26	6.05
91-100	95	190	1	917.68	57.36		65.96	0.302	0.347		700.56	217.12	917.68	4.83	5.55
101-110	105	210	1	940.54	58.78		67.60	0.280	0.322		700.56	239.98	940.54	4.48	5.15
111-120	115	230	1	963.39	60.21		69.24	0.262	0.301		700.56	262.83	963.39	4.19	4.82
121-130	125	250	1	986.25	61.64		70.89	0.247	0.284		700.56	285.69	986.25	3.94	4.54
131-140	135	270	1	1009.10	63.07		72.53	0.234	0.269		700.56	308.54	1009.10	3.74	4.30
141-150	145	290	1	1031.96	64.50		74.17	0.222	0.256		700.56	331.40	1031.96	3.56	4.09
151-160	155	310	1	1054.81	65.93		75.81	0.213	0.245		700.56	354.25	1054.81	3.40	3.91

Table 3: Operating Cost for Buses with Capital Subsidy

	MINI-BUS COST CALCULATION		
	B Group New		
VEHICLE	**Up to 16 Pass**		
New	**Minibus**		
	AANNAMES		
	Replacement cost (VAT excl)	(R)	500000
4x2	Finance cost	(%)	12.50%
Minibus	Depreciation	(Yrs)	5
	Residual value	(%)	25.00%
	Insurance (% of cost) OR	(%)	7.50%
	Insurance: Total (Rand/yr)		0
	Licence (1250-1500kg -Tarra)	(R)	800
	Number of tyres	(No)	6
	Price per tyre: New	(R)	2400
	Price per tyre: Retread	(R)	0
	Number of tyres (front)	(No)	2
	Number of tyres (rear)	(No)	4
	Tyre life (front)	(Km)	50000
	Tyre life: Rear	(Km)	50000
	Tyre life: Retread: Front	(Km)	0
	Tyre life : Retread : Rear	(Km)	0
	Number of steering axles	(No)	1
	Number of other axles	(No)	1
	Number of retreads: Front	(No)	0
	Number of retreads: Rear	(No)	0
Trailer	Replacement cost (VAT excl)	(R)	0
(if applicable)	Finance cost	(%)	12.50%
	Depreciation	(Yrs)	10
	Residual value	(%)	0.00%
	Insurance (% of cost) OR	(%)	5.00%
	Insurance: Total (Rand/yr)		0
	Licence (kg - Tarra)	(R)	0
	TR 1: 0kg - Tarra	(R)	0
	TR 2: 0kg - Tarra	(R)	0
	Number of tyres	(No)	0
	Price per tyre: New	(R)	0
	Price per tyre: Retread	(R)	0
	Number of retreads	(No)	1
	Tyre life (New)	(Km)	0
	Number of axles	(No)	0
	Tyre life (Retread)	(Km)	1
Drivers	Number of	(No)	1
	Monthly salary of driver	(R)	5000
Assistents	Number of	(No)	0
	Monthly salary of assistant	(R)	0
		(R)	
Overhead cost	Per year OR	(R)	
	% of fixed cost	(%)	10.00%
Maintenance	% of Fixed cost	(%)	0.00%
	% of Running cost OR	(%)	0.00%
	Variable maintenance cost	(c/km)	32.60

Fuel	Usage (l/100km)	(l/100km)	10
	Cost per litre (Petrol)	(c)	750
Lubrication	% of fuel cost	(%)	2.50%
Other variable operating costs		(R)	0
Additional provision for tyres per year		(R)	0
Average distance per return trip		(km)	140
Average distance per single trip		(km)	70
Return trips per day		(No)	1
Working days per week		(No)	5
Return trips per week		(No)	5
Weeks per year		(No)	40
Return trips per year		(No)	200
Learners per trip (return)		(No)	65
Learners transported per year		(No)	13000
Yearly kilometres		(Km)	500000
Working days per year		(Dae)	200

COST CALCULATION: SUMMARY

	(R/yr)	(C/KM)	(%)	(%)
Fixed Cost				
Cost of Capital	31250.00	6.3	13.95%	3.41%
Depreciation	72120.00	14.4	32.19%	7.88%
Insurance	37500.00	7.5	16.74%	4.10%
Vehicle personel	60000.00	12.0	26.78%	6.55%
License	800.00	0.2	0.36%	0.09%
Fixed maintenance	0.00	0.0	0.00%	0.00%
Overhead Cost	22407.78	4.5	10.00%	2.45%
Total Fixed Cost R/yr)	224077.78	44.8	100.0%	24.5%
Variable cost				
Fuel	375000.00	75.0	54.24%	40.96%
Lubrication	9375.00	1.9	1.36%	1.02%
Variable Maintenance	163000.00	32.6	23.58%	17.81%
Tyres	144000.00	28.80	20.83%	15.73%
Other	0.00	0.0	0.00%	0.00%
Total Variable Cost (c/km)	691375.00	138.3	100.0%	75.5%
TOTAL COST	915452.78	183.1		100%

Single trip distance	70
Return trip distance	140
FIXED COST PER DAY	1120.39
FIXED COST PER YEAR	224077.78
TOTAL COST PER YEAR	915452.78
RETURN TRIP LEARNERS P/YR	13000
TOTAL COST: RETURN TRIP	**1313.97**
RATE RETURN TRIP	**1511.07**

Table 4: Operating Cost for a Bus per Kilometre Travelled with Capital Subsidy

							15% profit		15% profit						15% profit
Distance (km)				**Cost R per trip**	**Cost R per Lrn**		**Rate R per Lrn**	**Cost R per Lrn/km**	**Cost R per Lrn/km**		**Fixed Cost R per trip**	**Variable Cost R per trip**	**Total Cost R per trip**	**Total Cost R per km**	**Total Cost R per km**
	Avg Distance (km)	**Return distance**	**Trips per day**	**New**	**New**		**New**	**New**	**New**		**New**	**New**	**New**	**New**	**New**
0-10	7.5	15	1	1141.13	71.32		82.02	4.755	5.468		1120.39	20.74	1141.13	76.08	87.49
11-20	15	30	1	1161.87	72.62		83.51	2.421	2.784		1120.39	41.48	1161.87	38.73	44.54
21-30	25	50	1	1189.53	74.35		85.50	1.487	1.710		1120.39	69.14	1189.53	23.79	27.36
31-40	35	70	1	1217.18	76.07		87.48	1.087	1.250		1120.39	96.79	1217.18	17.39	20.00
41-50	45	90	1	1244.84	77.80		89.47	0.864	0.994		1120.39	124.45	1244.84	13.83	15.91
51-60	55	110	1	1272.49	79.53		91.46	0.723	0.831		1120.39	152.10	1272.49	11.57	13.30
61-70	65	130	1	1300.15	81.26		93.45	0.625	0.719		1120.39	179.76	1300.15	10.00	11.50
71-80	75	150	1	1327.80	82.99		95.44	0.553	0.636		1120.39	207.41	1327.80	8.85	10.18
81-90	85	170	1	1355.46	84.72		97.42	0.498	0.573		1120.39	235.07	1355.46	7.97	9.17
91-100	95	190	1	1383.11	86.44		99.41	0.455	0.523		1120.39	262.72	1383.11	7.28	8.37
101-110	105	210	1	1410.77	88.17		101.40	0.420	0.483		1120.39	290.38	1410.77	6.72	7.73
111-120	115	230	1	1438.42	89.90		103.39	0.391	0.450		1120.39	318.03	1438.42	6.25	7.19
121-130	125	250	1	1466.08	91.63		105.37	0.367	0.421		1120.39	345.69	1466.08	5.86	6.74
131-140	135	270	1	1493.73	93.36		107.36	0.346	0.398		1120.39	373.34	1493.73	5.53	6.36
141-150	145	290	1	1521.39	95.09		109.35	0.328	0.377		1120.39	401.00	1521.39	5.25	6.03
151-160	155	310	1	1549.04	96.82		111.34	0.312	0.359		1120.39	428.65	1549.04	5.00	5.75

ANNEXURE C

Tables 1 – 7 (developed by the author in 2008) illustrates the results that were obtained from the model used to determine operating, time and accident cost.

Table 1: Operating, Time, and Accident Cost at 80km/h

Bereken - Gebruikerskoste							
Projekbeskrywing							
Pryse van:		***Feb-09***					
Alternatief:	**0**						
Tydperiode:		**Voertuig loopkoste (R per voertuig km)**					
Voertuigtipe	**Reisspoed**	**Brandstof**	**Olie**	**Bande**	**Waarde-vermindering**	**Instand-houding**	**Totaal**
MOTOR	80	0.41	0.00651	0.076912	0.990123498	0.527203	**2.01**
LDV	60	0.50	0.00775	0.138338	1.72204112	1.275543	**3.65**
LGV	60	1.03	0.00549	0.309477	1.345934563	1.150926	**3.84**
HGV	60	2.29	0.04034	1.859394	1.62289063	1.889041	**7.70**
BUS	60	1.29	0.02942	1.859394	1.485595989	0.973235	**5.64**

Tydkoste (R per persoon uur)		
Tydkategorie	**Tydsplit**	**Tydwaarde**
Werkers	80%	80.00
Nie-Werkers	10%	4.50
Leidige ure	10%	4.50
Totaal	**100%**	**89.00**

TOTALE GEBRUIKERSKOSTE		
		per km
Totale voertuigloopkoste	12015	2.01
Totale ongelukskoste	3325	0.221667
Totale tydkoste	6658	0.443888
TOTAAL	**21998**	2.673069

Table 2: Operating, Time, and Accident Cost at 70km/h

Bereken - Gebruikerskoste							
Projekbeskrywing							
Pryse van:		***Feb-09***					
Alternatief:	**0**						
Tydperiode:		**Voertuig loopkoste (R per voertuig km)**					
Voertuigtipe	**Reisspoed**	**Brandstof**	**Olie**	**Bande**	**Waarde-vermindering**	**Instand-houding**	**Totaal**
MOTOR	70	0.38	0.00632	0.082851	1.043042198	0.518703	**2.03**
LDV	60	0.50	0.00775	0.138338	1.72204112	1.275543	**3.65**
LGV	60	1.03	0.00549	0.309477	1.345934563	1.150926	**3.84**
HGV	60	2.29	0.04034	1.859394	1.62289063	1.889041	**7.70**
BUS	60	1.29	0.02942	1.859394	1.485595989	0.973235	**5.64**
Tydkoste (R per persoon uur)							
Tydkategorie	**Tydsplit**	**Tydwaarde**					

Werkers	80%	80.00					
Nie-Werkers	10%	4.50					
Leidige ure	10%	4.50					
Totaal	**100%**	**89.00**					

TOTALE GEBRUIKERSKOSTE				
				per km
Totale voertuigloopkoste			12149	2.03
Totale ongelukskoste			3325	0.221667
Totale tydkoste			7610	0.5073
TOTAAL			**23084**	2.758891

Table 3: Operating, Time, and Accident Cost at 60km/h

Bereken - Gebruikerskoste							
Projekbeskrywing							
Pryse van:		***Feb-09***					
Alternatief:	**0**						
Tydperiode:		**Voertuig loopkoste (R per voertuig km)**					
Voertuigtipe	**Reisspoed**	**Brandstof**	**Olie**	**Bande**	**Waarde-vermindering**	**Instand-houding**	**Totaal**
MOTOR	60	0.38	0.00632	0.087939	1.108424748	0.518442	**2.10**
LDV	60	0.50	0.00775	0.138338	1.72204112	1.275543	**3.65**
LGV	60	1.03	0.00549	0.309477	1.345934563	1.150926	**3.84**
HGV	60	2.29	0.04034	1.859394	1.62289063	1.889041	**7.70**
BUS	60	1.29	0.02942	1.859394	1.485595989	0.973235	**5.64**
Tydkoste (R per persoon uur)							
Tydkategorie	**Tydsplit**	**Tydwaarde**					
Werkers	80%	80.00					
Nie-Werkers	10%	4.50					
Leidige ure	10%	4.50					
Totaal	**100%**	**89.00**					

TOTALE GEBRUIKERSKOSTE				
				per km
Totale voertuigloopkoste			12570	2.10
Totale ongelukskoste			3325	0.221667
Totale tydkoste			8878	0.59185
TOTAAL			**24773**	2.913802

Table 4: Operating, Time, and Accident Cost at 50km/h

Bereken - Gebruikerskoste							
Projekbeskrywing							
Pryse van:		***Feb-09***					
Alternatief:	**0**						
Tydperiode:		**Voertuig loopkoste (R per voertuig km)**					
Voertuigtipe	**Reisspoed**	**Brandstof**	**Olie**	**Bande**	**Waarde-vermindering**	**Instand-houding**	**Totaal**
MOTOR	50	0.42	0.00650	0.091394	1.192407126	0.549785	**2.26**
LDV	60	0.50	0.00775	0.138338	1.72204112	1.275543	**3.65**
LGV	60	1.03	0.00549	0.309477	1.345934563	1.150926	**3.84**
HGV	60	2.29	0.04034	1.859394	1.62289063	1.889041	**7.70**
BUS	60	1.29	0.02942	1.859394	1.485595989	0.973235	**5.64**
Tydkoste (R per persoon uur)							

Tydkategorie	Tydsplit	Tydwaarde					
Werkers	80%	80.00					
Nie-Werkers	10%	4.50					
Leidige ure	10%	4.50					
Totaal	**100%**	**89.00**					

TOTALE GEBRUIKERSKOSTE		
		per km
Totale voertuigloopkoste	13541	2.26
Totale ongelukskoste	3325	0.221667
Totale tydkoste	10653	0.71022
TOTAAL	**27520**	3.194411

Table 5: Operating, Time, and Accident Cost at 40km/h

Bereken - Gebruikerskoste							
Projekbeskrywing							
Pryse van:		***Feb-09***					
Alternatief:	**0**						
Tydperiode:		**Voertuig loopkoste (R per voertuig km)**					
Voertuigtipe	**Reisspoed**	**Brandstof**	**Olie**	**Bande**	**Waarde-vermindering**	**Instand-houding**	**Totaal**
MOTOR	40	0.49	0.00677	0.092433	1.30649104	0.603804	**2.50**
LDV	60	0.50	0.00775	0.138338	1.72204112	1.275543	**3.65**
LGV	60	1.03	0.00549	0.309477	1.345934563	1.150926	**3.84**
HGV	60	2.29	0.04034	1.859394	1.62289063	1.889041	**7.70**
BUS	60	1.29	0.02942	1.859394	1.485595989	0.973235	**5.64**
Tydkoste (R per persoon uur)							
Tydkategorie	**Tydsplit**	**Tydwaarde**					
Werkers	80%	80.00					
Nie-Werkers	10%	4.50					
Leidige ure	10%	4.50					
Totaal	**100%**	**89.00**					

TOTALE GEBRUIKERSKOSTE		
		per km
Totale voertuigloopkoste	14944	2.50
Totale ongelukskoste	3325	0.221667
Totale tydkoste	13317	0.887775
TOTAAL	**31585**	3.606294

Table 6: Operating, Time, and Accident Cost at 30km/h

Bereken - Gebruikerskoste							
Projekbeskrywing							
Pryse van:		***Feb-09***					
Alternatief:	**0**						
Tydperiode:		**Voertuig loopkoste (R per voertuig km)**					
Voertuigtipe	**Reisspoed**	**Brandstof**	**Olie**	**Bande**	**Waarde-vermindering**	**Instand-houding**	**Totaal**
MOTOR	30	0.60	0.00721	0.090274	1.475660684	0.693835	**2.86**
LDV	60	0.50	0.00775	0.138338	1.72204112	1.275543	**3.65**
LGV	60	1.03	0.00549	0.309477	1.345934563	1.150926	**3.84**
HGV	60	2.29	0.04034	1.859394	1.62289063	1.889041	**7.70**
BUS	60	1.29	0.02942	1.859394	1.485595989	0.973235	**5.64**

Tydkoste (R per persoon uur)							
Tydkategorie	Tydsplit	Tydwaarde					
Werkers	80%	80.00					
Nie-Werkers	10%	4.50					
Leidige ure	10%	4.50					
Totaal	**100%**	**89.00**					

TOTALE GEBRUIKERSKOSTE				
				per km
Totale voertuigloopkoste			17132	2.86
Totale ongelukskoste			3325	0.221667
Totale tydkoste			17756	1.1837
TOTAAL			**38213**	4.267905

Table 7: Operating, Time, and Accident Cost at 20km/h

Bereken - Gebruikerskoste							
Projekbeskrywing							
Pryse van:		***Feb-08***					
Alternatief:	**0**						
Tydperiode:		Voertuig loopkoste (R per voertuig km)					
Voertuigtipe	**Reisspoed**	**Brandstof**	**Olie**	**Bande**	**Waarde-vermindering**	**Instand-houding**	**Totaal**
MOTOR	20	0.81	0.00809	0.084134	1.769259695	0.873898	**3.55**
LDV	60	0.50	0.00775	0.138338	1.72204112	1.275543	**3.65**
LGV	60	1.03	0.00549	0.309477	1.345934563	1.150926	**3.84**
HGV	60	2.29	0.04034	1.859394	1.62289063	1.889041	**7.70**
BUS	60	1.29	0.02942	1.859394	1.485595989	0.973235	**5.64**
Tydkoste (R per persoon uur)							
Tydkategorie	**Tydsplit**	**Tydwaarde**					
Werkers	80%	80.00					
Nie-Werkers	10%	4.50					
Leidige ure	10%	4.50					
Totaal	**100%**	**89.00**					

TOTALE GEBRUIKERSKOSTE				
				per km
Totale voertuigloopkoste			21231	3.55
Totale ongelukskoste			3325	0.221667
Totale tydkoste			26633	1.77555
TOTAAL			**51189**	5.544565

Table 8 illustrates the operating cost of private vehicles. Table 9 illustrates the operating cost of a private vehicle per distance travelled. In both of the above tables, the speed at which the vehicle is travelling is equal to 20 km/h (speed of travelling when congestion is present).

Table 8: Operating Cost of a Private Vehicle

	MINI-BUS COST CALCULATION		
	B Group New		
VEHICLE	**Up to 16 Pass**		
New	**Minibus**		
	AANNAMES		
	Replacement cost (VAT excl)	(R)	188500
4x2	Finance cost	(%)	12.50%
Minibus	Depreciation	(Yrs)	5
	Residual value	(%)	25.00%
	Insurance (% of cost) OR	(%)	7.50%
	Insurance: Total (Rand/yr)		0
	Licence (1250-1500kg -Tarra)	(R)	456
	Number of tyres	(No)	4
	Price per tyre: New	(R)	600
	Price per tyre: Retread	(R)	0
	Number of tyres (front)	(No)	2
	Number of tyres (rear)	(No)	2
	Tyre life (front)	(Km)	30000
	Tyre life: Rear	(Km)	30000
	Tyre life: Retread: Front	(Km)	0
	Tyre life : Retread : Rear	(Km)	0
	Number of steering axles	(No)	1
	Number of other axles	(No)	1
	Number of retreads: Front	(No)	0
	Number of retreads: Rear	(No)	0
Trailer	Replacement cost (VAT excl)	(R)	0
(if applicable)	Finance cost	(%)	12.50%
	Depreciation	(Yrs)	10
	Residual value	(%)	0.00%
	Insurance (% of cost) OR	(%)	5.00%
	Insurance: Total (Rand/yr)		0
	Licence (kg - Tarra)	(R)	0
	TR 1: 0kg - Tarra	(R)	0
	TR 2: 0kg - Tarra	(R)	0
	Number of tyres	(No)	0
	Price per tyre: New	(R)	0
	Price per tyre: Retread	(R)	0
	Number of retreads	(No)	1
	Tyre life (New)	(Km)	0
	Number of axles	(No)	0
	Tyre life (Retread)	(Km)	1
Drivers	Number of	(No)	1
	Monthly salary of driver	(R)	0
Assistents	Number of	(No)	0
	Monthly salary of assistant	(R)	0
		(R)	
Overhead cost	Per year OR	(R)	
	% of fixed cost	(%)	10.00%
Maintenance	% of Fixed cost	(%)	0.00%
	% of Running cost OR	(%)	0.00%
	Variable maintenance cost	(c/km)	32.60

Fuel	Usage (l/100km)	(l/100km)	10
	Cost per litre (Petrol)	(c)	720
Lubrication	% of fuel cost	(%)	2.50%
Other variable operating costs		(R)	0
Additional provision for tyres per year		(R)	0
Average distance per return trip		(km)	140
Average distance per single trip		(km)	70
Return trips per day		(No)	1
Working days per week		(No)	5
Return trips per week		(No)	5
Weeks per year		(No)	40
Return trips per year		(No)	200
Learners per trip (return)		(No)	16
Learners transported per year		(No)	3200
Yearly kilometres		(Km)	25000
Working days per year		(Dae)	200

COST CALCULATION: SUMMARY					
-					
		(R/yr)	**(C/KM)**	**(%)**	**(%)**
Fixed Cost					
Cost of Capital		11781.25	47.1	19.57%	13.27%
Depreciation		27795.00	111.2	46.18%	31.30%
Insurance		14137.50	56.6	23.49%	15.92%
Vehicle personel		0.00	0.0	0.00%	0.00%
License		456.00	1.8	0.76%	0.51%
Fixed maintenance		0.00	0.0	0.00%	0.00%
Overhead Cost		6018.86	24.1	10.00%	6.78%
Total Fixed Cost R/yr)		60188.61	240.8	100.0%	67.8%
Variable cost					
Fuel		18000.00	72.0	62.94%	20.27%
Lubrication		450.00	1.8	1.57%	0.51%
Variable Maintenance		8150.00	32.6	28.50%	9.18%
Tyres		2000.00	8.00	6.99%	2.25%
Other		0.00	0.0	0.00%	0.00%
Total Variable Cost (c/km)		28600.00	114.4	100.0%	32.2%
TOTAL COST		88788.61	355.2		100%
Single trip distance		70			
Return trip distance		140			
FIXED COST PER DAY		300.94			
FIXED COST PER YEAR		60188.61			
TOTAL COST PER YEAR		88788.61			
RETURN TRIP LEARNERS P/YR		3200			
TOTAL COST: RETURN TRIP		**461.10**			
RATE RETURN TRIP		**530.27**			

Table 9: Operating Cost of a Private Vehicle for a Specific Distance Travelled

						15% profit		15% profit					15% profit				
Distance (km)				**Cost R per trip**	**Cost R per Lrn**	**Rate R per Lrn**	**Cost R per Lrn/km**	**Cost R per Lrn/km**	**Fixed Cost R per trip**	**Variable Cost R per trip**	**Total Cost R per trip**	**Total Cost R per km**	**Total Cost R per km**				
	Avg Distance (km)	**Return distance**	**Trips per day**	**New**	**New**	**New**	**New**	**New**	**New**	**New**	**New**	**New**	**New**				
														A	B	C	D
0-10	7.5	15	1	318.10	19.88	22.86	1.325	1.524	300.94	17.16	318.10	21.21	24.39	0.564945	11.98072	5.99036	33.19
11-20	15	30	1	335.26	20.95	24.10	0.698	0.803	300.94	34.32	335.26	11.18	12.85	0.564945	6.313509	3.156754	17.49
21-30	25	50	1	358.14	22.38	25.74	0.448	0.515	300.94	57.20	358.14	7.16	8.24	0.564945	4.046624	2.023312	11.21
31-40	35	70	1	381.02	23.81	27.39	0.340	0.391	300.94	80.08	381.02	5.44	6.26	0.564945	3.075102	1.537551	8.52
41-50	45	90	1	403.90	25.24	29.03	0.280	0.323	300.94	102.96	403.90	4.49	5.16	0.564945	2.535368	1.267684	7.02
51-60	55	110	1	426.78	26.67	30.68	0.242	0.279	300.94	125.84	426.78	3.88	4.46	0.564945			
61-70	65	130	1	449.66	28.10	32.32	0.216	0.249	300.94	148.72	449.66	3.46	3.98				
71-80	75	150	1	472.54	29.53	33.96	0.197	0.226	300.94	171.60	472.54	3.15	3.62				
81-90	85	170	1	495.42	30.96	35.61	0.182	0.209	300.94	194.48	495.42	2.91	3.35				
91-100	95	190	1	518.30	32.39	37.25	0.170	0.196	300.94	217.36	518.30	2.73	3.14				
101-110	105	210	1	541.18	33.82	38.90	0.161	0.185	300.94	240.24	541.18	2.58	2.96				
111-120	115	230	1	564.06	35.25	40.54	0.153	0.176	300.94	263.12	564.06	2.45	2.82				
121-130	125	250	1	586.94	36.68	42.19	0.147	0.169	300.94	286.00	586.94	2.35	2.70				
131-140	135	270	1	609.82	38.11	43.83	0.141	0.162	300.94	308.88	609.82	2.26	2.60				
141-150	145	290	1	632.70	39.54	45.48	0.136	0.157	300.94	331.76	632.70	2.18	2.51				

ANNEXURE D

Tables 1 (developed by the author in 2008) illustrates the results that were obtained from the model used to determine operating, time and accident cost.

Table 1: Operating, Time, and Accident Cost at 50km/h

Bereken - Gebruikerskoste							
Projekbeskrywing							
Pryse van:		***Feb-09***					
Alternatief:	**0**						
Tydperiode:		**Voertuig loopkoste (R per voertuig km)**					
Voertuigtipe	**Reisspoed**	**Brandstof**	**Olie**	**Bande**	**Waarde-vermindering**	**Instand-houding**	**Totaal**
MOTOR	50	0.42	0.00650	0.091394	1.192407126	0.549785	**2.26**
LDV	60	0.50	0.00775	0.138338	1.72204112	1.275543	**3.65**
LGV	60	1.03	0.00549	0.309477	1.345934563	1.150926	**3.84**
HGV	60	2.29	0.04034	1.859394	1.62289063	1.889041	**7.70**
BUS	60	1.29	0.02942	1.859394	1.485595989	0.973235	**5.64**
Tydkoste (R per persoon uur)							
Tydkategorie	**Tydsplit**	**Tydwaarde**					
Werkers	80%	80.00					
Nie-Werkers	10%	4.50					
Leidige ure	10%	4.50					
Totaal	**100%**	**89.00**					

TOTALE GEBRUIKERSKOSTE		
		per km
Totale voertuigloopkoste	13541	2.26
Totale ongelukskoste	3325	0.221667
Totale tydkoste	10653	0.71022
TOTAAL	**27520**	3.194411

Table 2 illustrates the operating cost of private vehicles (model developed by Mr. Janse van Rensburg and Dr. Krygsman). Table 3 illustrates the operating cost of a private vehicle per distance travelled. In both of the above tables, the speed at which the vehicle is travelling is equal to 50 km/h (speed of travelling when congestion is present).

Table 2: Operating Cost of a Private Vehicle

COST CALCULATION: SUMMARY				
-				
	(R/yr)	**(C/KM)**	**(%)**	**(%)**
Fixed Cost				
Cost of Capital	5500.00	22.0	19.58%	9.70%
Depreciation	12720.00	50.9	45.29%	22.44%
Insurance	6600.00	26.4	23.50%	11.64%

Vehicle personel	0.00	0.0	0.00%	0.00%
License	456.00	1.8	1.62%	0.80%
Fixed maintenance	0.00	0.0	0.00%	0.00%
Overhead Cost	2808.44	11.2	10.00%	4.95%
Total Fixed Cost R/yr)	28084.44	112.3	100.0%	49.5%
Variable cost				
Fuel	18000.00	72.0	62.94%	31.75%
Lubrication	450.00	1.8	1.57%	0.79%
Variable Maintenance	8150.00	32.6	28.50%	14.38%
Tyres	2000.00	8.00	6.99%	3.53%
Other	0.00	0.0	0.00%	0.00%
Total Variable Cost (c/km)	28600.00	114.4	100.0%	50.5%
TOTAL COST	56684.44	226.7		100%
Single trip distance	70			
Return trip distance	140			
FIXED COST PER DAY	140.42			
FIXED COST PER YEAR	28084.44			
TOTAL COST PER YEAR	56684.44			
RETURN TRIP LEARNERS P/YR	3200			
TOTAL COST: RETURN TRIP	**300.58**			
RATE RETURN TRIP	**345.67**			

Table 3: Operating Cost of a Private Vehicle for a Specific Distance Travelled

						15% profit		15% profit					15% profit				
Distance (km)				**Cost R per trip**	**Cost R per Lrn**	**Rate R per Lrn**	**Cost R per Lrn/km**	**Cost R per Lrn/km**	**Fixed Cost R per trip**	**Variable Cost R per trip**	**Total Cost R per trip**	**Total Cost R per km**	**Total Cost R per km**				
	Avg Distance (km)	**Return distance**	**Trips per day**	**New**	**New**	**New**	**New**	**New**	**New**	**New**	**New**	**New**	**New**				
														a	b	c	d
0-10	7.5	15	1	157.58	9.85	11.33	0.657	0.755	140.42	17.16	157.58	10.51	12.08	0.564945	5.935022	2.96751	16.44
11-20	15	30	1	174.74	10.92	12.56	0.364	0.419	140.42	34.32	174.74	5.82	6.70	0.564945	3.290659	1.64533	9.12
21-30	25	50	1	197.62	12.35	14.20	0.247	0.284	140.42	57.20	197.62	3.95	4.55	0.564945	2.232915	1.116457	6.19
31-40	35	70	1	220.50	13.78	15.85	0.197	0.226	140.42	80.08	220.50	3.15	3.62	0.564945	1.779595	0.889798	4.93
41-50	45	90	1	243.38	15.21	17.49	0.169	0.194	140.42	102.96	243.38	2.70	3.11	0.564945	1.527751	0.763876	4.23
51-60	55	110	1	266.26	16.64	19.14	0.151	0.174	140.42	125.84	266.26	2.42	2.78	0.564945			
61-70	65	130	1	289.14	18.07	20.78	0.139	0.160	140.42	148.72	289.14	2.22	2.56				
71-80	75	150	1	312.02	19.50	22.43	0.130	0.150	140.42	171.60	312.02	2.08	2.39				
81-90	85	170	1	334.90	20.93	24.07	0.123	0.142	140.42	194.48	334.90	1.97	2.27				
91-100	95	190	1	357.78	22.36	25.72	0.118	0.135	140.42	217.36	357.78	1.88	2.17				
101-110	105	210	1	380.66	23.79	27.36	0.113	0.130	140.42	240.24	380.66	1.81	2.08				
111-120	115	230	1	403.54	25.22	29.00	0.110	0.126	140.42	263.12	403.54	1.75	2.02				
121-130	125	250	1	426.42	26.65	30.65	0.107	0.123	140.42	286.00	426.42	1.71	1.96				
131-140	135	270	1	449.30	28.08	32.29	0.104	0.120	140.42	308.88	449.30	1.66	1.91				
141-150	145	290	1	472.18	29.51	33.94	0.102	0.117	140.42	331.76	472.18	1.63	1.87				
151-160	155	310	1	495.06	30.94	35.58	0.100	0.115	140.42	354.64	495.06	1.60	1.84				