

*Full Length Research Paper*

# Integrative transport and modal interchanges: A social sustainable approach towards urban migration

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Transport is argued to be one of the most important human activities worldwide and an indispensable component of the economy. Transport provides an integral function in the forming of spatial relations between locations. Integrative transport systems are relatively unknown concept and therefore, only implemented to a certain extent. Integrating transport with the surrounding land use is however essential in order to create a sustainable and livable cities and to attain efficient transport systems that meet the daily needs of people. Modal interchanges have become a necessity for any transport system and should no longer be considered merely as passageways for commuters. The full-potential of these facilities should be explored. Property development in the vicinity of modal interchanges can also be limited by a narrow focus in the planning and development of modal interchanges, which in turn impacts the success of these facilities. The holistic planning of a transport system is essential in order for a system to be implemented for each specific location.

**Key words:** Integrative transport systems, modal interchanges, development, land use.

## INTRODUCTION

Transport is believed to be one of the most important human activities worldwide and an indispensable component of the economy. It therefore, provides an integral function in the forming of spatial relations between locations (Rodrigue et al., 2006). Du Plessis (2013:40) claims that in an effort to create livable cities with economic opportunities and sufficient access to public transport, bold decisions must be taken to ensure that developments of the future are livable and sustainable. There exists a great danger in an attempt to merely meet the required numbers set for infrastructure, but missing the opportunity of creating a sustainable

development. Never has this opportunity been as vital as it is now in South Africa and in Africa. Mankind is progressively moving beyond the concept of 'green buildings' to that of creating 'green precincts'. This research paper endeavours to address sustainability in a much wider context that is, ensuring optimal performance of an entire precinct. More questions are being asked such as:

"What about the urban space in-between?" to obtain ways to protect the urban space and ultimately not harm the planet (Du Plessis, 2013:40)".

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Most people are dependent on public transport in order to gain access to the various areas of daily routine as well as linking them efficiently to a growing number of jobs. This underlines the fact that transportation infrastructure and effective public transportation systems remain a key factor in the development and economic growth of a city (African Development Economic Consultants, 2012:2).

According to Kristersson (2012:16), modal interchanges can be defined as hubs where transport routes and different modes of transport are linked together. These areas are usually characterised by their central location for ease of access and surrounding development.

The government has set ambitious targets for the total transformation of public transportation systems within 12 major cities in South Africa alone. These transportation systems are currently at various stages of implementation, and will be rolled out during the next decade or so depending on funding. This poses the questions:

To what degree does the planning and implementation of public transport infrastructure in South Africa take integrative transport systems into consideration and to what extent are modal interchanges located and planned optimally in order to create sustainable and efficient urban areas?

Transport planners often tend to prioritise certain aspects that are less focused on integrating transport with the surrounding areas and land-uses that promote a more sustainable environment. Examples of aspects prioritized, that do not support integrative transport systems include the reduction of traffic congestion, travel-time reduction and flow optimisation of transport systems. According to Jenks et al. (1996:2) creating sustainable development has become a major concern within a very short time frame and this necessitates the input from various disciplines in order to achieve this.

New public transport systems are implemented in many cities throughout the world including South Africa. These new infrastructure systems have a prime objective to facilitate and improve urban transportation (Rodrigue et al., 2006). The transport systems and transport facilities also present an ideal opportunity to impact optimally on the surrounding urban areas and have the potential to act as a catalyst for commercial and property development if approached correctly (Hoogma and Kemp, 2002). However, the transport systems that are currently developed in South Africa are approached with a too narrow focus, and unique development opportunities are therefore lost.

### **The related literature**

Transport is a key element in forming the ecological

footprint and quality of life and ultimately enabling a sustainable future for cities (Gärling and Steh, 2007:293). Sustainability is more than a good idea and should rather be seen as the idea of our age. It should provide guidance for policies. The Environmental Goods and Services Forum of South Africa also emphasizes that sustainable transport and mobility are fundamental for the country's successful development (Du Plooy, 2009:7).

Bannister (2008:73) states that Transport Planners ought to change their paradigm if the sustainable mobility agenda is to become more prominent. He further explains that in order to obtain sustainable mobility the link between transport and land-use must be strengthened and be a priority in transport planning. Creating sustainable cities are largely dependent on public transport accessible corridors and public transport accessible interchanges Bannister (2008:73). Bannister (2008:75) highlights the following 4 aspects for creating a more sustainable city:

1. Transport policy measures modal shift: Transport policy measures can reduce the amount of car use and rather encourage cycling and walking and also the development of new transport hierarchy. This can be done through making it easier to use public transport,
2. Land-use policy measures: These aspects address the physical separation of activities and the means by which distance can be reduced. This can be achieved through creating more dense and concentrated developments, public transport orientated development and mixed-use development,
3. Reducing the need to travel: This deals with the fact that a trip is no longer necessary as it is replaced by a non-travel activity or it is substituted through technology,
4. Technological innovation efficiency increase: Technology impacts on the efficiency of public transport directly.

For the purpose of this article, ergonomics is the process of identifying human actions and needs and providing the subsequent physical forms of engineered or built systems (Wolf, 2003:1). The designing of the physical environment comprises of human safety, comfort, and satisfaction in order to reach optimal performance (Wolf, 2003:1).

By creating an environment for humans, two related system outcomes become evident: Firstly, performance, which consists of productivity; efficiency; effectiveness; quality; innovativeness; flexibility; safety and security; reliability and sustainability. Secondly, well-being, consists of health and safety; satisfaction; pleasure; learning and personal development (Frey and Stutzer, 2010). Performance and well-being are interrelated and therefore influence one another (Dul et al., 2012:379). According to Martin et al. (2013:365), sustainability is an issue that is recognised globally, but the role of ergonomics in the sustainability design is not understood

and not sufficiently considered. Dorf (2005:83-1), argues that in order to provide the efficient movement of people and goods, transportation facilities and systems are required. Rodrigue et al. (2006:178), argue that the spatiality of transport and the various levels at which it operates is the most significant discipline relating to the shaping of human activities.

Dorf (2005:85-9) further describes public transportation as ground passenger transportation modes that are available to the public. Conventional public transportation has set routes and fixed schedules and is usually bus and rail transit services that mainly focus to provide mobility to people without private cars. Unconventional public transport modes range from taxis, carools, rented cars and subscription services. Maclaren (2003:2) indicates that public transport links industrial, commercial and residential areas and makes the transfer of goods, people and information possible. According to African Development Economic Consultants (2012:3), transportation is also a key component in urban land markets, urban regeneration and economic upliftment.

Schiefelbusch and Dienel (2009:7) believe that the function of transport has changed over the years. Public transport in the nineteenth and early twentieth century was seen as the backbone for providing citizens and goods with a means of movement; however today, its function is to provide users with an alternative option of using cars. Public transport also contributes to environmental, social and energy objectives and is therefore considered a better alternative to the use of private automobile.

Makeka (2009:75) elaborates by describing modern-day public transport as a means of allowing access to various public spaces and supporting the flow of commerce. Public spaces are therefore the key determinant in social engagement, discourse, identity and without transport supporting it, it would not exist. As a result, public transport provides access and mobility to a large number of people and therefore supports the functions of public space.

The present urban environment is portrayed by different property rights from the individualised private residence sector to state-owned public spaces (Maclaren, 2003:67). Land use is defined as the physical land itself, which constitutes the geographical characteristics and the vegetation that occupies the surface, the building that is constructed on this land as well as the certain activities that take place on it (Premius et al., 2007). According to Maclaren (2003:81), zoning regulations are planning procedures used by authorities to regulate property development and reduce unwanted spillover effects from incompatible land use into desired land-use, thereby promoting new property development.

Due to each city having different policies and ways of thinking, cities have taken on different forms. Cheng and Lin (2010), elaborate on two types of urban development. In the first type, population growth is the cause, and

development is the effect. Population growth is therefore followed by development. The investment in this type of development will therefore not fail easily and will reduce the risk of developing land and lessen the financial strain on local government. However, the problems relating to insufficient infrastructure increase in traffic congestion and deterioration in residential quality. While the second type, developments occur where development is established first and are followed by population growth. The main benefits from this type of development are that local government has the opportunity to lead the direction of the implementation of new development, infrastructure can be implemented to attract private sector investors and traffic congestion can be taken into consideration during the planning procedures (Cheng and Lin, 2010 in Brink, 2013).

The history of apartheid in South Africa also plays a key role in the current formation of urban migration patterns. The apartheid city was created through manipulating settlement patterns in order to segregate people and to create an environment of spatially structured poverty (Makeka, 2009:78). Jenks et al. (1996:171), on the other hand argue that our cities take also a product of the development of transport technologies, which were dominant at different stages of their development.

Du Plessis (2013:41) declares that in order to create efficient livable cities, it is essential that the integration of diverse functions such as residential and commercial property with transportation take place. Dorf (2005:83-1) argued that transportation infrastructure always forms part of a much bigger project development process and therefore certain key characteristics of a project need to be considered during the planning of each transport corridor.

Doherty (2004:6) believes that accessibility is crucial in the development of a city and plays a major role in the process of forming land use. Hansen (1959:74) supports this view and argues that the greater the accessibility to various activities in a community, the greater the chance for growth in the community and defines accessibility as the potential for opportunities to interact. Vanderschuren (2012:34) elaborates that land use and transportation are interlinked and changes in land use will most probably lead to the change in user trip making patterns vice versa. According to Litman (2009:2), transportation also influences the surrounding land use through the upgrading of land use of the land required to accommodate the necessary transport facilities and also indirectly by enhancing accessibility to land use which stimulates development.

Makeka (2009:75) declares that cities, which lack the integration of public transport and public space, appear unorganised and unbalanced. According to Williams (2009:29) in order to obtain sustainability planners need to find common ground, not only to satisfy transport needs, but also between transport and the surrounding

activities. According to Makeka (2009:77) he elaborates that in South Africa, a large percentage of commuters rely on the use of private vehicles and in the large metropolitan cities, the modal split is usually around 50% private to 50% public transport going into the Central Business District (CBD). The private commuters are usually single occupancy vehicles, which increase congestion and inefficient fuel utilisation and ultimately release high levels of carbon emissions. Makeka (2009:77) states that the transport sector in South Africa contributes 25% of the total carbon emissions. Maclaren (2003:72) believes that planners do not take into consideration the public interests and do not strive to serve common values and therefore mutual beneficial results for everyone are not achieved. Infrastructure determines the nature and 15 performances of human settlements as people are dependent on infrastructure in order to build their existence. There are however, several challenges that surface. The full extents of the interrelationship between transport, public space and optimal urban form have yet to be fully understood and implemented.

In South Africa, the effect of poor planning pertaining to the integration of transport and land use is apparent in the existing low population densities in cities, causing users to travel long distances to reach their destinations (Vanderschuren, 2012:34). Makeka (2009:77) also indicate that there exists an immense problem between public space and transport where large amounts of capital required for the implementation of transport infrastructure is mismanaged. The creation of pedestrian orientated settlements has also become unattractive. The idea of transport efficiency has long been understood as increasing the speed of vehicle movement, and this has resulted in the loss of efficiency of satisfying human needs and human environments (Makeka, 2009:77). Hickey and Townsend (2009:2) also agree with this idea and claim that many authorities lack the vision of integrating transport with urban settlement, and many uncoordinated programs and agencies exist which do not facilitate a multi-disciplinary approach.

Transport systems are therefore necessary to ensure reduced costs of social and economic interactions and to allow goods and services to be exchanged in a more productive manner. Ineffective systems that are implemented on poor infrastructure platforms will mean that cities are not able to provide a productive environment for firms and provide points of access to the poor where they are able to obtain an income (South African Cities Network, 2009:5). Makeka (2009:75) states that commerce and social interaction have been non-existing due to a lack of integrative transport strategies, which have also resulted in the loss of communities and small scale economic integration in South Africa. South Africa's public space is worn out as a result of improper public transport and erected barriers for security reasons. Public transport enables public space to be linked to each

other and also contributes to better security. Development of a city is not just concerned with the users of transport facilities but what is more important is the effect it will have in the zone of influence which is likely to engender decay for kilometers away from the facility itself. Dorf (2005:86-13), states that transit also has difficulty attracting market share, which is among other reasons that land use patterns are not planned to incorporate transit use. Molai and Vanderschuren (2003:3), explain that the land use component can include a range of land uses such as residential, commercial and industrial.

Political control in terms of service plans, provision and funding have always been the case as cities are mostly owners of transport companies and regulate the services offered through contracting policies (Schiefelbusch and Dienel 2009:6). Maclaren (2003:71) explains that the main role of the state is therefore to obtain consensus, and work to affect social stability and maintain a basic balance of power between various interests groups through accommodating its actions towards these groups. In the function of urban development, many interests exist that seek to be heard by those with planning power such as environmentalists, transportation lobbies, developers, construction firms and professional institutions such as engineers and surveyors. This challenges the state, as conflicting values and interests of the various groups arise and the state has to fulfill the role as an arbitrator to ensure that no gains mastery and dominates state policy. Maclaren (2003:72) however proclaims that although many believe that the conflicting views of the various interest groups can be accommodated, the idea in reality is not possible and forces the state to prioritise financial grants for the various interest groups. Not only does the South African government prioritise certain interest groups above others but certain controlling decisions are also enforced which overrules planners' endeavour to integrate transport with land use and ultimately to create sustainable communities.

Ndamase (2013:4) emphasises that the malfunctioning of the Integrated Public Transport System (IPTS) in Nelson Mandela Bay alone is due to the fact that authorities wish to remain in control of the managing of the project and also hold on to the R298 million capital budgets from national funding. This serves as an example to illustrate the political barriers that restrict the optimal implementation of transport facilities. Thompson and Roux (2009:1) support this view and state that financial constraints tend to overrule integrated and holistically designed settlements. Figure 1 highlights the main areas of government expenditure in South Africa for the year 2013.

#### **National Treasury Republic of South Africa, 2013**

From Figure 1, it is clear that the transport expenditure

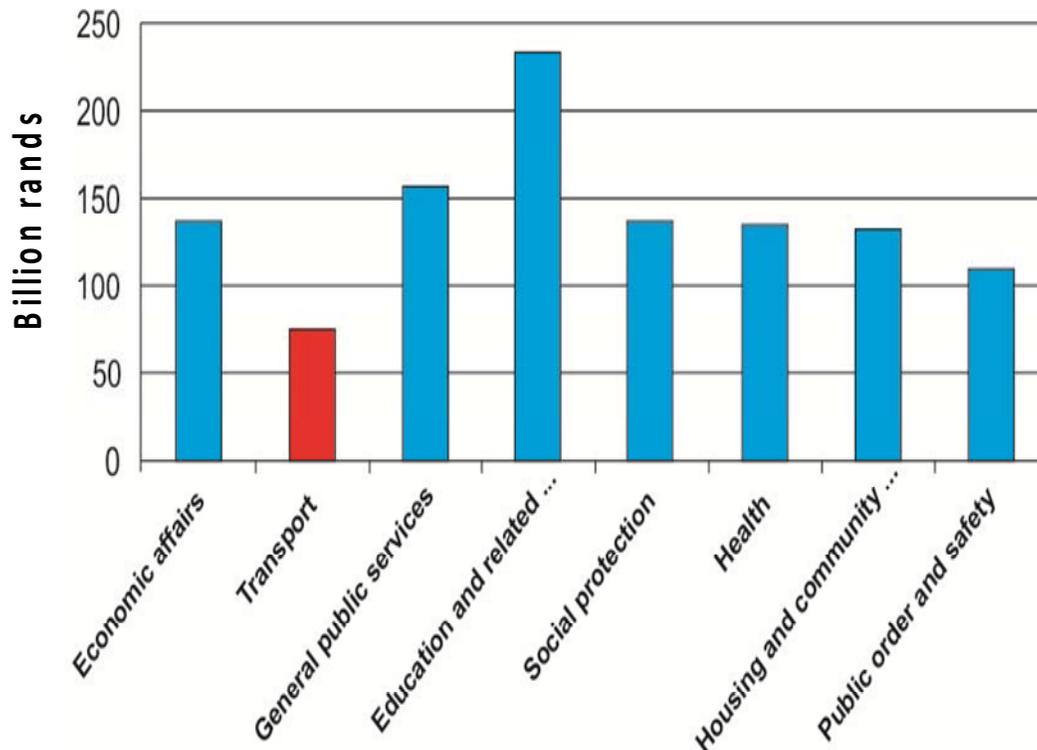


Figure 1. Government expenditure for 2013/2014.

issued by the government is substantially low compared to expenditure for other interest groups. The limited funds available for transport investment restrict the desired implementation of transport infrastructure in several cities.

From this study, it is plausible to argue that the state has the final decision as to how and what transport systems including implementation will be carried out. It seems as if it is not possible for government to accommodate all interest groups equally and ultimately government has to prioritise these needs accordingly. This in turn will influence the extent to which planned integrative transport systems are implemented. Even though government policies in South Africa promote sustainable human settlements, examples are few and far between (Thompson and Roux, 2009:1). This is a result of the continued old approach to township planning, infrastructure, housing design, the absence of cross-sector integration and collaboration. Planners do not take into consideration long-term environmental, social and economic sustainability and the large spatial areas formed due to apartheid constructs. The main reason for planners not considering this during the design stage is due to segmented professional education, where engineers, architects, planners, social scientists and environmentalists are trained in isolation and therefore only few are able to see settlements holistically as

integrated, resource efficient, social and economic systems embedded in natural ecosystems (Thompson and Roux, 2009:1). Abbott (2012:257) explains further that empiricism has long been influencing the way of thought and limiting the access to intellectual space.

The doctrine of empiricism believes that knowledge can only be obtained through past experiences. Abbott (2012:257) also argues that although poor urban development exists, Africa has a great opportunity to create its own development paradigms that are much more applicable to the twenty-first century. Ironically, this opportunity is not held back by lack of skills, lack of political will, or shortage in finance but rather a way of thinking with reference to urban infrastructure. Molai and Vanderschuren (2003:1) state that the high demand for transport as well as the difficulty of providing transport as a result of urban sprawl (which has created increasing spatial developed cities throughout South Africa) increases the difficulty of integration. Large amounts of houses are situated at the periphery of cities creating difficulty for transport infrastructure planning. Gärling and Steh (2007:297), declare that another major difficulty arises due to the fact that authorities previously structured cities in such a way that it facilitates the use of private cars and authorities have focused on constructing larger roads and parking areas resulting in poor quality bus services operating in highly congested cities. Makeka

(2009:75) states the following:

“The challenge of a nuanced approach to city management is moving beyond the broad-brushed debates about density, nodes and corridors that tend to dominate public discourse on spatial planning. A great city requires leadership that is bold enough to respond to the characteristics of each particular situation, and not standardise to the lowest common denominator in order to simplify the planning process.”

Jacobson and Forsyth (2008:73) point out that several of the best-loved places created are the outflow of decades or even centuries of development and redevelopment. What may seem as a development that appears fast is mostly the product of years of planning. According to Jacobson and Forsyth (2008:52) during the past few decades in the United States, Transit Orientated Development (TOD) has been implemented as a popular and influential planning concept. TOD is an approach to create pedestrianised, diverse neighbourhoods in the centre of cities and suburban location by integrating public transport investments and land use patterns. TOD projects have been implemented in a range of cities across the United States. Policy makers, urban planners, and transit officials commonly use TOD principles.

TOD focuses on creating a land use pattern that accommodates transportation choice, which is increasingly important in the complex lifestyles and business practices of today, and also supports the idea of creating sustainable mobility trends through less dependence on non-motorised transport (Curtis et al., 2009:3). According to Cervero (2009:23), TOD is a practical model to integrate transportation and land use in several developed cities of the world. When different modes of public transport are integrated, they provide the user with a variety of options. Abbott (2012:258) supports this statement, claims that the United States has been extremely successful in implementing an infrastructure development model (IDM), and is a country, which is relevant to African urban conditions and therefore provides good solutions.

In response to the poor implementation of transport infrastructure systems and the lack of integration of them, the South African Cities Network project has been established (South African Cities Network, 2009:5). The main focus of this project is to provide South African cities with information to guide the development of cities relating specifically to public transport into a safer, more effective, efficient and sustainable environment. It aims to advance the knowledge of operating complexities with regard to public transport infrastructure and to guide cities in restructuring inefficient human settlements through Transit Orientated Development (TOD) and public space interventions (South African Cities Network, 2009:5).

## Modal interchanges

A transport network is made up of a combination of modal interchanges and links where modal interchanges can be described as physical places such as transport terminals or stations, which functions as a connection between the links of a network being roads, highways and railway lines (Booz and Company, 2012:31). According to Dorf (2005:83-6) modal interchanges or transfer facilities are locations where commuters change from one mode of transport to another.

Rodrigue et al. (2006:126) defines modal interchanges or transport terminals as points of interchange within the same modal system which enables a continuous movement of passengers. They are mostly central and transitional locations within the movement of passengers. According to OECD (2012:16) interchanges facilitate the transfer between different transport routes and also link various modes of transport together. Lambas and Monzon (2010:323) argue that interchanges therefore are key elements for improving mobility in metropolitan cities as an increase in multi-stage trips are taking place in cities. Interchanges make transfers short, easy, comfortable and make the use of public transport more attractive to the public. There is however a lot that needs to go into the planning and construction in order to create good quality interchanges.

Urban planning forms a key element in creating sustainable, well-functioning cities, transport systems and facilities are highly dependent on good urban planning practices. Urban planning is a diverse practice creating a framework for shaping places, managing collective concerns of shared spaces, urban environments, seeks to capture and respond to the various ways of experiencing, encountering and valuing the urban environment (Maclaren, 2003:83). Maclaren (2003:70) further explains that a city, which is orderly and spatially integrated, fulfills the functional necessities of urban life and this can be produced through physical planning according to logically derived laws of urban development. Urban planning became necessary in order to control and co-ordinate the disorganised development patterns that existed. It is crucial in order to obtain the best use of land for the well-being of the public and to create an environment, which is aesthetically pleasing, healthy, safe and convenient with regard to economic, social, aesthetic and physical factors (Botha, 2013).

The relationship between modal interchanges and land value property developers, when asked what the most important element regarding the success of property development, would undoubtedly argue: location, location and location. This is because all property is exclusive in their location and different characteristics are apparent. For example their location to the city's prime retailing or office districts and transportation infrastructure (Maclaren, 2003:53). According to African Development Economic Consultants (2012:4), the upgrading of infrastructure systems have the potential to impact land use surrounding

transport arteries and the development opportunities tend to increase in such areas. Makeka (2009:77) strongly supports this view and indicate that the value of land is determined by what it can be used for as well as the accessibility.

Tian (2006:349) states however, that transportation infrastructure has a clearer impact on the economy in developing countries than the developed countries. The main reason for this is because transport systems are of lower quality in developing countries compared to developed countries and therefore the impact of transport facilities on property values are not the same globally. Development does not just take place as a simple reflex to the increase in demand but it also takes into account the profit-seeking criteria, which exist in this industry (Maclaren, 2003:11). Development will only happen if all the criteria of engagement of the various elements are met. Separate terms of engagement are determined through negotiating in markets such as the conditions for a developer to develop on a landowner's land, the cost and conditions of money borrowed to developers, and between developers and contractors in determining development costs. If no terms of engagement can be concluded, development will most probably not occur (Maclaren, 2003:11).

Transit corridors connect various transit stations and usually have different development patterns and market strengths from high-density residential, office, and retail development in city centres to sub-urban neighbourhoods that often consist of more spread out single-use development (United States Environmental Protection Agency, 2013:3). Suzuki et al. (2013:147), argue that although cities in developing countries have looked towards the integration of transit and land use as a more sustainable method, there are still many barriers that need to be overcome for its potential to be fully utilised. These barriers include: Short term goals for improving mobility dominating longer term goals of creating sustainable urban development; fragmented institutional frameworks creating difficulties for regional collaboration at city-level, cross sector integration; and regulatory barriers that limit real estate to take full advantage of the implementation of the transport investment.

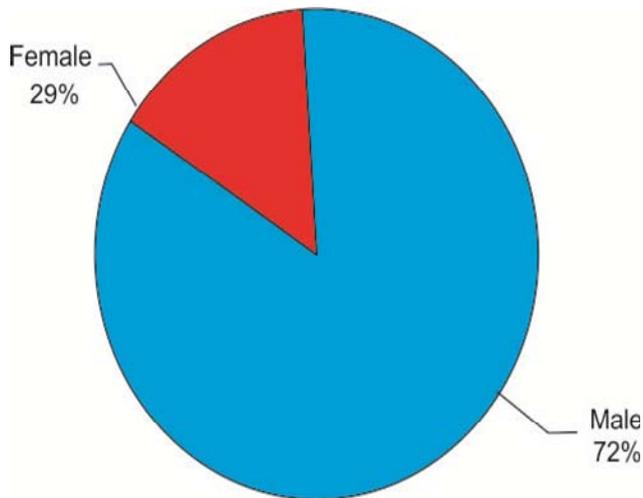
The design of transit stations is often aimed at reducing construction costs and therefore the location of these stations are placed in the midpoint between thorough fares and the acquisition of expensive land takings and interference are kept to a minimum (Suzuki et al., 2013:158). This results in development opportunities surrounding transit terminals being marginalised as authorities overlook them in order to reduce costs. Martin et al. (2013:367) also support this view and emphasise the importance of spatial planning, strategy effectiveness and the proper working of the city's authority as well as the implementation of effective rules and regulations to support development.

United States Environmental Protection Agency

(2013:3) argues that the infrastructure required surrounding transit stations depends on the context within which the development will take place as well as other factors such as the capacity of already existing facilities and the future development that potentially will take place. In more densely populated urban areas, future development requires improving the infrastructure capacity but this can however be costly. Infrastructure facilities must be already in place for new development to take place. In the case of weak real estate markets, it will also attract developers and investors, as less capital is required to obtain the necessary infrastructure. The problem however is that many authorities are shifting these responsibilities to developers (USEPA, 2013:3). U.S Environmental Protection Agency (2010:4) explains that another problem exists due to the existence of sprawling land use patterns, which increase costs for providing services, as it is less efficient to provide these services to dispersed developments. Authorities are therefore hesitant to provide services, which are key requirements for property development.

According to Maclaren (2003:86) 'free riding' is another associated problem, which leads to longer delays in the implementation of the required infrastructure for development. For development to take place, the necessary infrastructure is required such as trunk drainage, an additional road or a bridge to obtain access to a site. Many developers tend to wait for an original developer to implement such infrastructure so as to 'free ride' on their investment. Where development profitability is certain, developers tend to wait for other developers to carry pioneering risks and ultimately make it a less risky investment for themselves. Suzuki et al. (2013:152) argue that urban planners should focus on improving service provision so that greater densities surrounding transit stations can be accommodated. This can be ensured by addressing problems such as institutional and regulatory deficiencies, which include low levels of autonomy, accountability, inadequate cost recovery, and a lack of professional management. Maclaren (2003:86) explains that problems arising due to 'free riding' should be addressed through the state taking responsibility and supplying the necessary infrastructure through general taxation or special levies. U.S Environmental Protection Agency (2010:4) states that smart growth can also be incorporated into planner's strategy to ensure compact development, which means fewer resources and fewer costs incurred to build new roads and other necessary infrastructure. Maclaren (2003:90) claims that where the risk for developers are too great 'pump-priming' public spending to obtain the necessary infrastructure or fiscal inducements to subsidise developments should be implemented as techniques to promote development.

It is plausible to say that infrastructure is necessary for development to take place and if it is lacking, development will most probably not occur. Developers before committing to any opportunity will first have to



**Figure 2.** Percentage of male and female respondents.

obtain the necessary capital. The capital required therefore makes this the most important component in the development process. From the above, it is plausible to argue that careful planning is essential when deciding where to locate a modal interchange. It is also evident that planners often endeavour to obtain the best location for interchanges from a transport perspective, but fail to incorporate other potential aspects that can be gained from such facilities. The capital required to implement an optimal interchange can however create stumble blocks.

## RESEARCH METHODOLOGY

Two different data sources were used as part of the analysis of this article. This includes primary and secondary data. The primary data for this study comprises the data obtained through the questionnaires sent out via e-mail. The questionnaires were sent to all professionals with relevant background in the planning of transportation systems and modal interchanges in South Africa. Professionals mainly consisted of practitioners with experience in the planning of transportation systems, individuals who are owners of companies and individuals in the academia. The questionnaire was distributed in 2013 and the primary data was obtained over a period of 4 weeks.

The secondary data for this study comprises data obtained from: e-journals, internet websites, magazines, newspapers, conference papers and books. Due to the sensitivity being a highly specialised field, it was important that credible data was obtained from the quantitative research. The questionnaire was therefore only distributed to individuals who are employed by credible South African organisations with a certain standard of knowledge, experience of transport systems and modal interchanges. The questionnaire was also distributed to individuals in the academia who have adequate knowledge in this field.

The study was based on a quantitative research methodology and was supported from secondary data through conducting a survey of the literature so that the hypothesis could ultimately be tested for the sub-problems. The primary data was conducted by distributing questionnaires which were subsequently analysed and interpreted.

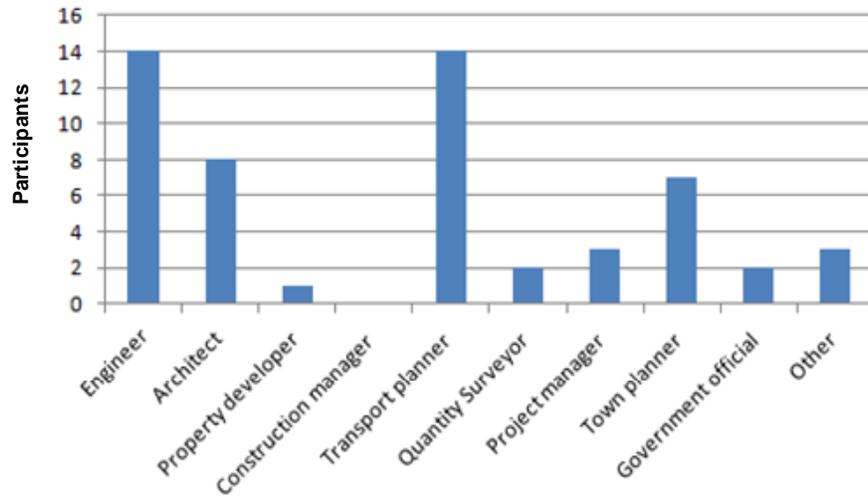
The questionnaire was distributed in an electronic format with an attached copy of the questionnaire. A questionnaire was used to evaluate the hypotheses of each sub-problem. The questionnaire consisted of five main sections that were based on the findings discussed in the literature review. The questions were structured to test the responses in a quantitative manner and the questionnaire was kept short and straight to the point as possible to attract more participants and ultimately obtain a more accurate indication. A total of 108 questionnaires were sent out and a total of 55 questionnaires were returned.

## RESULTS

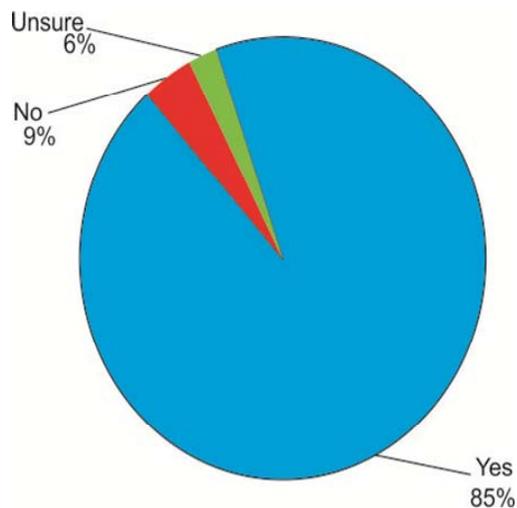
The larger the sample size, the better the results of the study. This study reveals that the small sample size of this study necessitates the need for further qualitative interviews to be conducted for a more accurate result. The results from the questionnaire are contained in this section and will be set out according to the same order as the questionnaire. The questionnaire was divided into 5 Sections namely: Section 1: Demographic information, Section 2: Perceptions relative to the role of transport planners in the process of planning transportation systems, Section 3: Perceptions relative to the role of transport planners in the process of planning modal interchanges/transport terminals, Section 4: Comments, Section 5: Personal details.

Figure 2 indicates that the majority (70.4%) of the participants was male and the minority (29.6%) was female. Figure 3 indicates the professions of the various participants within the building environment. It is notable that not one construction manager took part in the questionnaire. This is however understandable as Construction Managers in general do not get involved with the planning of transport systems and modal interchanges and therefore often do not have a detailed understanding of these matters. The lack of construction managers participating in the questionnaire will therefore not have a significant influence in the accurateness of the results obtained. It is also notable that more than half (51.9%) of the respondents were engineers and transport planners. Table 1 indicates the number of years the 54 respondents have been involved in the building environment industry. Figure 4 indicates the number of respondents who were familiar with urban transport systems/urban migration. This determined whether the respondents possessed any knowledge in this field. It is notable that most (85%) of respondents were familiar.

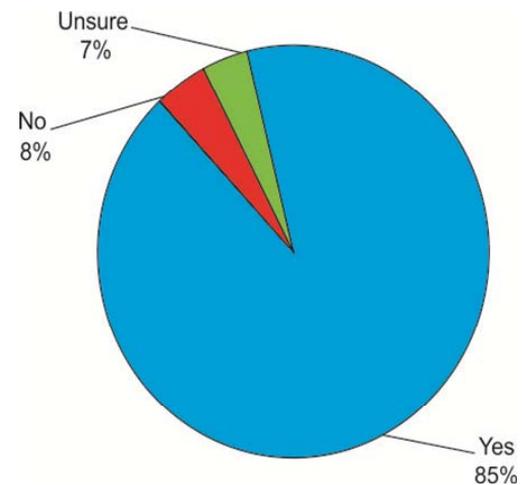
It is perceived that transport planners consider the aspects of increasing community accessibility to retail facilities, integrating transport with public areas and reducing pollution as the least important compared to the other aspects. Two of these three aspects as mentioned earlier do promote integrative transport systems (Table 2). With a mean score of 3.91, it is also apparent that respondents to some extent and also to some extent believe that lack of funding restricts the ability to optimally integrate transport systems with urban settlement



**Figure 3.** Profession or industrial association of respondents.



**Figure 4.** The percentage of respondents familiar with urban transport systems.



**Figure 5.** The percentage of respondents familiar with modal interchanges/transport terminals.

patterns (Table 3). Table 4 indicates the perceptions of the respondents relative to the extent that transport planners follow a multi-disciplinary approach towards urban transport planning. The mean score of 3.56 indicates that respondents believe that planners follow a multi-disciplinary approach towards urban transport planning to some extent to major extent.

Figure 5 indicates the number of respondents who were familiar with Modal interchanges/transport terminals. This determined whether the respondents possessed any knowledge in this field. It is notable that most (85%) of the respondents were familiar. It is however significant that all of these aspects have a mean score of between 2.91 and 3.88 and therefore at least fall

within the category of less than important to important (Table 5). Table 6 indicates transport planners consider the various aspects that the respondents believe important during the planning process of modal interchanges/transport terminals. It is notable (with a mean score of 4.04) that it is considered important by transport planners to create a secure environment for the travelers and commuters. Ranked second most important by the respondents was the aspect of taking the unique requirements of each interchange into consideration during the planning procedure. It is also notable that the least important aspect considered by transport planners according to the respondents was the aspect of creating investment opportunities, with the mean score of 3.37 (ranked 9<sup>th</sup>). Obtaining public opinion with a mean score

**Table 1.** Number of years of involvement of respondents.

Time of involvement (Years)	Total No.	Percentage of respondents (%)
<5	13	24
≥ 5 to < 10	10	18.5
≥ 10 to < 20	11	20.4
≥ 20 to < 30	10	18.5
≥ 30 to < 40	7	13
≥ 40	3	5.6
Grand total	54	100

**Table 2.** Integrating transport systems with the surrounding land-use.

Response (%)	Response (%)						Mean score	Rank
	U	1	2	3	4	5		
Reducing traffic congestion	2	0	2	11	33	53	4.39	1
Integrating transport with Urban settlement patterns	2	0	15	18	31	35	3.87	4
Reducing travel time	2	2	5	22	36	33	3.95	3
Increasing community accessibility to retail facilities	5	0	18	29	27	20	3.52	6
Integrating transport with public areas e.g. sports facilities	7	2	15	38	18	24	3.49	7
Minimizing cost of transport systems	4	7	7	20	31	40	3.74	5
Ensuring optimum flow systems	2	2	5	15	25	51	4.20	2
Reducing pollution	4	15	27	25	16	13	2.85	8

**Table 3.** External factors limiting the ability to integrate transport systems with urban settlement patterns.

Response (%)	Response (%)						
Statement	U	SD	D	N	A	SA	MS
A planner endeavours to integrate transport with urban settlement patterns are overruled by controlling policies	7	4	20	9	49	11	3.47
Funding restricts the ability to provide an efficient integration of transport systems with urban settlement patterns	4	0	13	13	42	29	3.91

Key: Unsure = U, Strongly Disagree = SD, Disagree = D, Neutral = N, Agree = A, and Strongly Agree = SA.

**Table 4.** Extent which transport planners follow a multi-disciplinary approach.

Response (%)						
Unsure	Not.....Very					Mean score
U	1	2	3	4	5	
5	5	7	33	27	22	3.56

**Table 5.** Aspects considered by transport planners regarding the location of modal interchanges/transport terminals.

Response (%)								
Aspect	Unsure	Not .....Very					Mean score	Rank
	U	1	2	3	4	5		
Adjacent urban development	7	2	11	15	33	31	3.88	1
Sufficient municipal services for development	2	2	9	24	36	27	3.79	2
Involving commercial property developers in the planning process	2	4	20	27	27	20	3.41	6
Considering development regulations and processes for areas adjacent to interchanges	4	2	4	33	38	20	3.74	3
Zoning and potential re-zoning opportunities for commercial development	4	4	13	25	34	21	3.57	5
Considering the commercial development potential of a particular location	4	4	17	19	35	22	3.58	4
Providing development and/or financial incentives to commercial developers	2	11	29	25	24	9	2.91	7

of 3.39 was also considered to be less important compared to other aspects listed. It is however significant that all of these aspects have a mean score of between 3.37 and 4.04 and therefore at least fall within the category of less than important to important.

**FINDINGS AND DISCUSSION**

The purpose of this study was to investigate the role of transport systems, facilities and their

potential in enhancing economic development opportunities. The aim and objectives of this study were:

1. To discover whether transport systems capture the full needs of urban migration patterns,
2. To determine whether certain critical factors limit the implementation of the planned transport systems. To investigate whether development surrounding modal interchanges is marginalised. To identify if modal interchanges reach optimal functional potential.

The sub-problems of the study evolved around the concept of transportation systems and facilities in South Africa not meeting their optimal potential. The findings in relation to the objectives of the study are as follows:

1. Non-integrative transport considerations are prioritised above considerations, which promote integrative transport systems,
2. The lack of funding and overruling policies, limits the implementation of the desired transport systems,

**Table 6.** Aspects considered by transport planners regarding the planning of modal interchanges/transport terminals.

Aspect	Response (%)						Mean score	Rank
	Unsure U	Not..... 1	2	3	4	Very 5		
Considering the unique context of each interchange	4	2	5	25	38	25	3.83	4
Public opinion	2	4	13	44	18	20	3.39	8
Optimising socio economic development potential	2	5	13	33	29	18	3.43	7
Ensuring optimal convenience for	2	2	9	20	33	35	3.91	3
Obtaining inputs from other professional disciplines	2	2	16	16	31	33	3.78	5
Taking the unique requirements of each interchange into	2	0	7	18	40	33	4	2
Creating a secure environment for travelers	2	0	13	15	26	44	4.04	1
Providing a welcoming environment for the traveler	2	2	13	27	27	29	3.70	6
Creating investment opportunities	2	9	18	25	18	27	3.37	9

3. Development and urban planning practices do consider the requirements for development surrounding modal interchanges,

4. Planners of modal interchanges to a degree do also consider modal interchanges holistically in South Africa.

Transport systems and facilities also contribute a great deal to a country's growth, economy, and present ideal opportunities to affect surrounding urban space. Transport systems and facilities therefore also have the potential to act as catalysts for surrounding development and commercial property development, if approached correctly.

Research has shown that it is essential to integrate transport systems with surrounding land use in order to ensure their optimal performance. However, there are certain external factors such as lack of funding and overruling policies that restrict the implementation of the desired transport systems. It appears as if the influence from

authorities is larger than perceived. Capturing the full potential that modal interchanges are capable of generating and the potential of development surrounding modal interchanges should be considered an integral part in the planning phase. Research has also indicated that transport planners do in fact to a certain degree, consider modal interchanges in their totality. However, there is still substantial room for improvement. Planners of transport systems need to be more aware of the importance as well as the benefits that come with integrative transport systems and modal interchanges. By seeking solutions that involve smart thinking, economically beneficial results will be needed to be obtained for transport systems and modal interchanges. A wider spectrum of stakeholders should therefore be involved in the planning stage to ensure a more holistic approach towards transport systems and modal interchanges. It is essential that planners maintain a mind-set that will create sustainable long-term urban development patterns and not

only focus on the short-term goals such as improving mobility.

Political influence concerning decisions is substantial and it is therefore critical that politicians and transport planners in South Africa obtain the same perspective relative to the requirements of an optimal transport system. It is also important that transport planners do not become politically driven, as this will have a negative impact on the end product. Conferences should be conducted on a regular basis so that stakeholders can buy into the vision of creating transport systems that endeavour to enhance the overall urban environment and create opportunities for growth and sustainability in South Africa. This will also provide opportunities for the input from different disciplines and will produce continual improvement of systems and ways of thinking. Challenges that are encountered should also be discussed to ensure that best practice solutions are achieved.

Integrative transport should not be perceived as

an isolated component in South Africa, but rather as a component that has the potential to solve various other problems simultaneously. If integrative transport systems are not emphasised more transport infrastructure will become less efficient and this will result in the private taxi industry taking control. It is also important that segmented professional training be reduced and that manuals do not solely focus on problems such as congestion, accidents and throughput but includes aspects that support the facilitation of integrative transport systems.

Modal interchanges are integrated part of any transport system and it is therefore important that these facilities are planned in advance and take into consideration the contextual factors of each transport corridor in South Africa. Commercial property developers should also be included from the beginning of the planning process so that facilities can reach optimum development potential. Property developers should furthermore partake in the design and location of modal interchanges in order to facilitate optimum development potential and attract developers in South Africa. Public funding for modal interchanges can be reduced by acquiring potential developers to invest in these systems from an early stage. Incentives such as tax reductions can be provided to attract developers and planners should therefore take the responsibility of adopting a holistic approach to ensure that conditions, which will stimulate development are provided.

## Conclusion

Modal interchanges should no longer be considered merely as passageways for commuters in South Africa and the full potential of these facilities needs to be explored by investigating the perceptions of planners of internationally successful interchanges. Planning therefore, forms a fundamental part of the success of transport systems as well as modal interchanges in South Africa.

## Conflict of Interest

The author(s) have not declared any conflict of interests.

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