# CHAPTER 1: INTRODUCTION

## 1.1    BACKGROUND

One of the fundamental issues of modern metropolitan areas is the provision of adequate road infrastructure.  In this regard, Bruton (1993:234) contends that the implementation of transport and road proposals affects the well-being of individuals and groups in society, and given that they can affect the life opportunities of large numbers of people the cumulative consequences are important.  The provision of road infrastructure is the responsibility of the public sector – hence the majority of road proposals are put forward by public agencies.  Transport infrastructure impacts on both transport users and nonusers.  It is therefore necessary for the merits of transport proposals to be judged by their potential effect on all members of society and not only on transport users, as was traditionally the case.  This implies that effects other than transport effects should also be studied.

One of the primary, but often ignored, effects relates to the relationship between transport infrastructure provision and economic growth and development.  Generally, the relationship between transport and economic development is not disputed and, according to Button (1993:222), economists have long been involved in the assessment of links between changes in the transport sector and the evolving pattern of economic development in the area served.  According to Cole (1998:373), it is possible to illustrate that transport increases development, and vice versa.

While the importance of transport (and more specifically road infrastructure investment) in economic development has never been seriously questioned, its exact role and influence have been the subject of much debate and periodic reappraisals.  This problem is highlighted by Floor, Freeman and Naude  (DOT 1993:1-1) who  argue that most of the literature on the relationship between transport infrastructure and economic growth deals

with empirical studies of transportation projects and their proposed benefits. They maintain that few studies examine such projects in retrospect in an attempt to discern the actual effect of the project on economic development, and no theory of investment in transport infrastructure has been evolved. Madrick (1996:7) concurs with this argument and contends that few attempts have been made to estimate the overall, programme-wide economic benefits of public investments in transportation facilities. According to Bruton (1993:22), the underlying problem is a more general one in that our understanding of what causes economic development is poor. Driver (1999:16) suggests that the main question should be: Under what conditions does infrastructure lead to economic growth? This question thus highlights an additional dimension of the relationship between road infrastructure and economic returns, namely that both the causality and conditional issues are of crucial importance.

Generally two schools of thought exist on the influence of road infrastructure on economic development. Floor et al (DOT 1993:4-1) describe these as follows:

(1)     The first school maintains that roads play a leading role in development – in other words they are a prerequisite for development. It is thus assumed that the provision of roads will almost automatically lead to the development of a region. This school also argues that a region has latent potential to develop and the provision of road infrastructure will unlock this development potential.

(2)     The second school of thought accepts that roads should be regarded as one of the elements in a development plan, but not necessarily the most important one.

From this it is clear that there is uncertainty about the exact role road infrastructure investment plays in the economic development of urban areas. There is thus a definite need to analyse this relationship in order to develop a theory on road investment. It is also necessary to assess whether these two schools of thought might be applicable to

specific circumstances, and if so, under what conditions these would apply.

## 1.2 ANALYTICAL FRAMEWORK OF TRANSPORT AND ECONOMIC DEVELOPMENT

Transport provides a key to the understanding and operations of many other systems at many different scales, and "… is an epitome of the complex relationships that exist between the physical environment, patterns of social and political activity, and levels of economic development" (Hoyle & Knowles 1992:11). The efficiency and effectiveness of the transport sector could impact on these relationships. The general analytical framework is provided in figure 1.1, and shows how inputs are transferred into outputs through productive and allocative efficiency processes, while outputs can be transferred into outcomes through an effective process.
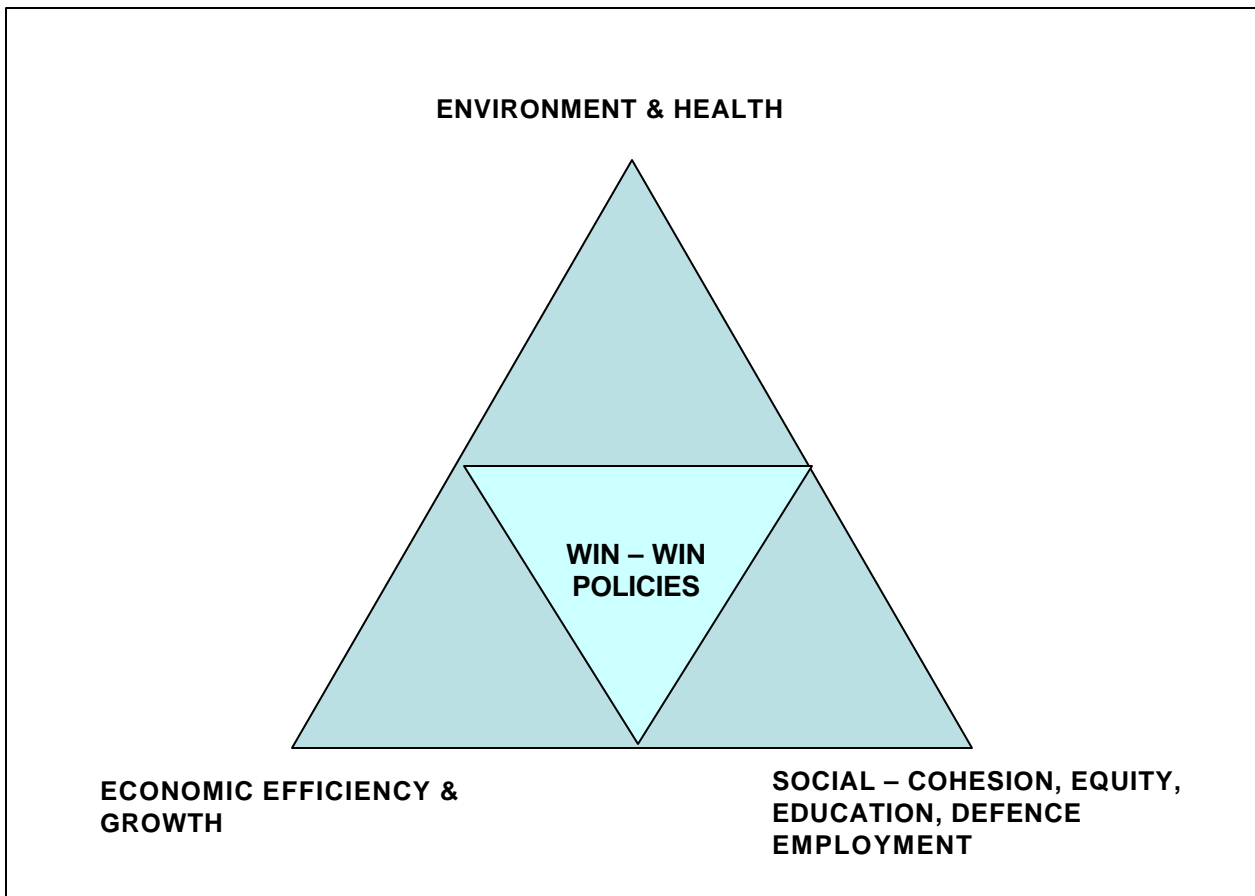
**Figure 1.1: Framework for analysing the performance of the road transport sector**
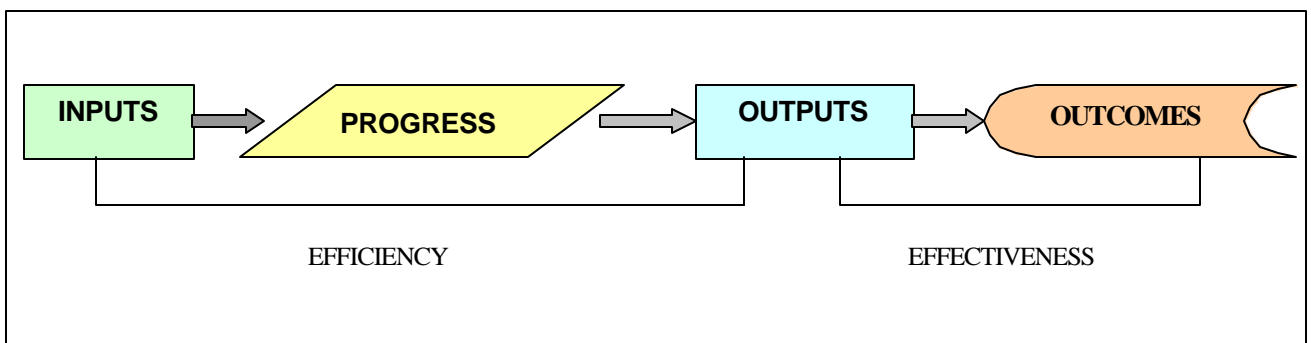


**Source:** Cox (2000:2)

Once can infer from this figure that outputs are only effective if they contribute to desired outcomes.

According to Cox (2000:2) the outcomes of the transport sector as required by the community, can be visualised in a national outcomes triangle. See figure 1.2 below.

**Figure 1.2: National outcomes triangle**



**ENVIRONMENT & HEALTH**

**WIN – WIN POLICIES**

**ECONOMIC EFFICIENCY & GROWTH**

**SOCIAL – COHESION, EQUITY, EDUCATION, DEFENCE EMPLOYMENT**

**Source:** Cox (2000:2)

From figure 1.2 it is evident that society is no longer solely motivated by economic scarcity, and requires that other outcomes such as social, environmental and health outcomes be satisfied. In this regard, the epitome of the complex relationship that exists between the physical environment, patterns of social and political activity and levels of economic development becomes evident.

Many factors are involved in the complex relationship between transport and development. Figure 1.3 emphasises that these factors affect transport systems in different ways, influencing each other as well as affecting the transport system directly or indirectly.

**Figure 1.3: Some factors influencing the development of transport systems and the transport/development relationships**
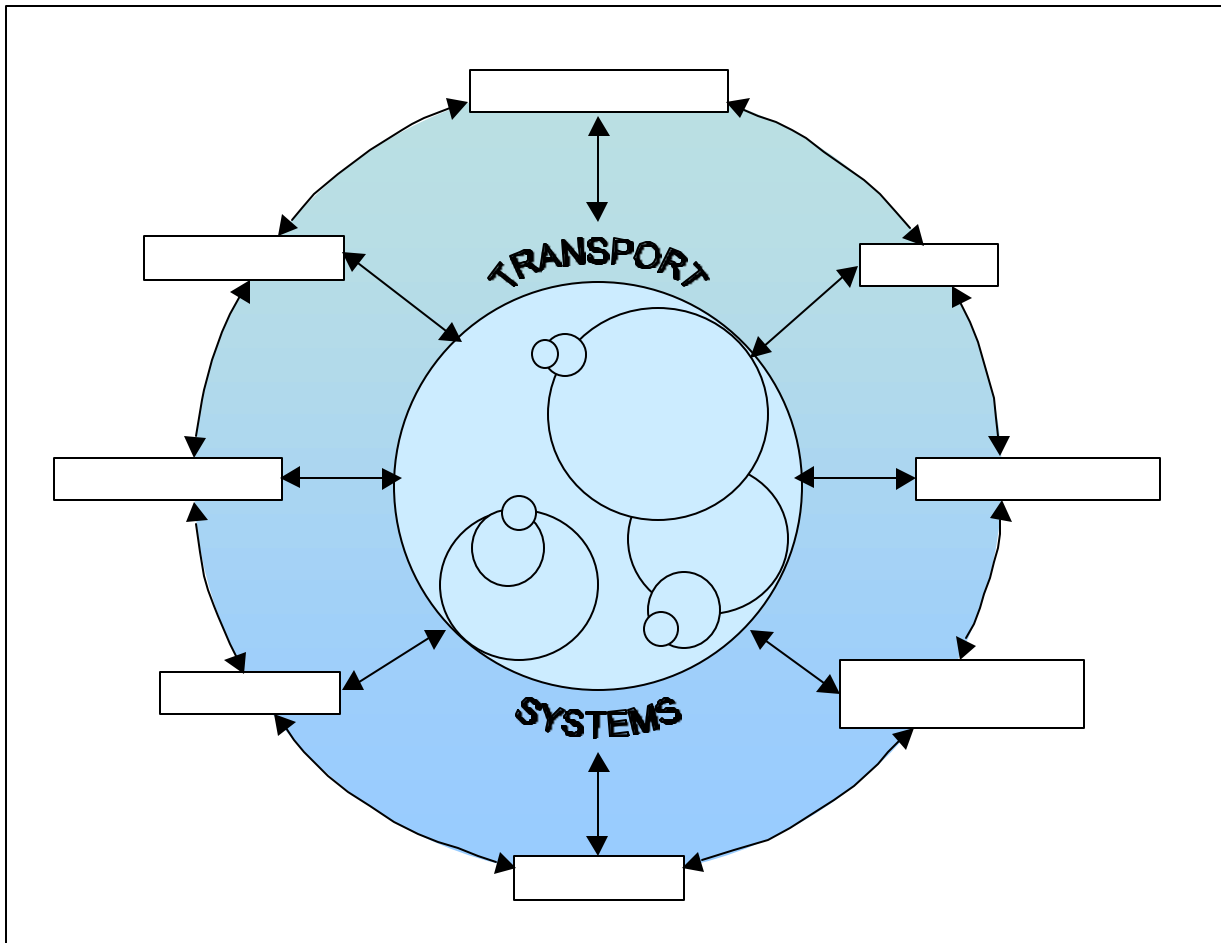


**Source:** Hoyle & Knowles (1992:13)

Although these factors are illustrated mainly from a macro-perspective they also impact on the micro-transport environment.  The actual impact of the factors is dependent on the scale of the activity – from local (micro) to global (macro).  From the micro-perspective, the local factors may impact on the local road network, the soils in the vicinity of the road, the local government administration and local residential areas. From the macro-perspective, the global factors have an impact on sea and air transport, on the environmental issues of oceans, on countries and on international politics.  It is thus obvious that the transport systems themselves, together with the physical environment within which they are situated, also influence the different areas of human activity and

the environment.

A comparison of figures 1.1 and 1.3 shows the effect of transport on the economic, social and environmental outcomes. Although this thesis focuses on the economic returns of road infrastructure, social and environmental considerations are also discussed. This is necessary because the introductory discussion has shown that the social and environmental factors are inextricably linked to the economic outcomes of roads.

### 1.2.1 Road infrastructure investment

The interface between transportation or road investment and economic development has broad implications that go beyond transportation's basic purpose of moving goods and people from one place to another. Although there is no question that roads are essential to the operation of the economy, much still needs to be understood about ways in which an efficient road system can improve the productivity of the economy.

When considering investment in roads it is vital to understand the different forms of investment. The forms of investment are a broader categorisation of investment options in transport and roads compared with the various different types of investment that are found, namely that of the construction of local roads and highways to the provision of public transport facilities along roads. In this regard Eberts (1999:1-2) identifies two basic forms, namely:

(1)     **Capital expansion.** This expansion includes the construction of additional highway segments, rail lines, runways, or additional air, sea, rail or bus terminal capacity using traditional technology.

(2)     **Capital enhancements.** Enhancements refer to new technologies that can enhance the efficiency of the existing highway system. Examples include intelligent

highway systems, congestion pricing, intermodal freight facilities, geographic positioning systems and instrument landing systems, to name a few.

Capital expansion is the appropriate form of investment for the purposes of this study because it focuses on the economic returns associated with road infrastructure investment. When considering road investment, it is necessary to determine whether this infrastructure investment has a positive or negative impact on economic growth. Research in the USA has shown that the effect can work both ways (Madrick 1996:28). The economic effects of investment in transport and road infrastructure have several phases, which are aptly described by Floor et al (DOT 1993:2-2):

> During the construction phase expenditure on the goods and services required will have a multiplying effect and may add to the national income per capita, so constituting economic growth. The multiplying effect depends upon the velocity of money and will continue while the expenditure is being incurred and for some time afterwards, but will eventually disappear and the national income will revert to its former level. If the multiplying effects extend over a long period as a result, of, say labour intensive construction methods, the demand created may result in ongoing investment to enable supply. This can be self-sustaining for a long time after the initial expenditure has ceased. Such an effect has given rise to the theory of the so-called "big-push" whereby a large infrastructural project, especially when financed by foreign loans, may generate sufficient income to create a demand which will initiate increased economic activity. The activity will not continue, however, unless the demand is adequate to attract more investment and so on. Road projects in underdeveloped countries or regions can have this effect, although usually investment in productive industries dependent on the road is necessary to provide sufficient impetus to set the economic process in action.

## 1.2.2 Economic returns

Economic returns or impacts are regarded as the effects on the level of economic activity in a given area. According to Weisbrod and Weisbrod (1997:1), these may be viewed in terms of business output (or sales volume); value added (or gross regional product), wealth (including property values), personal income (including wages) or jobs. Any of these measures can be an indicator of improvement in the economic well-being of area residents, which is usually the major goal of economic development efforts. There are various approaches to appraising the economic effects of infrastructure. Van Koesveld and Van Santen (1997:1) identified the five approaches that are most often used. These are summarised as follows:

(1)     The traditional cost-benefit analysis compares savings in direct costs and time with the amount invested.

(2)     The social cost-benefit analysis can also be used. This method employs the same neoclassical methodology, but goes beyond the traditional approach by including external effects on the natural environment and social welfare.

(3)     Production and cost functions to calculate macroeconomic productivity gains or losses over time are estimated.

(4)     This is a more elaborate approach, namely that of macroeconomic simulation models, which incorporate multiplier effects and regional interactions. These models explore the macroeconomic return of (specific) investments in terms of growth and employment.

(5)     Infrastructure investments can be viewed from a more strategic point of view, making use of scenario and risk analysis. Risk scenarios are often asymmetric, in the sense that by not investing, the losses may be higher than the gains.

From the above it is obvious that there are different approaches to determine the impact of road infrastructure investment. Each has its own unique method of appraisal, which may differ from other methods. The purpose of this study is to assess the applicability of certain of these methods applied in practice, and to test their applicability in the South African context. The main goal of this study is to explore ways of maximising the economic returns of road infrastructure investment – hence the need for a standardised process or procedure to evaluate the economic returns of various road projects in order to prioritise investment.

Although it was stated earlier that social impacts would also receive attention, one should bear in mind that economic impacts are different from the valuation of individual user benefits because they differ from broader social impacts. In this regard, Weisbrod and Weisbrod (1997:1) caution that user benefits and social impacts may include the valuation of changes in amenity or quality of life factors (such as health, safety, recreation, air or noise quality). Yet while these various types of benefits and impacts may be valued in economic (money) terms, through studies of individuals' or society's "willingness to pay" for improving them, they are not economic impacts, except insofar as they also affect an area's level of economic activity.

## 1.3    HISTORICAL PERSPECTIVE

As stated previously the debate over the links between transport investment and economic development is certainly not new. Ever since the construction of roads and railroads, their impact on the economy has been debated. Banister and Berechman (2000:7-18) grouped the historical debates into the following eras:

- the early days: 1800 to1970

- the 1970s and 1980s

- the 1990s plus

The **first era** is regarded as having a strong focus on location theory, the main arguments being based on the implications of whether reduced transport costs would bring new areas and products into the market.  In this regard, it is stated that the railways played a significant role in the development of trade, the improvement of living conditions of workers, as well as the development of the agriculture and mining industries in Great Britain during the 1800s (Shahia & Smuts 1993:153).

During the 1960s, Rostow was regarded as the most ardent proponent of the positive impact of transport.  It was argued that the railways were the single most powerful indicator of economic development and were decisive in the USA, Canada and Russia (Shahia & Smuts 1993:153).

It was further contended that transport investment also contributed to major export sectors and was instrumental in the development of the modern coal, iron and engineering industries (Banister & Berechman 2000:8).

The importance of location come strongly to the fore during this stage, and according to Banister and Berechman (2000:9), the land-use transportation links were explicitly included in Von Thunen's (1826) classical study on the impact transport has had on patterns of agricultural development.  This approach focuses on the components of distance and location, with transport cost fulfilling a vital role (Van der Merwe 1987:19).

During subsequent years, the work of Christaller (Banister & Berechman 2000:9) in

Southern Germany emphasised the crucial role of transport and economic development. He demonstrated the links between transport costs and the spatial distribution of economic activity. The main principle behind his theory was that an urban hierarchy of town and larger cities existed, each with different transport costs and economic activity. Towns higher up the hierarchy offered more products and improved the transport system over time. Improvements to the transport system strengthened the accessibility and dominance of the central city within this urban environment (Banister & Berechman 2000:9).

Although many other proponents of the location theory followed – each with their own interpretation of the role of transport in the economic activity – the central focus of the location theory was maintained. From this discussion it is clear that a reduction in transport costs was related to improvements in economic activity.

The **second era** (1970s & 1980s) was characterised by the development of a series of more sophisticated models that analysed land use and transportation at both urban and regional scales. These models allocated housing and jobs within urban regions on the basis of accessibility, land availability, income levels, population employment and other factors. These models were thus based on socioeconomic and physical characteristics.

These models had some success in modelling proposed transport improvements or policy changes in the transport infrastructure provision, as well as forecasting future travel demand. The main constraint of this era was that the modelling focused primarily on the use of transport cost as the principal driving mechanism. Important location considerations such as quality of housing and lifestyle considerations were downplayed in these models.

Although limited consideration was given to economic factors, employment impacts were

given priority.  This was the result of the limited understanding or focus of the various interactions of the city as an economic entity.  In the second  half of the 1980s, a number of studies concluded that transport is a second-order consideration for location, based on the premise of a good quality road network.  As such, transport was considered as a background variable that has to be present, but of less significance than economic factors such as the efficiency, productivity and profitability of firms.

The **third era** (1990s plus) is characterised by the macroeconomic approaches.  These approaches have come to the fore at a time when infrastructural provision has been scaled down in most countries.  The need for improved economic quantification of road projects has emerged because fewer resources are being allocated for road construction purposes.  At the forefront of this stage are economists such as Aschauer and Munnell.  Their work is discussed in section 1.4.  Most of the work consulted in this thesis will be based on research conducted during this era.

## 1.4    PROBLEM STATEMENT

### 1.4.1  General

This study focuses on measures of how to maximise the economic returns associated with road investment.  It is therefore necessary to briefly discuss relevant research conducted in both the international and local arenas.  This will complement the discussion on the problem statement.

In recent decades, international interest in the economic role of public infrastructure,

including road infrastructure, has been sparked by the work of Aschauer and later Munnell in the late 1980s and early 1990s in the USA. Aschauer's work focuses on the value of public infrastructure by pointing out that the role of public investment in private production has been overlooked, despite the size of the stock of public capital (Allen Consulting 1993:48). In an endeavour to measure this relationship, Aschauer developed a model that focuses on production function analysis. This model assumes that the output of the economy (gross domestic product) is a function of the total supply of labour and available private capital stock as well as the rate of technological progress. In an effort to measure the impact of capital, a production function can be expanded to also include the supply of infrastructure investment as a variable. It is argued that if the relationship between changes in infrastructure investment and the economy's output is close, one possible interpretation is that infrastructure investment is a significant determinant of economic output.

Munnell conducted similar research. The work of both economists was the topic of much debate and criticism. This research was followed by a pioneering study in Australia on the contribution of investment in land transport infrastructure to the Australian economy during 1993 (Allen Consulting 1993). More recent work on this subject was done by Cox (1994) and Nardiri (Madrick 1996).

No similar detailed research on this topic was conducted in South Africa, although relevant topics were researched. Local topics and projects relevant to this study include the following:

### 1.4.1.1    *Spatial development initiatives (SDIs)*

The SDI programme is part of government's macroeconomic growth strategy, and ties in with its economic strategy and policy. It is a government initiative to promote development in specified areas, or more specifically, a short-term investment strategy

aimed at unlocking inherent economic potential in specific spatial locations in South Africa. It uses public resources to leverage private sector investment. One of these initiatives relates to development corridors. Unfortunately no guidelines are provided to ensure successful implementation of these corridors. A development corridor is defined as a linear strip or area traversing urban areas or interurban areas, surrounding a major transport facility, providing high levels of accessibility to adjacent areas and containing a high density of population and job opportunities (TCC 1998:14). The Mabopane Centurion Development Corridor (MCDC) will receive specific attention in this regard, and more specifically road PWV9. This road forms part of the MCDC and the study area is located to the west of Pretoria and close to the Rosslyn industrial areas (see plan 1). This project proposes to unlock the inherent and underutilised economic and social development potential of the study area to ensure a sustainable economic development corridor. The importance of road PWV9 to the MCDC is that it will ensure connectivity between major urban nodes, it guarantee continuity within the corridor, major land uses may locate along it, it will allow multimodal transportation, and it will provide a high level of accessibility and mobility.

SDIs are relevant to this thesis because it focuses on unlocking inherent economic potential of spatial locations of development corridors. The MCDC with road PWV9 will serve as a case study.

*1.4.1.2     Studies analysing the linkage between the transport industry and the South African economy*

The focus of these studies is on the entire transport industry and its actual impact on the South African economy. Three of these studies have been commissioned by the Department of Transport, namely:

(1)    A macroeconomic analysis of the linkage between transport industry and the South African economy
(2)    An investigation into the economic structure of transport
(3)    The relationship between transport infrastructure and economic growth

The relevance of these studies to the thesis stems from their economic focus and the relationship with transport (which includes road infrastructure).

*1.4.1.3     Modelling transport and the economy*

The CSIR has developed a model to examine the transport sector in South Africa's economy, called MOTE (model of transport and the economy) (Naude 1998). Generally, economic input-output tables are used to model the relationship between transport and the economy. This work is relevant to this thesis because it will help to determine the relevance and applicability of input-output tables to model the economic returns, related to road infrastructure investment.

*1.4.1.4        Economic impacts of road projects*

The City Council of Pretoria (now the City of Tshwane Metropolitan Municipality) commissioned two studies during 2000 and 2001, to determine the economic impacts of specific road investment proposals. The road projects were that of proposed road K8 and that of proposed road K16, located within the urban area of Pretoria.  This thesis will use these two studies as case studies because of their specific focus on the economic returns of urban roads.  The details of these road projects are as follows:

(1)    ***Road K8.***  See plan 2 for the location of this road in the city of Pretoria. The study area is bounded by the Magaliesberg range in the south, Lavender Road in the west, the PWV2 (N4) route to the north and Moloto Road (R573) in the east. Road K8 will be a dual carriageway and will improve accessibility both in the study area, and the region as a whole.  This proposed road falls within a development corridor and the area is characterised by major land development activities.  The need for the road is based on the major development pressure associated with a significant latent traffic demand. This demand is in excess of 10 000 vehicles per peak hour.  It is thus clear that the construction of this road will open up the area for more land development.

(2)    **Road K16.**  The proposed road K16 is located in the Moot area, to the north of the Pretoria central business district (see plan 3), and follows the Michael Brink Street alignment.  The proposed road K16 will not only open up the Moot area for increased economic growth, but will facilitate mobility and an efficient transport network.  Indications are that, if development along the route is integrated as part of a balanced economic system, both road users and local businesses can benefit from the construction of road K16.

*1.4.1.5      Corridor priority systems*

The following two local studies focusing on corridor priorities were identified:

(1)     Development of an Integrated Urban Corridor Assessment Strategy and Strategy Development Process for Transportation Authorities and Provinces commissioned by the Department of Transport (Del Mistro 2002).

(2)     Typology and Priority System for the Planning and Development of Viable Corridors (Green, Aberman & Dominik 2002).

The importance of corridor priority systems to this thesis relates to the focus of prioritising and planning corridors on the basis of economic, social and environmental factors.

From the above it is possible to identify the key focus areas of the research and projects undertaken in South Africa and internationally. The following areas are of relevance to this study:

- the relationship between public infrastructure (including roads) and the economy's output
- the contribution of investment in land transport infrastructure to the economy
- the role of development corridors to unlock the inherent economic potential of spatial locations
- analysing the linkage between transport and the economy
- modelling the relationship between transport and the economy
- measuring the economic impacts of roads
- prioritising and planning road corridors

**1.4.2  The problem**

Section 1.1 highlighted some of the problems associated with the relationship between transport infrastructure and economic returns. This ties in with the exact role and influence of the said relationship, as well as economists' poor understanding of this relationship. Although the studies discussed in section 1.4.1 are relevant to this thesis, the following problem areas are identified:

(1)     Although these studies did address road infrastructure, there was no specific focus on its impact on the national economy. Hence limited information can be obtained on the role of road infrastructure projects and economic growth, which is the focus of this thesis. However, the studies on roads K8 and K16 addressed this aspect to some extent.

(2)     The modelling techniques that were used, modelled the impact of transport on the entire economy of the country. There was a limited focus, with the exception of the studies on roads K8 and K16, on the applicability of economic modelling to the subregional and regional economy of the road investment location.

(3)     Neither of the studies focused on maximising economic returns of road investment. The focus was rather on proving the relationship between transport infrastructure investment, and the measurement of this relationship. The conditions necessary for maximised economic returns related to infrastructure investment were thus omitted or ignored.

(4)     In section 1.4.1.5, mention was made of local corridor priority systems. The problem with these two systems is that they were not specifically developed for the assessment of road investment proposals. The Typology and Priority System (TPS) is described as a first-step analysis to deal with the trade-offs between urban restructuring, a rationalised public transport network, economic development and environmental maintenance (Green et al 2002:10). The Integrated Corridor

Assessment Strategy System (ICASS), on the other hand, proposes developing guidelines on the evaluation of a corridor. This is necessary to determine the probability of the corridor evolving as planned and in terms of the performance of the corridor in relation to a set of objectives (Del Mistro 2002:13). These two systems thus assess corridors in relation to certain policy and strategy trade-offs. One of the limitations of these systems is that they may focus only on a specific corridor.

The other problem with these systems relates to their data requirements. The TPS system formulated the typology with six main categories (including land-use and transport) with subcategories (10 in total). To ensure a balanced approach to development, further analysis was done for economic and environmental factors. The economic factors included four main factors that were further divided into economically functional zones and nodes. Five environmental factors were considered. The land-use data were obtained from captured GIS data, while transport data were based on modelled results. The economic factors measured the perceptions of tenants, developers and investors on the basis of interviews. To obtain usable economic data, economic modelling had to be conducted – the so-called "precinct evaluation". To obtain data on the environmental category, desktop level environmental assessments had to be conducted (Green et al 2002:5-8). Data collection is extremely costly and time-consuming (eg the interviews and additional studies).

The data requirements and collection for the ICASS are onerous. It has 30 objectives with related performance measures, 8 alternative urban forms, 14 land-use types and 41 interventions (Del Mistro 2002). Some of the data requirements are extremely detailed and hence difficult to obtain.

In this thesis, the researcher also proposes refuting claims by Floor et al (DOT 1993: 9-1)

who concluded as follows:

> The benefits of roads cannot really be related to economic growth except in the negative sense that the lack of road capacity will inevitably retard economic growth. Roads, however, contribute significantly to welfare through their externalities and the accessibility that they afford. Through externalities they may also cause disbenefits and diminish welfare.

In this study, the emphasis is on maximising the economic returns of road infrastructure investment projects. Hence the problem statement of this thesis is related to three broad study areas, namely:

(1) It is essential to understand the role of road infrastructure investment in economic development.

(2) It is necessary to assess the conditions required for road projects to maximise the economic impacts of certain spatial locations.

(3) It is meaningful to develop a process to ensure that road investment proposals will maximise economic returns.

### 1.4.3  The goal of the study

Based on the foregoing discussions, the **purpose** of this study is:

**To explore ways to maximise the economic returns of road infrastructure**

**investment**

Certain subgoals are required to achieve the purpose of this study. Based on the discussion in section 1.4.2 the subgoals of this study are:

**Subgoal 1:**    To analyse the relationship between road infrastructure investment and economic development. This goal will ensure an understanding of this important relationship.

**Subgoal 2**:    To determine under what conditions road investment will maximise the economic returns of spatial locations. This goal will ensure that road investment will only be done in locations where the conditions are suitable for maximising economic returns.

**Subgoal 3:**    To develop a procedure that will ensure that road investment proposals will maximise the economic returns associated with them. This procedure will standardise the assessment of the economic potential of road projects and should help to maximise the economic returns related to those projects.

**Subgoal 4:**    To develop a formula of road investment and economic development. This formula will guide road investment and ensure maximised economic returns.

**Subgoal 5:**    To develop an understanding of the relationship between decision making, road investment practices and actual economic returns. This understanding will help decision makers to ensure policy making on road investment that will maximise the economic returns associated with it.

## 1.5    IMPORTANCE OF AND REASON FOR STUDY

This study is vital because it is extremely specialised and limited research has been conducted in South Africa.  This thesis proposes developing guidelines on road investment to maximise the economic potential of certain spatial locations.  It proposes, inter alia, to investigate the macro or wider relationship between road investment and associated economic returns as well as the direct economic effects of individual road projects, in an effort to maximise the economic returns of road projects.  It also endeavours to differentiate between the *gross* economic effect of a project and the *net* economic impact because of road investment.  Weisbrod and Weisbrod (1997:1) view the net economic effect as the expansion or contraction of an area's economy, resulting from changes in a project (such as road construction).  The gross effect relates to the project's contribution to the area economy. This is usually viewed in terms of the number of jobs, income and/or business sales directly or indirectly supported by the project.  They contend that the gross effect is not necessarily the same as the net impact, particularly if other objectives would be expected to enter or expand in the absence of this road project.

According to Weisbrod and Treyz (1998:1) many studies of the local economic impacts of individual highway projects rely on overly narrow measures of economic benefits. Other types of research focus on economic productivity that define benefits more broadly, but they are also limited by geographic and functional constraints.  This study attempts to bridge these two perspectives, by describing how project specific analysis methods can shed light on the overall macroeconomic effects of road infrastructure spending with a view to maximising the economic returns.

The aforementioned discussion highlighted the importance of this study.  The discussion to follow will focus on the reason for it.  The National Department of Transport initiated the Moving South Africa (MSA) project in June 1997.  The project aims to take the vision of MSA to develop a 20-year strategy to realise it.  The vision formulates the

overall objective to:

Provide safe, reliable, effective, efficient, and fully integrated transport operations and infrastructure which will best meet the needs of freight and passenger customers 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 (**author's highlighting) (DOT 1998:15). This vision is further strengthened by the MSA mandate to develop a strategy to ensure that the transportation system of South Africa meets the needs of South Africa in the 21st century and therefore contributes to the country's growth and economic development  (DOT 1998:17).

From the MSA strategy it is clear that investment in transport infrastructure should also take cognisance of its contribution to economic development – hence the significance of this thesis.

In addition, it is a known fact that there are limited funds available for road construction projects. An overriding issue is thus how to continue to make significant investments in infrastructure in an era of scarce public resources. Public awareness should thus be created on how road infrastructure investments can stimulate economic development. By considering the potential economic impacts together with the traditional approach to savings in travel time and vehicle operating costs, it will be possible to ensure the right investment at the right time and in the right place.

Lastly, it can be stated that the general theory of public investment applies to road infrastructure investment in many ways, but there are still attributes of road infrastructure which influence economic development to the extent that investment in this infrastructure needs to be considered separately from other public investment. The author proposes developing a formula for investment in road infrastructure.

Finally, the author hopes that the findings of this research will be used to improve policy making on road investment decisions in South Africa in order to maximise economic returns.

## 1.6    METHODOLOGY

The methodology comprises two approaches – firstly a detailed literature study and, secondly an empirical study.

### 1.6.1  Literature study

This approach entails a detailed literature survey of relevant studies or research projects undertaken on transport infrastructure investment and economic productivity.  The most significant international studies on this topic will be evaluated, and the work of leading economists in this field of study analysed.

In addition, all relevant work done in South Africa will be investigated.  Some of these studies were briefly touched on in the previous section.

### 1.6.2  Empirical study

The case studies of roads K8 and K16 will form part of the empirical study, as well as the MCDC (road PWV9).  All of these studies are road projects in the urban area of Pretoria. The aforementioned two studies are of direct relevance to this investigation because they are regarded as pioneering work on the economic returns of road infrastructure investment projects in South Africa.  This section will involve an empirical testing of the hypothesis by processing and interpreting the data used in the case studies to see whether the interpretation of these data will resolve the problem statement that initiated the research.  The following factors, inter alia, will be considered:

- description of project details

- selection of an appropriate geographic area of study

- identification of economic impacts

- measuring economic impacts

- usage of multipliers

- options for economic modelling

The statistical or econometric analysis will be based on input-output models. These models are used worldwide to determine the economic impacts of projects. The applicability of input-output modelling with regard to road infrastructure investment will also be investigated.

## 7. CHAPTER LAYOUT

The layout of the chapters is as follows:

Chapter 1 introduces the study. It provides background information on the relationship between road infrastructure investment and economic development, as well as an analytical framework of transport and economic development. The problem statement and purpose and relevance of this study are also discussed, and methodology and scope of the study explained.

Chapter 2 addresses the nature of road infrastructure. This is primarily a literature investigation into the demand and supply characteristics of road infrastructure, as well as the respective approaches towards road infrastructure provision. This chapter also analyses the characteristics of roads as economic infrastructure and the externalities involved. The chapter provides a theoretical understanding of the relationship between roads and their economic returns, and how to maximise this.

Chapter 3 addresses the relationship between road infrastructure investment and economic development. Although this chapter is theoretical, it primarily investigates the question of how to maximise the economic returns of road investment. The main focus of this chapter is on the causality between road investment and economic development. The main components of this relationship, namely the investment component, the network performance component, the transport economic component and the economic development component are discussed and analysed on the basis of case studies.

Chapter 4 provides an assessment of case studies and economic modelling. It evaluates certain economic modelling techniques and provides a modelling strategy. Certain international and local transport economic projects are analysed and used to develop a study and modelling approach on how to maximise the economic returns of roads.

Chapter 5 develops a theory of road investment, and interprets the economic effects of road investment. This is then used to formulate the theory and its performance indicators. Lastly, the theory is tested against the case studies. This theory will ensure the maximisation of the economic returns of road investment.

Chapter 6 provides insight into road investment practices and maximised economic returns. The aim of this chapter is to refine road investment practices in South Africa to ensure maximised economic returns. It identifies the relationship between policy making, investment decisions and the economic returns of road infrastructure.

Chapter 7 deals with the findings, conclusions and recommendations of the study.