THE IMPACT(S) OF ENCLOSED NEIGHBOURHOODS ON TRANSPORT PATTERNS WITHIN THE CITY OF TSHWANE

by

TRUDI SMIT

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Supervisor: Doctor Karina Landman
Co-Supervisor: Professor Christo Venter

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UNIVERSITY OF PRETORIA
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Full names of student: **TRUDI SMIT**
Student number: **26195004**

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ABSTRACT

The occurrence of enclosed neighbourhoods has become a common phenomenon in South African cities from the early 1990's as a direct impact of crime rates and the fear of crime. While the enclosure of neighbourhoods provide an immediate (temporary) solution to combatting crime within existing neighbourhoods, a number of (unintentional) socio-physical and spatial consequences occur.

Numerous research have been done to establish the social implications of enclosed neighbourhoods in South African cities, including the City of Tshwane, while very little research have been done to establish the physical impacts of enclosed neighbourhoods on the urban form, its impact on the transport patterns or travel behaviour and consequently the increased greenhouse gas levels being emitted into the atmosphere.

This study establishes the occurrence and extent of enclosed neighbourhoods within the City of Tshwane to create a generic classification system to establish the practical impact of enclosed neighbourhoods on urban form. In-depth case studies into two enclosed neighbourhoods and a neighbourhood located adjacent to an enclosed neighbourhood were conducted to examine the impact(s) of these neighbourhoods on transport patterns, travel behaviour and greenhouse gas emissions.

An overview of movement networks and an investigation of the influence of the built environment versus self-selection were launched to gain insight into the different factors that might contribute to travel behaviour in general, in addition to neighbourhood enclosures and neighbourhood re-design. This brought forth the very important relationship between land use management, transport planning and the different governing bodies and policies.

The ultimate results gained from the study of selected neighbourhoods clearly showed that a number of factors influence individual transport patterns and travel behaviour, such as self-selection, initial neighbourhood design and population growth. The study did however reveal that through enclosing neighbourhoods and altering its initial neighbourhood design and movement networks, travel behaviour, transport patterns and inevitably greenhouse gas emissions for the specific neighbourhoods and adjacent neighbourhoods will unavoidably change and thus impact negatively (in some ways) on the urban form.

More specifically, the results gained from this study showed that those residing within and adjacent to enclosed neighbourhoods travel greater distances on an average day, compared to those who live in an 'open' neighbourhood. Consequently, the average household residing within an enclosed neighbourhood emit on average up to (approximately) 4600 g/km CO_2 per day more than households residing in 'open' neighbourhoods, which result in enclosed neighbourhoods emitting up to 26% more CO_2 than 'open' neighbourhoods.

Despite these results, residents of these enclosed neighbourhoods believe that the enclosure of these once 'open' neighbourhoods do not affect their travel behaviour or any traffic congestion and proclaim that their number one priority is safety which they believe is achieved through the enclosure.

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List of Acronyms

CSIR	Council for Scientific and Industrial Research
CO_2	Carbon dioxide
CoT	City of Tshwane
DoT	South African Department of Transport
B&B	Bed and Breakfast
GEF	Global Environment Facility
GHG	Greenhouse gas
GIS	Geographic Information System
IDP	Integrated Development Plan
MCA	Multi-Criteria Analysis
RSDF	Regional Spatial Development Framework
SAPS	South African Police Service
SDP	Site Development Plan
TIS	Traffic Impact Study
UNDP	United Nations Development Programme
USA	United States of America
VKT	Vehicle Kilometres Travelled

Definitions

Cross sectional research – "The study of a particular phenomenon (or phenomena) at a particular time, i.e. a 'snapshot'." (Saunders, Lewis and Thornhill, 2007: 595)

Duplex – "An apartment with rooms on two floors with and inner staircase" (Oxford 1974: 275)

Erf – "…land in an approved township registered in a deeds registry as an erf, lot plot or stand or as a portion or the reminder of any erf, lot, plot or stand or land indicated as such on the general plan of an approved township, and includes any particular portion of land laid out as a township which is not identified for a public place…" (Transvaal Province, 1986)

Enclosed neighbourhood – "...enclosed neighbourhoods are concerned with restriction of access to existing public roads." (Landman, 2007a: 140) "Enclosed neighbourhoods refer to the existing neighbourhoods that have controlled access through gates or booms across existing roads." (Landman, 2006: 137)

Gated community – "...a physical area that is fenced or walled off from its surroundings, either prohibiting or controlling access to these areas by means of gates or booms. It does not refer only to residential areas, but may also include controlled access villages for work (office parks) and/or recreational purposes." (Landman, 2006: 136-137)

Mixed method research – "...the combination of at least one qualitative and at least one quantitative component in a single research project or program..." (Bergman, 2008: 1)

Movement networks – "...public right-of-way networks, accommodating land-based movement by a range of movement modes. Earlier guidelines have referred to "movement networks" as "road layouts." (CSIR, 2000: 5.1: 1)

Open neighbourhood – An open neighbourhood in this study refers to a neighbourhood that is not fenced off and access to and movement through the neighbourhood is not hindered or controlled.

Security villages/estates – "...refers to private developments where the entire area is developed by a private developer. These areas/buildings are physically walled or fenced off and usually have a security guard. The roads within these developments are private, and in most cases, the management and maintenance is carried out by a private management body." (Landman, 2006: 137)

Townhouse – "…privately owned single-family dwelling unit which is a part of, and adjacent to other similarly owned single-family dwelling units…"

"Typically, a townhouse has a Strata Title, i.e. a type of title where the common property (landscaped area, public corridors, building structure etc.) is owned by a corporation of individual owners and the houses on the property are owned by the individual owners." (Gonzales, 2010)

CHAPTER 1: INTRODUCTION

1. 1. Introduction

> *"Everyone has the right to walk from one end of the city to the other in secure and beautiful spaces. Everybody has the right to go by public transport. Everybody has the right to an unhampered view down their street, not full of railings, signs and rubbish."*
>
> - Richard Rogers

Arguably the greatest influence on the urban form in the twentieth century was the emergence of the automobile. Once thought to be a great revolutionary solution to urban travel and conquering the distance-time barrier, resulted in the decentralisation of our cities and suburban sprawl, making the usage of public transport less viable and less desirable (Brown, Morris and Taylor, 2009). In the case of South African cities, decentralisation and urban sprawl was further encouraged due to apartheid planning principles making public transport even less viable (Du Plessis *et al,* 2003). This resulted in the divorce of land use management and transport planning, leaving these two disciplines to compete against one another instead of working together to create more liveable urban areas.

Apart from automobiles and other modes of private transportation having a profound effect on the urban form, another factor has influenced the way existing neighbourhoods function and appear, and new neighbourhoods and developments are planned – crime. Although planning and designing to ensure secure and safe environments have been relevant throughout history (Hopper and Droge, 2005: 1), a trend have recurred within South Africa causing once open and friendly neighbourhoods to become fortified entities of fear (Landman, 2007a).

The effects of crime and the fear of crime in South African cities have resulted in the physical altering of the urban form in the form of gated communities. Gated communities, in all its various forms, further have an influence on transport patterns, travel behaviour and subsequent increase in greenhouse gas (GHG) emissions (Landman, 2006: 139). This trend known as 'gated communities' are yet another wedge in the reconciliation of land use management and transport planning. It is therefore that the main aim of this study is to establish the extent of the physical impact of enclosed neighbourhoods (a specific sub-form of gated communities) on the functioning of cities

in a South African context, with special emphasis on the alterations of transport patterns and the subsequent increase in GHG emissions due to the alterations.

Numerous research have been done by authors such as Landman, Lemanski, Durington, Jürgens and Schönteich to establish the social implications of enclosed neighbourhoods in South African cities, but very little research have been dedicated to the physical impacts of enclosed neighbourhoods on the urban form, or its impact on the transport patterns and consequently the increased GHG levels being emitted into the atmosphere.

This chapter will thus further explain and establish the rationale and contextual background to this study, introduce the assumptions, limitations and scope of the study, state the research question, sub-questions and objectives and provide an overview of the structure of the dissertation.

1. 2. Background

South African neighbourhoods are characterised by fortified dwellings consisting of fences, walls, palisades and burglar bars. Although these elements ensure a less attractive facade, it sends out a clear message: South African citizens are living in constant fear of crime or the perception of crime and insecurity (Landman, 2007a: 134-135).

Apart from home owners securing their dwellings and fortifying their property, another trend in South Africa occurred: Gated communities. Gated communities are a common phenomenon in many countries over the world (Landman, 2007a: 134), but in South Africa, the emergence of gated communities became evident from the early 1990s, as a direct impact of extremely high crime rates and the fear of crime (Landman and Schönteich, 2002: 71; Lemanski, 2006: 397).

In South Africa, gated communities can be classified into two prominent types. These are security villages/estates and enclosed neighbourhoods. Security villages/estates refer to private developed areas that are walled off with access control and are not limited to residential developments (Landman, 2006: 137), while enclosed neighbourhoods specifically refer to existing neighbourhoods with access control to restrict access to public roads (Landman, 2006: 137; Landman 2007a: 140).

Although it has been established through various sources that crime and the fear of crime is the main motivator behind choosing to reside within a gated community (Jürgens and Landman, 2006: 118; Lemanski, 2006: 400; Durington, 2009: 76), when looking at the crime statistics for South Africa it is clearly understood why. In South Africa the overall crime level began to increase between the mid-1980s and early 1990s, and as a result, the levels of violent crimes such as rape, murder, hijackings and break-ins have increased. The murder statistics for South Africa is especially alarming. During 2005, the rate reflected that fifty-seven (57) out of every hundred thousand victims died in violent crime incidents which were almost six times higher than that of the United States of America for the same year (USA) (Davis, Du Plessis and Klopper, 2005: 16). Although there has since been a decrease in this rate, the numbers are still alarming.

Many people believe that residing within a gated community provides safety and a solution to crime, but they do not realise the socio-spatial impacts of gated communities, and more specifically, enclosed neighbourhoods (Landman, 2006: 133).

On this note it must be pointed out that gating or enclosing neighbourhoods is not a fundamental solution to crime, but merely a symptonic solution. The symptom, being crime, has multiple solutions or “courses of action”, one being gating or enclosing neighbourhoods which is a quick fix solution and apparent results are immediate. The correct or fundamental solution, however, is one that takes time. These include skills development, job creation, respect for the law and adequate law enforcement/policing etc. (Landman, 2007b: 13-14).

However, finding the right balance between short term solutions and working on long term solutions is a battle that South Africa has been fighting for a long time. As Jody Kollapen, chairperson of the South African Human Rights Commission noted in 2009, South Africa is faced with numerous issues such as poverty and racism that can lead to crime, and we need to resolve these issues before our country can be a truly healthy and safe society. But at the same time, we cannot wait for these issues to be resolved and therefore safety needs to be improved on a daily basis (Ehlers and Tait, 2009: 24). This is why short term solutions such as gated communities are becoming more evident in cities across South Africa.

Although it is easy to understand the reasoning behind enclosing neighbourhoods from a safety point of view, it is important to acknowledge that enclosed neighbourhoods are a controversial issue, with not just physical impacts, but also complex social impacts and facets. This can, in most cases, be illustrated by a person's opinion regarding the enclosure of neighbourhoods, as it is, for the greater part, influenced by the answer to the following question: 'On which side of the racial divide did you (by default) find yourself during the previous dispensation?' The answer to this question is result of a very common social psychological phenomenon known as prejudice (Baron and Byrne, 2004: 209).

According to Baron and Byrne (2004: 209), prejudice can be defined as a negative attitude towards member of a specific group based only on their membership to that group. In a South African context with reference to the previous dispensation, this would typically be based on race. While it has been established that prejudice is based on attitudes, it is important to note that discrimination only occurs once these attitudes escalate to actions (Baron and Byrne, 2004: 211). In South Africa, as in many other countries, blatant discrimination (and discriminating legislation and practices) such as segregation of race and ethnicity has been abolished, certain attitudes and actions continue in a more subtle manner (Baron and Byrne, 2004: 211).

At this stage it is important to state that opinions regarding the enclosure of neighbourhoods can be ascribed to the realistic conflict theory. This theory states that prejudice and subsequent discrimination develops from direct competition between different social groups over scares and valued resources (Baron and Byrne, 2004: 215). Although apartheid was based on racial segregation – distancing the 'whites' from the 'blacks' - today it takes on the form of distancing the 'rich' from the 'poor' to ensure safety and security.

Although the realistic conflict theory and its applicability to enclosed neighbourhoods and it's much more radical prequel – apartheid - is more complicated, intricate and dynamic as stated above, it is important to understand that the majority of white South African's who lived during apartheid were made to believe that there was nothing wrong with segregation of race and the perception that one race is superior to all the others. Media were censored and propaganda and teachings in school ensured that white citizens were kept in the dark regarding the inner workings of apartheid and they believed that blacks and communism was the enemy of the day. This account is not to exempt any blame but to simply state that to some level these white citizens were

aware that apartheid was not right, but due to a combination of ignorance, a feeling of superiority and perhaps fear, the majority accepted apartheid as the rule of the day (Van Niekerk, 2010). Even after the abolishment of apartheid, insecurities and prejudice engraved into the minds of white South Africans have in some cases been inherited by the next generation (Jansen, 2008).

The above prejudices and insecurities regarding the white population group's future, role and identity (Fabiyi, 2006; Hook and Vrdoljak, 2001; Dirsuweit and Wafer, forthcoming; Bénit-Gbaffou, 2007), coupled with the fear of the 'unknown' and subsequent safety risks, a social categorization known as the 'Us-versus-Them Effect' became evident, which in some cases (and perhaps subconsciously) became one of the motivators for the enclosing of neighbourhoods within South Africa, to insure that the 'in-group' (social group to which an individual is self-perceived to belong to) are protected against the 'out-group' (any other person that do not belong to the group to which an individual is self-perceived to belong to)(Baron and Byrne, 2004:222).

When looking at the apartheid spatial planning legislation, it is clear that the aim was to segregate racial groups with a disproportionate distribution of infrastructure and services towards those areas allocated to white citizens (Berrisford, 2011: 248; Lemanski, 2006: 418). With this in mind it is understandable why residents from 'traditional' white neighbourhoods and suburbs chose to segregate themselves once again when feeling vulnerable and unsafe – it is what they know.

This study acknowledge the important influence of these social impacts laced with historical injustices, but are largely focussed on the physical detrimental impacts of enclosed neighbourhoods to the urban form. This research is thus dedicated to establish the extent of these physical impacts.

1. 3. Rationale

Enclosed neighbourhoods have various (non-intentional) impacts on the urban form of our cities, including spatial fragmentation and segregation which results in the sustainability of our urban areas being threatened (Landman, 2007b: 4).

Seeing as enclosed neighbourhoods are existing neighbourhoods consisting of public roads and public open space that has been walled off to benefit only a small population,

the closing of these public roads may have an impact on movement patterns of not only the individuals residing within the enclosed neighbourhood, but more so on the greater population living outside this neighbourhood who cannot gain access to these “public streets” and are forced to only use higher order roads (Landman, 2007b: 7; Landman 2007a: 139).

The original movement patterns which is a result of the original neighbourhood design, are no longer functioning, resulting in increased travelling times, traffic congestion, discomfort for pedestrians and cyclists and a higher concentration of GHGs along higher order or arterial roads (Landman 2007a: 139). At this stage it should be acknowledged that original neighbourhood designs do not all conform to being ‘open’ networks as some are designed specifically to close-off or isolate neighbourhoods from unnecessary or unwanted through-traffic. ‘Open’ road and ‘closed’ road networks and their impact on travel behaviour and the significance of converting these into enclosed neighbourhoods are discussed in great detail in chapter 4.

According to Curtis (2008: 104), urban transport cannot and should not be treated in isolation to land use and the environment, for this would result in unsustainable development. Neighbourhoods are planned with movement networks (road layouts) that take into consideration the physical movement and reticulation of people, goods and services within a neighbourhood, in order to achieve convenient, efficient, affordable and safe movement of these aforementioned people, goods and services (CSIR, 2000: 5.1: 3).

It is therefore, in most cases, speculated that by closing off a neighbourhood, the movement network within that specific neighbourhood is disrupted and will have a direct impact on the movement networks around the said neighbourhood. Zhao (2010: 236) further establish that by changing transport patterns or movement networks, a dramatic growth in trip distance will occur. This will have a direct effect on the growth rate of CO_2 and other GHG emissions caused by private (and public) transport.

It is therefore that the need to do a thorough study on the impact of enclosed neighbourhoods on movement networks and environmental factors such as pollution has arisen. This study will aim to establish whether and to what extent enclosed neighbourhoods are changing our cities’ urban form and functioning, with specific emphasis on the City of Tshwane.

1. 4. Assumptions, scope and limitations

For this study, it is assumed that the majority of individuals and households residing within enclosed neighbourhoods chose to live there and it was not forced upon them as in accordance with Rationalisation of Local Government Affairs Act, 1998 (Act No. 10 of 1998) Chapter 7 Section 45(b) that states that "...at least two thirds of the persons affected by the circumstances giving to the application approve of the restriction..." (Gauteng Provincial Legislature, 1998: 21).

The study aims to measure the physical impact by establishing the additional distances and time residents spend on roads due to the formation of enclosed neighbourhoods, the amount of additional GHGs being emitted into the atmosphere due to the additional distances and time spent on roads, and the travel behaviour and perception of households living in different neighbourhoods (enclosed neighbourhoods, adjacent-open neighbourhoods and open neighbourhoods) of enclosed neighbourhoods.

The above was achieved by conducting travel surveys and interviews with households in the abovementioned neighbourhood types. Due to time limits that included the interview period limitations due to school and public holidays that had to be adhered to in order to gain accurate travel behaviour and transport patterns, and time frames set out by the UNDP, DoT and GEF, only four samples with populations of only thirty five each could be surveyed. This means that the study was limited to investigate the impacts of enclosed neighbourhoods on the residential population inside or adjacent to the enclosed neighbourhood, and not on other through traffic users such as individuals living further away or general road users such as heavy vehicles or minibus taxis.

Due to the above mentioned financial and time constraints, the study did not involve doing a cross-sectional study across many neighbourhoods within the City of Tshwane, but rather an in-depth study if a small group of neighbourhoods. Therefore, the generalisations taken from this study will be limited.

The surveys furthermore could not be conducted during school holidays as the normal travel patterns are interrupted during this period. The surveys were conducted within the first school term that ran from 12 January to 25 March 2011.

The above stated time limitation, number of samples and size of population make the study susceptible to critique and criticism regarding the depth of the research, but the

findings are supported by literature and other recorded secondary sources that ensure its validity.

1. 5. Research question and sub-questions (research objectives)

Research Question: What is the impact of enclosed neighbourhoods on transport/traffic patterns within the City of Tshwane?

- **Sub-Question 1**: What is the extent and frequency of enclosed neighbourhoods within the City of Tshwane?

- **Sub-Question 2**: What is the impact of enclosed neighbourhoods on travel behaviour of individuals residing within an enclosed neighbourhood?

- **Sub-Question 3**: What is the impact of enclosed neighbourhoods on travel behaviour of individuals residing within an open neighbourhood adjacent to an enclosed neighbourhood?

- **Sub-Question 4:** What is the impact of enclosed neighbourhoods on traffic congestion and GHG emissions in and around enclosed neighbourhoods?

- **Sub-Question 5:** What does legislation, transport and land use policies, plans and principles say about sustainable urban form with regards to planning in general, and does it support enclosed neighbourhoods, or not?

1. 6. Literature review objectives

To ensure an increased understanding with regard to the literature review for this study, a number of literature review objectives were set aside. These are:

Objective 1: The trend of enclosing neighbourhoods within the City of Tshwane
Objective 2: Transport networks and its significance within a neighbourhood
Objective 3: The influence of urban structure characteristics on travel behaviour
Objective 4: The relationship between vehicle transport and GHG emissions

Objective 5: Policies, strategies, plans and legislation relating to the transport - land use relationship

These objectives aim to answer the research question and sub-questions while ensuring the study follows a logical pattern.

1. 7. Overview and structure of the remainder of the thesis

Chapter 1 of the study (as read up to this point) forms the introduction of the thesis. The background, rationale and need for the study are explained. It further contains the assumptions, limitations and scope, research question and sub-questions of the study and literature review objectives. The remainder of this chapter also gives a structural overview of the study.

Chapter 2 of the study contains the research methodology and study outline and sets a guide or logical framework for the rest of the study. The research methods chosen are justified within this chapter and its applicability to the study is explained.

Chapter 3 deals with the phenomenon of enclosed neighbourhoods in the City of Tshwane and explores the occurrence, extent, and number of enclosed neighbourhoods within the city. GIS methods were used to illustrate the location of these enclosed neighbourhoods and by assessing each enclosed neighbourhood through a set of criteria, the theoretical impact on the transport patterns and travel behaviour thereof were measured. This chapter further explains why these neighbourhoods are located where they are, and why their location and existence pose a problem for the sustainability of the City of Tshwane.

Chapter 4 looks at movement networks of road networks evident within the City of Tshwane, how these road networks are synonymous with suburbs influence travel behaviour and whether and to what extent the enclosing of neighbourhood would theoretically influence travel behaviour and transport routes.

Chapter 5 looks at the different legislation, policies, plans, programmes and frameworks regarding enclosed neighbourhoods, land use management and transport planning and the relationship of these disciplines with each other and the urban form.

Chapter 6 of this study revolves around the specific enclosed neighbourhoods that have been chosen and the context of these neighbourhoods is explored. An analysis of the primary quantitative data captured through the field-work were analysed and explained, and the impact of these neighbourhoods on the urban form was established. Furthermore, the extent of the impact of enclosed neighbourhoods in terms of GHG emissions was explored. These results were furthermore compared to literature and theories regarding enclosed neighbourhoods and changes in the urban form.

Furthermore, this chapter looks at the primary qualitative data captured through the fieldwork. The travel diaries and opinions of the residents of the various neighbourhoods that have been chosen regarding the impact of enclosing of neighbourhoods were analysed and compared to the quantitative data. This was done to establish whether there is a relation between the actual physical impact as reflected by the qualitative and quantitative data and the opinions of the residents living in the respective types of neighbourhoods (enclosed, open-adjacent and open neighbourhoods). Findings are revealed by comparing the results from the chosen study areas.

Chapter 7 contains the synthesis, conclusion of the study and recommendations with regards to enclosed neighbourhoods and their impacts on the built environment.

The research process and structure of chapters are illustrated below:

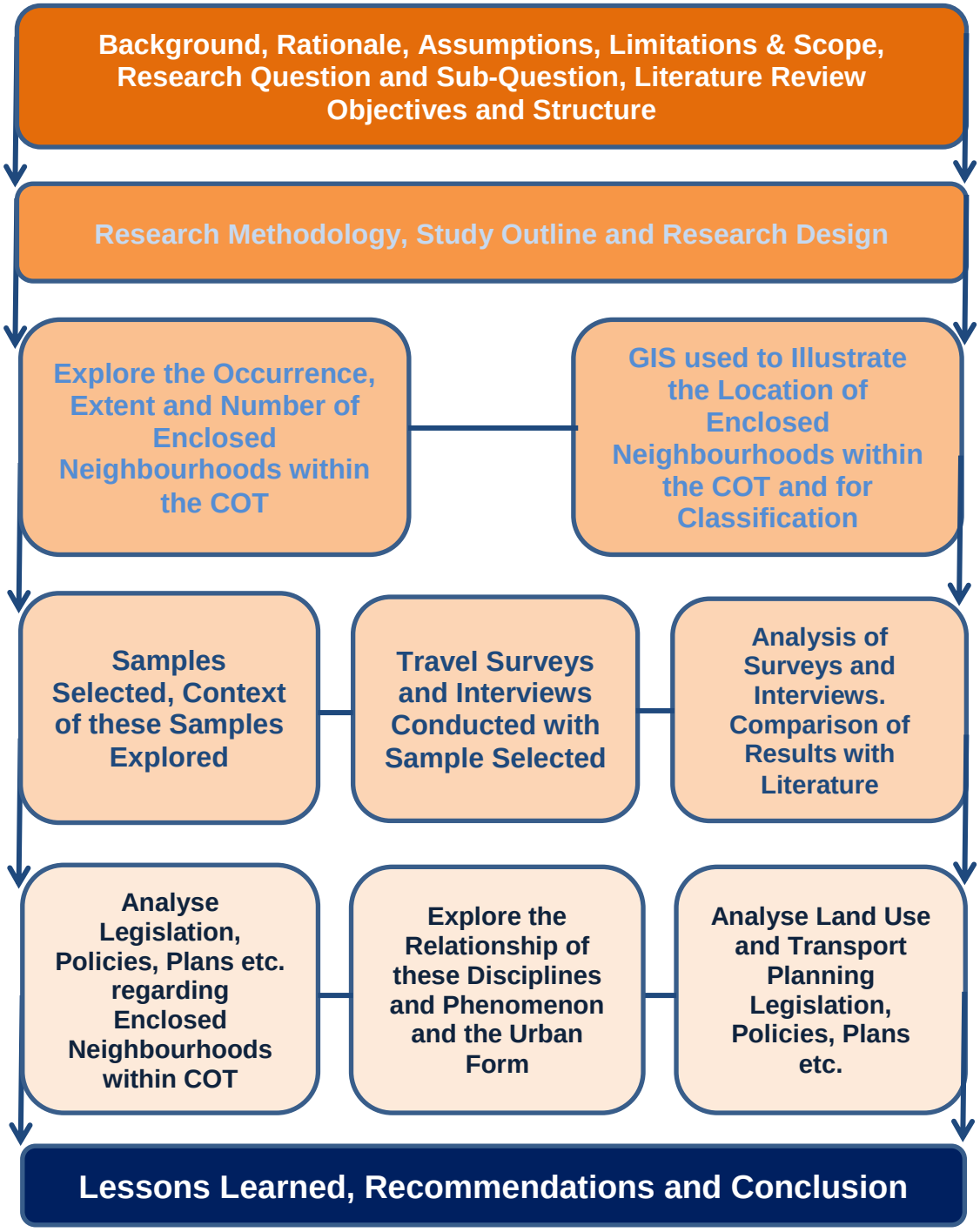


Diagram 1: Research process and structure of chapters

CHAPTER 2: METHODOLOGY

2. 1. Introduction

Research design is very important for any research or project conducted as it sets the framework for the research to take place in. It reveals which decisions have been made to conduct the research, what will be studied, how it will be studied, which population have been chosen to study and reveal which methods and procedures was chosen to study the relevant subject (Babbie, 2005: 86-119).

The purpose of this chapter is to link theoretical knowledge with methods of collecting empirical data and guide the research to ultimately answer the research question and sub-questions through reaching the objectives as listed in Chapter 1.

2. 2. Research design and methods

2. 2.1 Mixed method approach

Mixed method research essentially means to adopt more than one research method that vary from a mix of quantitative methods, a mix of qualitative methods or a mix of quantitative and qualitative methods (Brannen, 2008: 53). This study will take on a mixed method research approach as it will comprise of qualitative as well as quantitative methods and components (Bergman, 2008: 1).

Mixed method designs can take on various forms, with two types of mixed method designs better known and frequently used. These are parallel- and sequential mixed method design (Teddlie and Tashakkori, 2009: 26). The main differences between these two designs are:

- **Parallel mixed method design**. This design is also known as concurrent or simultaneous designs. When using this design, the quantitative and qualitative components of the study will occur simultaneously or with a time gap between them. The two types of components do not follow on one another, and aims to answer related aspects of the same research question or questions (Teddlie and Tashakkori, 2009: 26).

- **Sequential mixed method design**. When using this design, the quantitative and qualitative components of the study follow one another in a logical or chronological order or in phases. The research question for each phase may differ, but are related to one another (Teddlie and Tashakkori, 2009: 26-27).

This study makes use of a parallel mixed method design as the qualitative aspects and quantitative aspects both look to answer the same questions, but with making use of different approaches. According to Creswell, Plano Clark and Garrett (2008: 68) this parallel mixed method design can further be classified into triangulation design and concurrent embedded design.

Triangulation design comprises of quantitative and qualitative data that are collected and analysed in parallel, and then combined to form a better understanding and to compare the results (Creswell, Plano Clark and Garrett, 2008: 68). This will form the basis of this study, and can be illustrated as follows:

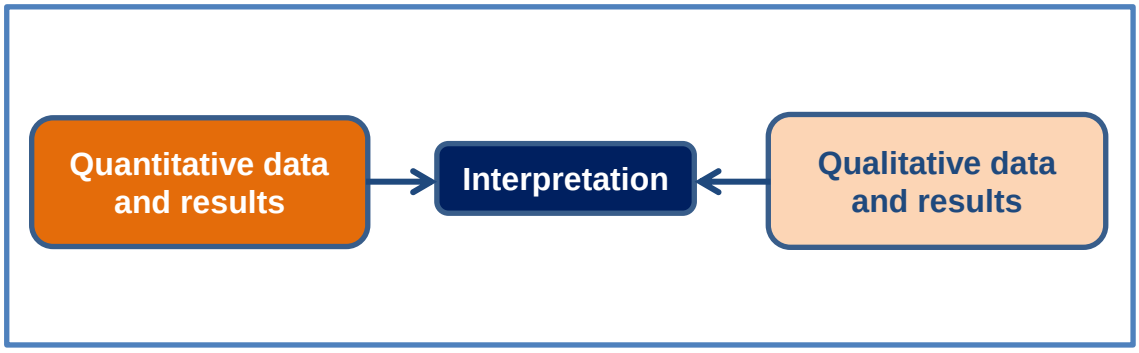


Figure 1: Triangulation Design (Creswell, Plano Clark and Garrett, 2008: 68)

By taking all of the above into consideration and taking the qualitative and a quantitative research methods that best suit this study, a unique research design was created and followed to accommodate and include all the quantitative and qualitative aspects of the study.

2. 2.2 Research design

This study mainly comprise of cross sectional case studies with aspects of the study taking on a phenomenological approach. The case study serves as the qualitative component of the design, with relevant quantitative and qualitative data sources used to further explore this phenomenon (Teddlie and Tashakkori, 2009: 25).

A case study can be defined as an examination of people or units (such as a geographical entity) over a period of time or at a specific moment in time, and can be used to measure a universal set of features (Neuman, 2006: 29-30). It is further defined as a method of conducting research through an empirical investigation of a particular actual phenomenon using multiple sources of data, evidence and information (Robson, 2002 as sourced by Saunders, Lewis and Thornhill, 2007:139).

When making use of a case study to obtain data, the researcher may use one case study or make a comparison between a set of case studies (Neuman, 2006: 29-30).The case study has been defined as a 'systematic research tool' and an 'acceptable craft' (Yin, 1981: 58).

When conducting a case study, the researcher typically collects extensive data on the individuals or phenomenon under question that may include interviews, observations, documents, past records, etc. The context of the case is also very important and factors such as history, the socio-economic climate and the physical environment are also typically taken into consideration (Leedy and Ormrod, 2005: 135). Yin (1981: 58; 2004: 2) emphasises the fact that case studies can be done using either qualitative or quantitative evidence, or a combination of both which may take on an array of forms as highlighted by Leedy and Ormrod. Collecting primary data is integral to any case study, as this allows for direct observations and data collected in a natural environment to answer questions such as 'what?', 'why?' and 'how?' that cannot always be observed from secondary data (Yin, 2004: 4). These methods will certainly necessitate the triangulation of these multiple sources of data, as has already been identified as an integral part of this research design.

This study first looks at the occurrence of enclosed neighbourhoods within the City of Tshwane, which is the phenomenon being studied as part of the case study. This was done by making use of Geographic Information System (GIS) mapping to illustrate the location, number and extend of enclosed neighbourhoods within the City of Tshwane (Du Toit, 2009: 3). Thereafter, a theoretical classification system was created by rating each enclosed neighbourhood according to a set of criteria to establish its impact on transport patterns and travel behaviour within the city.

The above was done with the assistance of the City of Tshwane's City Planning, Development and Regional Services Department who supplied the relevant GIS data and who allowed me to survey all the applications received for the restriction of access

to public places for safety and security purposes in terms of the Rationalisation of Local Government Affairs Act (Act 10 of 1998).

After establishing the extent of enclosed neighbourhoods within the City of Tshwane, two enclosed neighbourhoods were selected as case studies. These are Lynnwood Glen Estate and Eldoraigne X18 Security Village. Furthermore, two additional neighbourhoods were selected to form part of the case studies which consist of an open neighbourhood, Lynnwood Glen, directly adjacent to Lynnwood Glen Estate, and an open neighbourhood, Doringkloof (not located near any enclosed neighbourhoods) to act as the control group. Refer to figure 2 below:

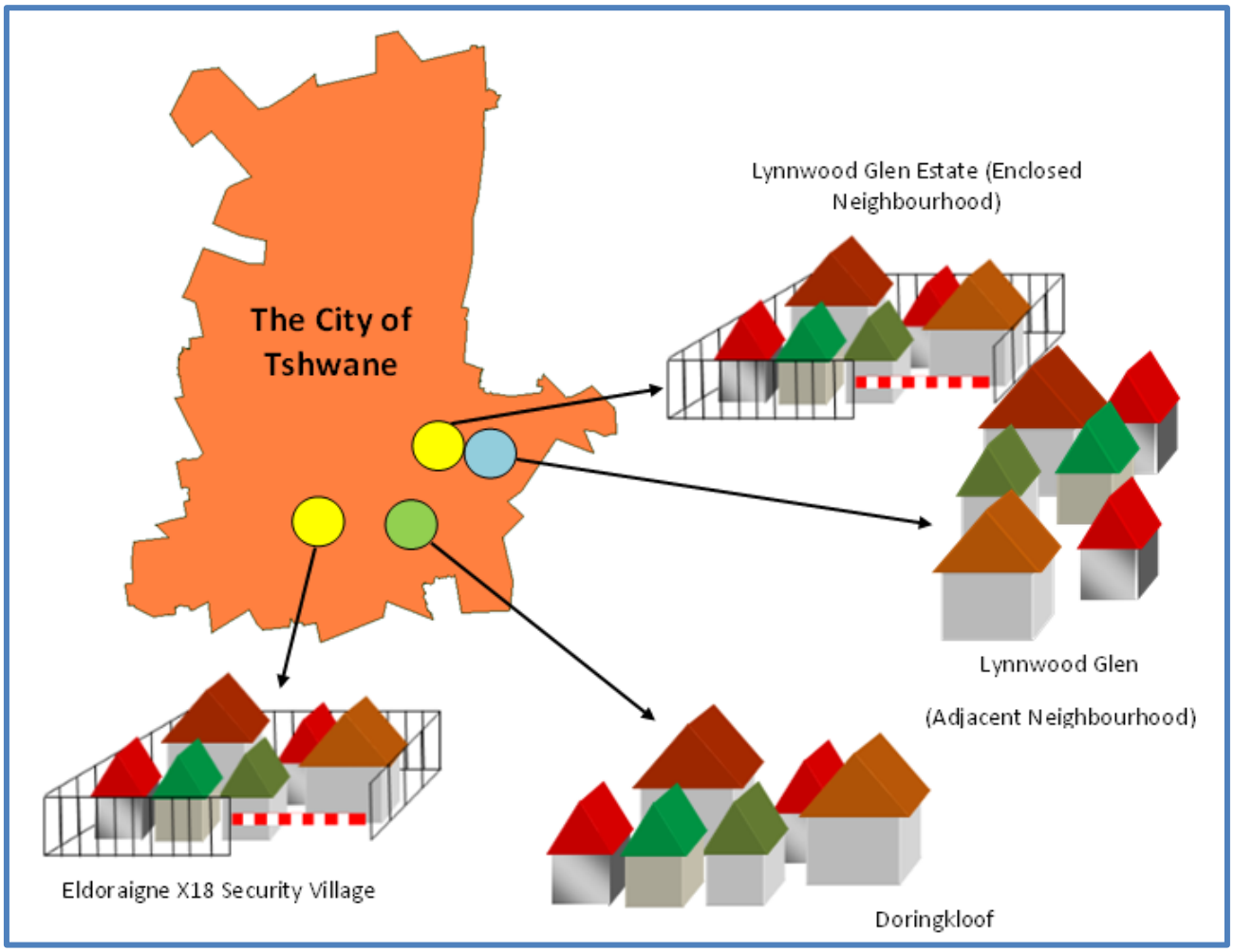


Figure 2: Graphic illustration of the method of selecting case studies within the City of Tshwane

Each of these neighbourhoods has been studied in detail and assisted questionnaires/interviews have been conducted with 35 households residing within each of these neighbourhoods. Travel behaviour and patterns have been established by assisting each of these households to complete a two day retrospective travel diary. This allowed us to investigate the following for each household:

- Vehicle Kilometres Travelled (VKT)
- Travel time
- Trip rates for different purposes
- Modes used
- GHG emission levels

This ensured that data collection over a specified period of time to take a glimpse into the phenomenon and its complexities, further supports the case study approach.

The qualitative side of the questionnaire explores the individual's perception, residing in each of the above neighbourhoods (enclosed neighbourhoods, adjacent-open neighbourhoods and open neighbourhoods not located within close proximity of an enclosed neighbourhood) of enclosed neighbourhoods, and its impact on the following:

- Transport patterns;
- Travel behaviour;
- Traffic congestion;
- Travel time;
- Air pollution; and
- Convenience.

For results and analysis of the fieldwork section of the research, refer to chapter 6. The different types of questionnaires and travel diary are attached as Annexure A to D.

In order to form a better understanding of the phenomenon of enclosed neighbourhoods and subsequent traffic behaviour alteration, and to be able to verify the fieldwork data, a content analysis was done. This was an on-going process throughout the study consisting mainly of literature review and by examining other secondary data sources. According to Neuman (2006: 31), a content analysis is used to analyse information in various forms of material such as audio, visual and published sources. When using content analysis as a research technique, it is important to approach the data sources and material in an orderly and systematic fashion to ensure consistency and legibility. Leedy and Ormrod (2005: 142) go on to state that a content analysis requires a great amount of planning and enough time should be devoted when a proper analysis is necessary.

The policy document review (content analysis) aspect of the study included studying recorded or published material, for example journals, textbooks, newspapers,

magazines, books, legislation, bills, policies, strategies, plans and even audio and visual material (Babbie, 2005: 328). By doing this, the validity of enclosing neighbourhoods when looking at municipal transport planning and land use management strategies and its goals and principles for sustainable urban neighbourhoods was assessed.

By integrating the findings from both the case study and content analysis, and analysing and processing the integrated data, conclusions and interpretations of the findings were made which formed a better understanding of the phenomenon and the impacts of enclosed neighbourhoods on the urban form and more specifically the impacts thereof on transport networks and travel behaviour. This approached is more commonly referred to as cross-case evidence analysis (Yin, 1981: 62) which tries to apply the unique nature of a specific case to a number of cases. The challenges with this approach is that in many cases, accurate, yet slim generalisations are applied to a number of cases which is not the most desirable outcome when investigating a wide phenomenon. However, some opportunities exist using this method such as in selective cases (such as studying a unique phenomenon i.e. enclosed neighbourhoods in a unique setting i.e. the City of Tshwane) where a critical factor or two (such as travel behaviour, transport patterns and GHG emissions) which are of great importance to the outcome of the study is examined to set up a set of guidelines for future in-depth research (Yin: 1981: 63).

2. 2.3 Data Collection, Analysis and Presentation

As mentioned above, the bulk of data collection was done by means of questionnaires, travel diaries and by studying published material, legislation, municipal- policies, strategies and plans. It is thus necessary to make a distinction between different forms of data, i.e. primary and secondary data.

Primary data refers to data captured directly by the researcher by making use of methods such as interviews, interactions and questionnaires (as highlighted above) (Leedy and Ormrod, 2005: 162). Primary data will comprise the majority of the data analysed, as it is the most reliable (Leedy and Ormond, 2005: 189). Secondary data refers to the re-analysis of primary data, and can be found in various forms including legislation, textbooks, journal articles and newspapers, which are mostly published material (Babbie, 2005: 286).

In order to collect the primary data, a professional survey company, Consulta, was contracted to undertake the data collection and capturing (although making use of a professional survey company is uncharacteristically of research at this level, it was stipulated as a prerequisite as per the bursary agreement with the UNDP, the DoT and the GEF). As mentioned in the previous section, in order to obtain secondary data, textual analysis and literature reviews were conducted.

Data have been organised and analysed based on the Creswell data analysis spiral (Leedy and Ormond, 2005: 150-151). This method consists of four steps:

1. Organising the data through the creation of databases, filing all collected information, and the breaking down of large units into smaller components;
2. Examination of data to obtain an overall understanding of the data collected, and dividing the data into possible categories;
3. Classifying all the data collected into categories and subcategories to get a sense of repetitive thoughts;
4. Integration and synthesising of collected data to make it simple to interpret.

Through analysing the data on this principle, consistency and legibility is ensured. The risks of confusion and repetition are minimised when working in such an orderly and well-planned manner.

Data presentation was done by compiling a written report in a narrative and personal style, combined with graphs and tables which better summarised certain findings. In some cases, figures were used to graphically illustrate a principle or finding (Leedy and Ormond, 2005: 97).

The data was furthermore presented in terms of the research question. The research question is divided into sub-questions and by answering the sub-questions in a categorised fashion, the research question were directly or indirectly, answered (Leedy and Ormond, 2005: 285).

The use of sub-questions and their respective answers guides the reader through the study, and will ensure that focus is placed on certain topics of discussion throughout the study. A short summary at the end of each section provides the reader with the linkage to the research question and its sub-questions. Through a proper presentation of the data, conclusions serve as evidence that were drawn from the data.

2. 3. Conclusion

The research design serves as a guideline for this study. It furthermore provides the study area supervisor and reader with an understanding of the extent of the study, and explains the patterns of thought in detail.

This research design and methods is sufficient in explaining the intentions of this study and it will indeed serve as a map to the final destination that is the study findings.
The matrix below set out the research design in practical terms. This research design is unique in many ways, as there are no fixed recipe when undertaking case studies as each case study proves to be unique with its own set of challenges and opportunities.

Sub-question	Objective	Design	Data collection	Analysis
Sub-question 1	The trend of enclosing neighbourhoods within the City of Tshwane	**Qualitative** • Content analysis • Policy document review • Structured interviews	**Primary data** • Interviews with Municipal officials and enclosure professionals • Observations **Secondary data** • CoT GIS data • Actual enclosed neighbourhood applications	• Multi criteria analysis • Performance matrix • Classification
Sub-question 2 **Sub-question 3**	Transport networks and its significance within a neighbourhood	**Parallel Mixed-method** • Cross sectional case study • Triangulation • Surveys • Narrative • Statistical	**Primary data** • Opinion based questionnaires • Travel survey/diary • Observations **Secondary data** • Policies and guidelines • Journal articles • Other academic & technical sources	• Demographic statistical comparison • Travel behaviour statistical comparison
Sub-question 2 **Sub-question 3**	The influence of urban structure characteristics on travel behaviour	**Parallel Mixed-method** • Cross sectional case study • Triangulation • Surveys • Narrative • Statistical	**Primary data** • Opinion based questionnaires • Travel survey/diary • Observations **Secondary data** • Policies and guidelines • Journal articles • Other academic & technical sources	• Opinion-based statistical comparison • Travel behaviour statistical comparison
Sub-question 4	The relationship between vehicle transport and GHG emissions	**Quantitative** • Statistical	**Primary data** • Travel survey/diary **Secondary data** • Policies and guidelines • Journal articles • Academic & technical sources	• CO_2 calculations and comparisons
Sub-question 5	Policies, strategies, plans and legislation relating to the transport-land use relationship	**Qualitative** • Narrative	**Secondary data** • Legislations • Policies and guidelines • Journal articles • Other academic & technical sources	• Policy overview • Content analysis

Diagram 2: Research design matrix

CHAPTER 3: THE TREND OF ENCLOSING NEIGHBOURHOODS WITHIN THE CITY OF TSHWANE

3.1 Introduction

When casually engaging in a conversation with a group of people, and the topic of discussion relates to the enclosing of neighbourhoods, it is immediately evident that the group can be divided into two groups: those who are for the enclosing of neighbourhoods, and those who are against it.

The reasons behind the support or opposing of enclosing of neighbourhoods may vary, and very often these reasons cannot be proved or disproved by hard facts, but one fact, however, is cast in stone: the enclosing of neighbourhoods has become a trend in South Africa, and it has an impact on the urban form of our cities. The question now remains, to what extent?

During the *Urban Futures Conference* that was held in Johannesburg 10 – 14 July 2000, Dr Karina Landman (2000: 2) raised the exact same question: are gated communities (including enclosed neighbourhoods) the future that will shape the urban form, or is it only a temporary phenomenon? More than ten years later, and it seems that the evidence are showing that the frequency of gated communities (which includes enclosed neighbourhoods) are increasing at an alarming rate.

Global and local studies have highlighted a number of social issues relating to enclosed neighbourhoods, some of which are unique to the South African context. These include:

- The ‘re-establishment’ of an apartheid tradition of separating different groups of people, which in this case can be associated with income groups or class (Landman, 2007b: 5; Lemanski, Landman, and Durington, 2008: 135; Landman, 2007a: 135; Jürgens, and Landman, 2006: 112; Sanchez, Lang and Dhavale, 2005: 283);
- The infringement of each citizen’s constitutional right to freedom of movement (Republic of South Africa, 1996); and
- Indirect control over the social environment by affecting property prices positively within the enclosure, and negatively outside (Sanchez, Lang and Dhavale, 2005: 283).

Physical concerns such as the altering of transport or movement patterns and the altering or destruction of a functional relationship between transportation and land use and travel behaviour due to enclosed neighbourhoods within South Africa have been raised (Landman, 2007b: 5; Lemanski, Landman, and Durington, 2008: 134), but little in-depth research on this matter exists.

A popular argument for the enclosing of neighbourhoods often relates to the reduction of crime within that specific area (Van Zyl, 2010; Versluis, 2010) which some authors argue is only temporary (Landman and Liebermann, 2005: 23) or simply displaced (Lemanski, Landman, and Durington, 2008: 151).

Either way, the enclosing of neighbourhoods are merely a symptomatic solution to crime, it only brings temporary relief to one specific 'infected' area, whereas the cure lies in the fundamental solution which includes skills development, job creation, respecting the law, poverty alleviation, proper education and functional law enforcement (Landman, 2007b: 12). The problem with this is that the fundamental solution takes time to manifest and deliver results, and citizens are not willing to wait, as their livelihoods, safety and quality of life are in the balance.

The problem with the above, however, is that by enclosing neighbourhoods, the urban form is altered, which in turn results in unconstitutional and unsustainable (often unintentional) consequences.

This is also the case in the City of Tshwane. The rest of this chapter will thus deal with the occurrence, number, extent, status and location of enclosed neighbourhoods within the City of Tshwane to better understand this rapidly occurring phenomenon within the city's context.

3.2 The Occurrence of Enclosed Neighbourhoods within the City of Tshwane

As the rest of South Africa, and specifically Gauteng, the enclosing of neighbourhoods within the City of Tshwane has become an increasing occurrence. The reasons for this trend within the City of Tshwane are argued to be the same as for the rest of the

country: crime, the fear of crime, and the perception that crime is increasing (Landman and Schönteich, 2002: 71; Lemanski, 2006: 397).

The increase in the enclosure of neighbourhoods all over South Africa and specifically in the City of Tshwane can be linked to the increase in crime figures. When taking a brief look at the official crime statistics for South Africa during 2008/2009 and 2009/2010, it is clear that house robberies have increased during both these time periods (Burger, 2009: 3; Burger, Gould and Newham, 2010: 4). During 2008/2009, house robberies increased in all nine provinces and during 2009/2010, it increased by eight per cent (8%) over the country with 18 724 reported cases (Burger, 2009: 3; Burger, Gould and Newham, 2010: 4).

According to Breetzke (2010: 4), between the year 2002 and 2006, 980 000 incidents of crime (constituting all categories of crime[1]) were reported within the City of Tshwane. What is even more worrisome than this figure is the fact that a great percentage of crimes are never reported, making the true crime levels within the City of Tshwane, impossible to establish. A study conducted by Breetzke (2010: 4) within the borders of the City of Tshwane also indicate that over 30 per cent of crimes committed in the City of Tshwane are ascribed to common robberies and aggravated robberies, with a further 78 per cent of these crimes not reported.

From the above, one can, to a certain extent, understand why individuals and communities would want to enclosed their neighbourhoods. Crime and crime rates is a great driver behind the perception of security or insecurity of residents of the City of Tshwane (Breetzke, 2010: 3). Even if a household has never been a victim of crime, the fear of crime can be a good enough incentive to consider applying for or living within an enclosed neighbourhood (Landman, 2007a: 138).

Although safety and security is a desired outcome of the physical enclosure of a neighbourhood (Sanchez, Lang and Dhavale, 2005: 281), it is not necessarily the reality. According to Blakely and Snyder (1997) as referred to by Landman (2000a: 20), enclosed neighbourhoods in some cases does indeed experience a reduction in crime

[1] The South African Police Service (SAPS) have classified crime into five categories:
1. Contact crime;
2. Contact-related crime;
3. Property-related crime;
4. Crimes heavily dependent on police action for detection; and
5. Other forms of serious crime.

(Breetzke, 2010: 3)

rates, while other enclosed neighbourhoods only experience temporary reductions. In the worst case scenarios, there have been incidents where enclosed neighbourhoods have experience no changes in crime rates at all.

Coupled with the above, the issue of crime displacement becomes a great concern when closing off neighbourhoods (Landman, 2000a: 20; Landman, 2000b: 3). This leads to neighbouring areas being targeted or communities in close proximity to develop fear of being the new target. This leads to a snowball effect as a great number of areas are closed off within short distances of each other.

The City of Tshwane has raised the issue of crime displacement in a report with the title 'Gated Communities and the Restriction of Access to Public Places' (date unknown: 10), but defends the enclosure of neighbourhoods with regards to crime displacement as inevitable, no matter what crime prevention measure is taken at which location, stating that "The opinion is that the merits of private initiatives to prevent crime should far outweigh the criticism" (City of Tshwane, date unknown: 10). This is interesting as a report (Elphick, 2010) that can be accessed via the City of Tshwane's website, as well as an extraction from this report located under the "Crime Prevention" link clearly state that "This (gated communities) does not solve crime but shifts crime to areas where there are no gated communities. In actual fact it displaces crime" (Elphick, 2010: 27). From this it is unclear whether the City of Tshwane regards the displacement of crime an issue and concern when considering applications for enclosure, or not.

Although crime, fear of crime and fear of displaced crime is without a doubt greatly contributing to the increased occurrence of enclosed neighbourhoods within the City of Tshwane, it is not the only force behind it. It has been argued that the enclosure of neighbourhoods establishes a greater sense of community for those who support the enclosure (Landman, 2000a: 20; Landman 2000b; Landman, 2007a: 138; Landman and Du Plessis, 2007: 23; Lemanski, Landman, and Durington, 2008: 148). Others encourage enclosed neighbourhoods for the lifestyle and/or status gained by living within an enclosed neighbourhood. Enclosed neighbourhoods 'ensures' a protected, idyllic lifestyle, it influence property prices and insurance premiums beneficially (Landman and Du Plessis, 2007: 23; Lemanski, Landman and Durington, 2008: 151). This perception of safety and a protected lifestyle may in some cases leave residents extremely vulnerable. Residents might become at ease and negligent which could lead to them leave their homes or vehicles unlocked, which as a result make them easy targets (Landman, 2000a: 20).

Now that the rationale behind the enclosing of neighbourhoods have been addressed, it is important to focus on the amount of enclosed neighbourhoods that occur within the City of Tshwane in order to assess its impacts on the physical environment, and more specifically, the transport patterns and travel behaviour of individuals residing within the enclosed neighbourhoods as well as the city as a whole.

3.2.1 Applications and associated procedures and social consequences at a glance

According to a report compiled by the City Planning, Development and Regional Services Department (City of Tshwane, 2010: 183), since the implementation of the Rationalisation of Government Affairs Act, (Act 10 of 1998), the city received 99 applications to restrict access to neighbourhoods to create enclosed neighbourhoods. This figure however differs from a report compiled by the same department during 2003, which stated that the number of applications received at that particular point in time was approximately 120, excluding applications received and approved by the former councils (Pretoria, Centurion and Akasia/Soshanguve Councils) which formed what we now know as the City of Tshwane Metropolitan Municipality (City of Tshwane, 2003), and further differs from the reported 75 formal applications received by the City of Tshwane during 2006 (Landman, 2006: 138). Whichever the accurate number of applications may be, it is assumed that the number of enquiries regarding the creation of enclosed neighbourhoods is surely much greater, as these are not formally recorded. It is speculated that many enquiries made are not followed by a formal application as the application fees for such an application within the City of Tshwane are exceptionally high (from 1 July 2010 – 30 June 2011 application fees are R11 489,00 to R61 105,30, depending on size of enclosure) compared to those of the City of Johannesburg (R6 200,00 application fee with an additional R350,00 for every restriction point) (City of Tshwane, 2009:15; City of Johannesburg, date unknown: Annexure D).

It may be argued that the high application cost will deter neighbourhoods to apply for enclosure, as the cost associated with such an application does not end with the application fee. According to the 'Gated Communities and the Restriction of Access to Public Places' report compiled by the City Planning Division of the City of Tshwane (date unknown: 26), the application criteria and procedure to follow when applying for an enclosed neighbourhood, the following procedures needs to be adhered to, which

has a cost implication for the applicant, and in some cases professionals needs to be appointed in order to fulfil these criteria:

- A comprehensive memorandum and information relating to all the properties within the proposed enclosed neighbourhood;
- Proof of compliance of specifications regarding the nature of access structures, waiting space for vehicles, turning circles and technical standards for closures;
- A site plan, a site development plan (SDP) and building plans;
- The erection of access control structures (gates, booms, palisade fencing and control room);
- Maintenance of all structures erected by applicant;
- All cost involved in relocating or repairing service connections;
- Any additional engineering services required;
- Road signs within and outside the restricted area;
- 20% deposit of erection of access control structures cost;
- Establishing of a Section 21 company;
- A public liability insurance policy;
- Access control points must be manned by a gatekeeper/guard 24/7; and
- R2000[2] for lease of portion of road and road reserve for two years.

In order to accurately determine the cost and time spent to apply and implement an enclosed neighbourhood, the knowledge of an expert on the field of applying for enclosed neighbourhoods was sourced. Jan Malan, the founding member of a company called Streetsafe which provides a one-stop service for communities who wish to apply for an enclosed neighbourhood as stipulated by chapter seven of the Rationalisation of Local Government Affairs Act, Act No. 10 of 1998[3], supplied a detailed breakdown of the time and cost involved in establishing a typical enclosed neighbourhood consisting of two hundred houses and three entrances, within the City of Tshwane. This breakdown revealed that it takes approximately one hundred weeks from inception of the application procedure to the finalisation at an alarming total cost (including fees of professionals, service providers, fees to the City of Tshwane and construction fees) of more than R900 000.

[2] According to the 'Gated Communities and the Restriction of Access to Public Places' report compiled by the City Planning Division of the City of Tshwane (date unknown: 34), the lease of a portion of road for two years are calculated at R800, however, after further investigation and discussions with the founding member of Streetsafe, it was discovered that the current fee is R2000, although there is no official documentation where this have been recorded.
[3] For background and profile on Streetsafe, please visit http://www.streetsafe.co.za/index.html

The statement that was made earlier that the high cost of enclosing a neighbourhood may deter communities to apply seems more and more plausible, however, in reality this is not necessarily the case. The implication of these high costs is simply one of a renewed segregation within the City of Tshwane (Landman, 2007a: 135; Landman and Schönteich, 2002; Kruger and Landman, 2008). Segregation in this instance is determined by income or class and not necessarily by race. Those neighbourhoods who can afford the high cost of enclosure practice it, and in South Africa and the City of Tshwane, class and race is to a great extent still related, leaving the less fortunate vulnerable to displaced violence and crime (Lemanski, Landman, and Durington, 2008: 135). In essence, high cost of applications do not deter neighbourhoods from applying, it merely drives a wedge between the rich and the poor.

This is even of more concern when considering the number and location of enclosed neighbourhoods within the City of Tshwane. The next section will take a closer look at the extent of enclosed neighbourhoods and its possible consequences.

3.3 The Extent of Enclosed Neighbourhoods within the City of Tshwane

As stated earlier, the exact number of applications for the enclosing of neighbourhoods within the City of Tshwane is unclear. By means of an independent survey and by comparing the data collected with the data available from the City of Tshwane, the number of enclosed neighbourhoods found within the boundaries of the City of Tshwane is currently 71. These consist of any existing neighbourhood, or section of an existing neighbourhood that has been closed off by means of gates, booms, walls, palisades or any other obstruction, whether it be manned or operated by remote control. Of these 71 enclosed neighbourhoods, the legal status of the enclosed neighbourhoods was not taken into consideration. This is due to the fact that the impact of the enclosed neighbourhoods on the surrounding areas and traffic is not impacted by its status.

However, to form a clear picture of the context of enclosed neighbourhoods within the City of Tshwane, the legal status of these neighbourhoods will be briefly discussed.

3.3.1 The legal status of enclosed neighbourhoods within the City of Tshwane

According to the City of Tshwane (2010: 183), only twenty three per cent of all applications submitted has been approved and legally implemented. Twenty six per cent of applications have been approved, implemented but have since lapsed as according to the Rationalisation of Government Affairs Act, each neighbourhood has to reapply after two years. Twenty per cent of all enclosed neighbourhoods have not been approved but have been implemented illegally. This in effect means that forty six per cent of all enclosed neighbourhoods within the City of Tshwane are currently illegal.

This furthermore brings us back to the dilemma of high application fees as discussed under 3.2.1. The above statistics is a clear indication that even these enclosed neighbourhoods that are all situated in middle to high income areas are not deterred or even bothered by the application fees or procedures but are still in the fortunate position to afford the instillation cost of gates, booms, palisades, security guards and other security measures. This brings us to the question: if almost half of the enclosed neighbourhoods within the City of Tshwane are illegal, what does this imply for the monitor procedures of the City Planning, Development and Regional Services Department within the municipality? It can thus be concluded that illegal enclosure of neighbourhoods is a consequence of high application fees.

In order to further discuss the extent of enclosed neighbourhoods within the City of Tshwane and its implications for the urban form, aspects such as the location of enclosed neighbourhoods, the spatial overview of enclosed neighbourhoods and proximity and impact on road networks need to be examined. The rest of this section is dedicated accordingly.

3.3.2 The location of enclosed neighbourhoods within the City of Tshwane

The location of enclosed neighbourhoods within the City of Tshwane is significant as it plays a role in the level of impact it has on its direct environment (social, physical, spatial) and the urban form of the city as a whole. The location of enclosed neighbourhoods furthermore supplies insight in terms of the socio-economic climate of these areas as well as show a direct link to the city's historical context.

The process of surveying the enclosed neighbourhoods within the City of Tshwane posed some challenges. First of all, permission had to be obtained to gain access to a report entitled 'Report on the Status Quo of Restriction of Access (Gated Communities) to Public Places for Safety and Security Purposes in the City of Tshwane' (2010) containing information regarding the number of applications received by the municipality. This was a rather lengthy procedure as seven months passed before permission was granted to view this report. According to an official at the City of Tshwane Metropolitan Municipality, the information contained in the report was sensitive of nature and needed to be submitted to a number of officials and committees before it was to be made available to the public. The municipality did however supply the researcher with GIS data regarding the location of enclosed neighbourhoods within the City of Tshwane. This data however contained a number of enclosed neighbourhoods that was not in existence. This compelled the verification of the data by means of other data collection methods, which may also be referred to as a basic form of triangulation (Saunders, Lewis, and Thornhill 2007: 139).

This lead to first of all, the conduct, with permission from the municipality, of a survey of all the applications received by the municipality and its status of implementation (not necessarily the legal status) and secondly, by means of combining site visits with the aid of aerial photography from Google Earth and the aid of geographic information and aerial photos from the City of Tshwane's online GIS.

With the correct location of the enclosed neighbourhoods verified the need to visually illustrate the locations thereof arisen. This called for the assistance of GIS. According to Bolstad (2005: 1), GIS is "a computer based system to aid in the collection, maintenance, storage, analysis, output, and distribution of spatial data and information".

With the aid of ArcGIS, (GIS software) the coordinates of the enclosed neighbourhoods were plotted to specify the locations of the various enclosed neighbourhoods. The data supplied by the municipality also allowed for the visual representation of the area (in Ha) of the enclosed neighbourhood using the most basic methods to represent the spatial data visually (Bolstad, 2005: 16). Using both the verified spatial data and ArcInfo, the exact centre point location of the enclosed neighbourhoods were represented using the boundary as the City of Tshwane as a backdrop. First of all the area in Ha was calculated from the polygon features, which was then converted into point features to represent the areas more effectively. Using the calculated size enabled the representation of the areas as graduated symbols of five classes ranging

from 0.729017 - 10.788010 HA up to 78.292959 - 163.429012 Ha. This is illustrated by figure 3 below.

When looking at the map of the City of Tshwane below (figure 3), it is interesting to note that a vast majority of enclosed neighbourhoods is situated in the eastern region and southern region. In fact, 64 per cent of enclosed neighbourhoods are located in the eastern region and 28 per cent is situated in the southern region of the city of Tshwane.

The clustering of enclosed neighbourhoods within specific areas can be explained when looking back at the spatial history of the City of Tshwane. The greater Pretoria region (as the City of Tshwane was known as during the apartheid regime), was known as the ideal apartheid city, with reference to spatial planning (Horn, 2004: 319). This entailed the intentional segregation of neighbourhoods based on race, which resulted in the centrally located neighbourhoods to be reserved exclusively for whites, with non-white areas and areas of poverty located at the outskirts of the urban areas (Prinsloo and Cloete, 2002: 275; Horn, 2002: 310).

The eastern region of the City of Tshwane mainly comprise of former white residential areas, often referred to as the “new east”, with the southern region of the comprising of Centurion which are also made up of former white residential suburbs (Horn, 2004: 319). Even though spatial segregation has been abolished in South Africa, and racial integration (desegregation) in these former white neighbourhoods are occurring (even if at quite a measured pace), the income ratios of the former white areas and black areas have remained virtually the same (Horn, 2002: 318).

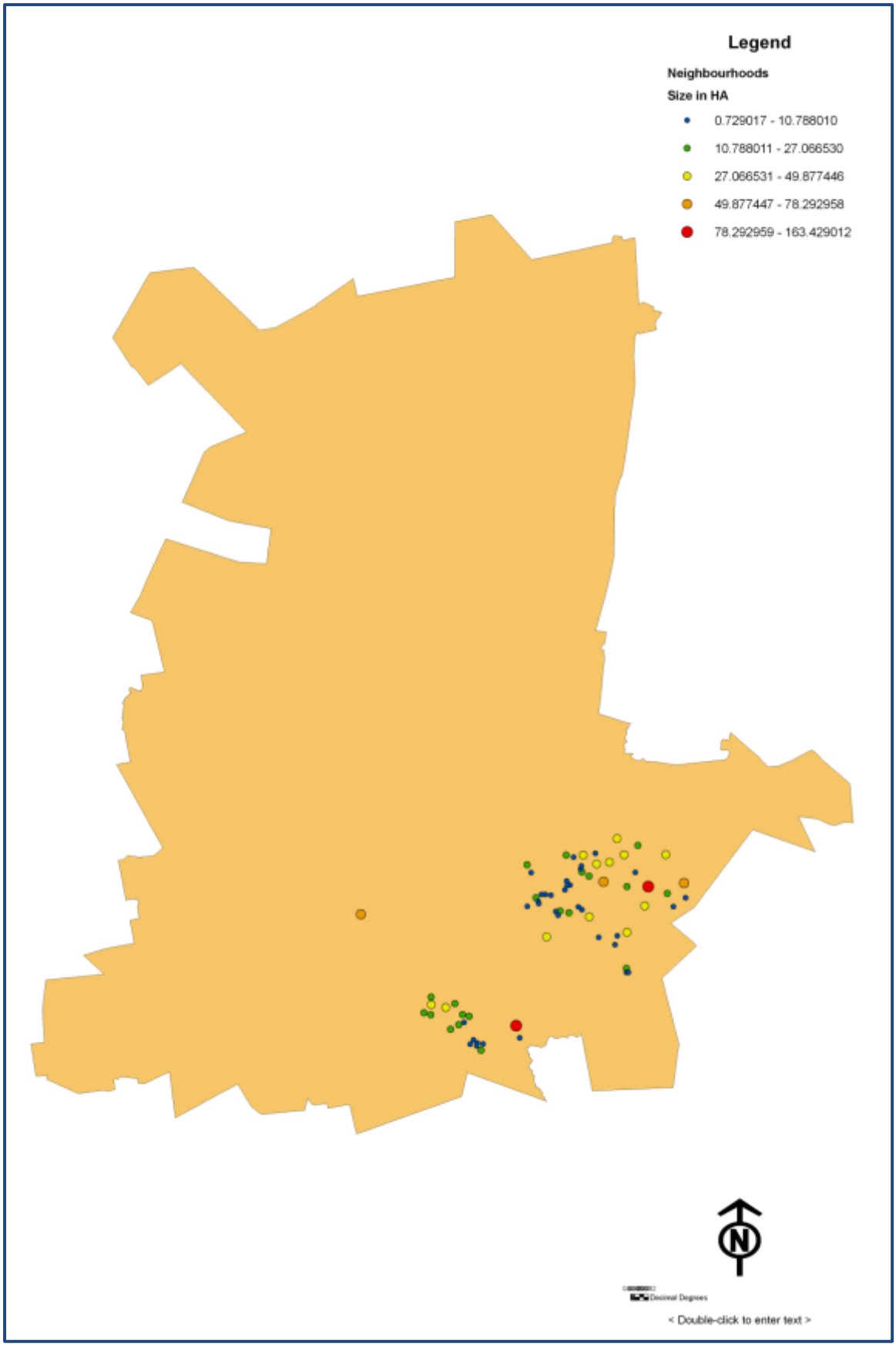


Figure 3: Location and size of Enclosed Neighbourhoods within the City of Tshwane

As a result, the south eastern parts of the eastern region (where the most of the enclosed neighbourhoods are located) has the highest income per capita in the City of Tshwane and boasts a great number of facilities and amenities (City of Tshwane, 2007b: 20). The southern region of the City of Tshwane, where a considerable number of enclosed neighbourhoods are located, is also economically strong with the Centurion area falling within the economic core of the Gauteng Province. The residential component is also characterised by low density suburban areas and good accessibility via an extensive road network (City of Tshwane, 2007c: 19-20).

When referring back to Figure 3, it is evident that these enclosed neighbourhoods within these regions are located close together, forming “clusters of privatisation”, limiting access and integration. These large concentrations of enclosed areas, or “clusters of privatisation” which are mainly located in the eastern and southern regions of the City of Tshwane, displace vehicles in the sense that they have no choice but to make use of main arterials (Landman, 2006: 139). Nowhere in Tshwane is this clearer than in the Lynnwood area (Lynnwood, Lynnwood Glen, Lynnwood Manor, Lynnwood Ridge) with congestion on Lynnwood Road and Atterbury Road undeniable (refer to Figure 4). Furthermore, this causes pedestrians and cyclists a great degree of inconvenience and danger as they are forced out of these residential areas to navigate alongside major roads and arterials (Landman, 2007b: 6; Landman 2006: 139). According to the Eastern Regional Spatial Development Framework (RSDF) (2007b: 20) this region is very dependent on private vehicle usage with the east to west transportation linkages (such as Lynnwood Road and Atterbury Road) heavily congested during peak hours, an indication that the city cannot afford to add to this congestion by limiting access through local roads.

It should be acknowledged that neighbourhood design and road network design in terms of modern town planning intends to focus higher order movement and through traffic onto major arterials by using ‘closed’ movement and road networks (as discussed in chapter 4). In this specific case, congestion occurs when population growth and thus growth in traffic volumes occur which result in ‘rat-running’ through neighbourhoods, resulting in safety problems (CSIR, 2000: 5.1:7; O’Flaherty, 1997a: 281-282). Under these circumstances, it can be argued that in some cases, closing entrances to neighbourhoods merely force congestion back onto mobility roads where it should have been concentrated in the first place. The question is thus, under which circumstances do road closures and neighbourhood closures result in congestion and lack of accessibility worse than it was intended or designed for.

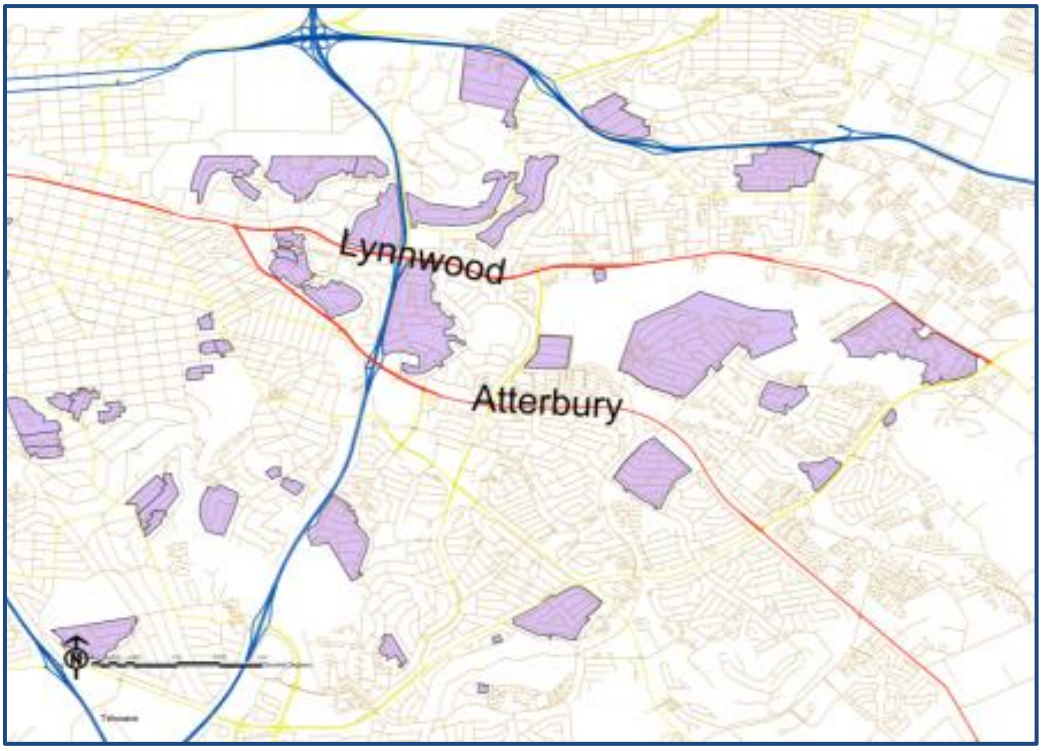


Figure 4: Enclosed neighbourhoods forming clusters of privatisation

From a practical point of view, it is clear that the closing of public streets and neighbourhoods would have an impact on the surrounding physical, natural and social environment. In order to better and uniformly investigate the impact of each enclosed neighbourhood on its surroundings and urban form, a classification system to accurately measure this was formulated?

The following section is dedicated to the formulation and reasoning behind the creation of this classification system.

3.4 The Classification of Enclosed Neighbourhoods within the City of Tshwane

In order to fully grasp the physical impact that enclosed neighbourhoods have on the urban form and with that travel behaviour and transport patterns, 70 of these 71 enclosed neighbourhoods that are located within the City of Tshwane had to be examined individually. From this, a set of criteria was formulated to be able to accurately analyse and classify each enclosed neighbourhood. Multiple criteria were identified.

First of all, the enclosed neighbourhood had to be residential of nature, and not commercial or educational, which excluded only one existing enclosed neighbourhood (Prinshof School). The criteria further entailed that a number of factors that in theory would influence traffic congestion, transport patterns, travel behaviour, accessibility, comfort and need for public to gain access to the enclosed neighbourhood be examined. These factors, along with the rationalisation thereof are set out below:

- **The number of residential dwellings located within each enclosed neighbourhood**

  The greater the number of residential dwellings located within an enclosed neighbourhood, the greater the number of individuals (residents, visitors and domestic workers) and thus vehicles that will need to enter and exit the enclosed neighbourhood, causing delays at the controlled access points and congestion along the adjacent roads.

- **The area of the enclosed neighbourhood (measured in hectares)**

  The bigger the area that an enclosed neighbourhood consists of, the greater the number of roads it encompasses. This means that motorists, cyclists and pedestrians are barred from the option to use alternative routes through the enclosed neighbourhoods to reach their destinations (Landman, 2007b: 7; Landman 2007a: 139).

- **The number of streets closed**

  The number of streets closed for the purpose of this analysis includes the main entrances, as access are controlled, and thus individuals cannot freely gain access without being hindered or delayed. It also applies in the event of both ends of a street being closed off. The importance of this factor is due to the fact that closed streets force motorists to use higher order roads and strip them of the right to use local public roads that run through the neighbourhood. This in turn causes heavy delays and congestion on higher order roads (Landman, 2007b: 7; Landman 2007a: 139).

- **The highest class of street closed**

  According to the national guidelines for road access management (Committee of Transport Officials: 2004), the classification of roads is as follows:
  - Class 1: Primary metropolitan distributor (e.g. N1 Danie Joubert Freeway)
  - Class 2: Metropolitan distributor (e.g. M6 Lynnwood Road)

- Class 3: Urban district distributor (e.g. M25 Hendrik Verwoerd Drive)
- Class 4: Urban collector (e.g. Estcourt Avenue)
- Class 5: Local street (e.g. Delaware Road)
- Class 6: Pedestrian/cycle path

The class of road closed is important when establishing the level of impact on transport patterns and travel behaviour. This is due to the fact that neighbourhoods and movement networks are planned to accommodate a certain amount of traffic on a daily basis, and when class 5 roads (local streets) are closed, those roads are underutilised and the traffic is displaced to higher order roads (class 1-4). In the event of a closure of a higher class of roads (class 1-4), the effects are detrimental as they carry higher traffic volumes (CSIR, 2000: 5.1: 3).

- **The proximity of a class 1-3 road to the main entrance(s) of the enclosed neighbourhood**

  As briefly mentioned earlier in this chapter, when clusters of enclosed neighbourhood occur around higher order roads, these roads become heavily congested (Landman, 2006: 139). In some cases, traffic congestion around the entrances of enclosed neighbourhoods become a problem to the degree that traffic is held up on class 1-3 roads due to the heavy volume of traffic needing to pass by the enclosed neighbourhood to reach a class 1-3 road.

- **The number of public facilities located within the enclosed neighbourhood**

  When public facilities are located within enclosed neighbourhoods, it not only hampers the public from gaining free access to it, it also ensures that individuals will constantly need to visit the neighbourhood to make use of it. This means that a great volume of traffic will occur in and around the enclosed neighbourhood, as once again vehicles are forced to make use of only one (in some cases one or two) entrances. Public facilities were defined as the following:
  - Schools (public and private- high schools, primary schools, nursery schools, crèches and afterschool care centres);
  - Parks, sanctuaries and hikers trails;
  - Churches and places of worship;
  - Cemeteries;
  - Libraries;

- Sport facilities (cricket ovals, tennis courts, golf courses etc.);
- Reservoirs, water meters, water towers and electricity sub-stations;
- Embassies;
- Museums and memorials;
- Community halls; and
- Bus routes.

- **The number of commercial facilities within the enclosed neighbourhood**

  The same argument that applies to public facilities also applies to commercial facilities. Commercial activities are associated with clientele who need to gain access to and from these enclosed neighbourhoods where they are located. These facilities include:

  - Offices;
  - Guest houses and bed & breakfast (B&Bs);
  - Swimming schools;
  - Education centres (all that do not fall under the abovementioned schools classification);
  - Retail or business activities (Wendy house sales, graphic designers, photographers, hair and beauty salons etc.);
  - Medical rooms (doctors, dentists, physiotherapists etc.);
  - Filling stations; and
  - Parking lots.

- **The number of streets open during peak hours/section of the day (excluding main entrances)**

  In the event that additional streets are opened during peak hours, traffic congestion is relieved to an extent, especially if the additional open streets allow vehicles to pass through the neighbourhood to avoid higher order roads. This also relieves traffic congestion in and around the main entrances of the enclosed neighbourhoods as residents can exit and enter their neighbourhood at more than one location.

- **The number of manned gates/entrances**

  More manned entrances means better access to public roads and amenities located within the enclosed neighbourhood. This also means that traffic congestion caused by entering or exiting the neighbourhood is avoided (Fabiyi, 2006).

- **Whether the enclosed neighbourhood comprise only of a cul-de-sac, a crescent or a dead end road**
  Enclosed neighbourhoods that comprise of only a cul-de-sac, a crescent of a dead end does not significantly contribute to traffic congestion, as the only purpose to enter the neighbourhood would be specifically to visit someone or because you reside within the neighbourhood. These roads do not carry any through traffic and cannot serve as an alternative route to reach a destination (Fabiyi, 2006: 386).

The above a challenge to classify as a magnitude of factors had to be taken into consideration. This called for the application of multi-criteria analysis (MCA) techniques.

The basic feature of MCA is to analyse or compare between options or in this case entities (enclosed neighbourhoods) by reference to a well-defined or clear set of objectives that is coupled with measurable criteria to assess to what extent the objectives have been achieved (DCLG, 2009: 20; Kuyler, 2006: 36). The objective for this specific instance is to establish the theoretical level of impact of enclosed neighbourhoods on the urban form and subsequent transport patterns and travel behaviour.

There are numerous MCA techniques to be used and selecting the correct technique depends on the types of decisions to be made, the time available to analyse the criteria, the amount of data available to ease the analysis, the analytical skills of the analyser and the requirements of the criteria (DCLG, 2009: 19).

For the purpose of evaluating the impact of enclosed neighbourhoods a simple MCA technique known as the performance matrix or the consequences table were deemed appropriate. This straightforward approach entails that each row of the table describes an option and each column the performance of the options against each criterion/factor (DCLG, 2009: 21). The advantage of using this technique is the fact that using it in its basic form, this performance matrix can be the final product of the analysis. In order to ease the process of analysis numerical values are awarded to the criteria. This is done in two stages to enable scoring and weighing (DCLG, 2009: 22; Kuyler, 2006: 37).

Scoring requires that the ranking of each option are awarded a numerical value on a preference scale for every set of criteria (DCLG, 2009: 22). In this instance, the lower the score achieved by an enclosed neighbourhood, the lower the impact thereof on the urban form and consequent theoretical transport patterns and travel behaviour. The

scale ranged from 1-5, with 1 representing the option for each criterion that results in the lowest impact and 5 the highest.

The next stage consists of weighing. This in affect means that numerical weights are assigned to define for each criterion, the relative estimates of a shift between the top and the bottom of the relevant scale (DCLG, 2009: 22). For this performance matrix, weights with the value of 1 have been assigned to all criteria, except when the number of residential dwelling within an enclosed neighbourhood exceeds 200, or if the enclosed area comprises of a cul-de-sac, a crescent or a dead end, in which case the weights are calculated at 2 and 0.5 respectively.

On this note it should be acknowledged that the weighing affects the outcome, and is not necessarily the only method, but as a first attempt and without specific evidence available on which to weigh criteria differently, it suffices to use equal rating.

Table 1 below illustrates the performance matrix with an example of the analysis of an enclosed neighbourhood (Bronberrik Security Estate).

Enclosed neighbourhood:	**Bronberrik Security Estate**				
Level of impact on traffic and travel behaviour	**1**	**2**	**3**	**4**	**5**
Number of residential dwellings	**≥4; <10**	**≥10; <25**	**≥25; <100**	**≥100; <200**	**≥200 (5.W)***
					X
Area of enclosed neighbourhood (Ha)	**<2Ha**	**≥2Ha; <10Ha**	**≥10Ha; <30Ha**	**≥30Ha; <50**	**≥50Ha**
			X		
Number of streets closed	**1**	**2**	**3 - 4**	**5**	**≥6**
			X		
Highest class of street closed	**5**	**4**	**3**	**2**	**1**
	X				
Proximity to class 1-3 road (m)	**≥1000m**	**≥500m;<1000m**	**≥150m;<500m**	**≥50m;<150m**	**<50m**
			X		
Number of public facilities within	**0**	**1**	**2**	**3**	**≥4**
		X			
Number of commercial activities within	**0**	**1**	**2**	**3**	**≥4**
	X				
Number of gates open during peak hours	**≥4**	**3**	**2**	**1**	**0**
					X
Number of manned entrances	**≥3**	**2**	**1**	**-**	**0**
			X		
Total	**31**				
Cul-de-sac, crescent or dead end?	**Yes** [ ] (Total)(0.5) **No** [X] (Total)(1)			**TOTAL**	**31**

* W (weight) = 2

Table 2: Example of a Performance Matrix - Bronberrik Security Estate

Each of the 70 enclosed neighbourhoods were analysed according to the above performance matrix (Please refer to annexure E) for a complete breakdown of the analysis for each enclosed neighbourhood. Below these 70 enclosed neighbourhoods are disclosed and arranged according to its theoretical level of impact on transport patterns and travel behaviour.

Level of impact	Little to no impact	Little impact	Considerable impact	Substantial impact	Severe impact
Classification	1	2	3	4	5
Total score	1-10	11-20	21-30	31-40	41-50
Enclosed Neighbourhoods	Bootes Place Brittany Place Canopus Place Fernwick Place Holden Crescent Irene Country Club Jack Bennet Estate Maru Close Milner Close Milner Village Rising Close Silver Pine Crescent Verena Street Victoria Close Volt Street Willowrun Bicycle Patrol	Aspen Estate Caper Estate Crescendo Estate Dali Street Estate Drakensberg Estate Faerie Glen Security Village Highveld 43 Estate Highveld 44 Estate Highveld Estate Lawley Estate Lizjohn Street East Plough Argo Turnhouse Estate Uitsig Park Waterkloof Heights Estate Zwartkop 8 Bicycle Patrol Zwartkop Extension 8	Bailey's Muckleneuk Security Village Blackberry Estate Bronberrik Security Estate Eldo 3 Manor Friesland Estate Grus Street Estate Gunib-Verdi Security Village Hillside Security Village Irene View Estate Jupiter Estate Lynnwood Manor Village Lynnwood Park Lyra Ridge Manor Estate Murrayfield Security Village Newkloof Estate Nixon Street Om die Berg Queens Crescent Estate Rand Estate Silver Oak Place Strubenkop Security Village Sussex North and Sussex South The Loop Waterkloof Ridge Estate Zwartkop 7 North	Brunaly Security Area Claudius Estate Die Wilgers Security Village Eldoraigne X18 Security Village Lynnwood Glen Estate Moreleta Village Secura Park The Ring Estate Wapadrand Security Village	Irene Village

Table 3: Classification table

The advantage of compiling such a classification system is that it ensures a standard for evaluating existing enclosed neighbourhoods and applications in different cities over South Africa.

Furthermore, this classification system as applied to enclosed neighbourhoods within the City of Tshwane gave some interesting insights into the range and severity of enclosed neighbourhoods. It is clear that the majority of enclosed neighbourhoods (thirty seven per cent) are classified as having a considerable impact on the urban form and traffic patterns, with approximately thirteen per cent of neighbourhoods are considered to have a substantial impact while only one per cent of neighbourhoods have a severe impact. This means that almost fifty per cent of enclosed neighbourhoods have little impact or little to no impact on the urban form and traffic patterns and travel behaviour.

The opportunity thus exist to apply this classification system to enclosed neighbourhoods located outside of Tshwane, to compare the severity based on the classification between those located within the City of Tshwane and outside, along with comparing it to the subjective opinion of enclosed neighbourhoods.

3.5 Conclusion

This section supplied a brief overview of the context of enclosed neighbourhoods within the City of Tshwane and investigated the theoretical impact thereof on transport patterns and travel behaviour by means of compiling a classification table. After this classification was complete, the need to further investigate the impact of enclosed neighbourhoods on transport patterns and travel behaviour occurred to verify whether the theoretical impact of the enclosed neighbourhoods, as established by the above classification table.

Before delving into an extensive examination of case studies selected with regards to transport patterns and travel behaviour of households residing within and directly outside of these enclosed neighbourhoods, an understanding of the history of neighbourhood design, road networks and the relationship between movement patterns, travel behaviour and the built environment is required. The following chapter is thus dedicated to this and will take a glimpse at the impact of enclosed neighbourhoods have on the current street patterns and road dynamics

CHAPTER 4: MOVEMENT NETWORKS, TRAVEL BEHAVIOUR AND THE BUILT ENVIRONMENT

4.1. Introduction

The conventional neighbourhood design and with that residential road network design have undergone a great degree of change in accordance with societal change. A great number of neighbourhoods within the City of Tshwane were designed decades ago (and in some cases centuries ago) for a completely different milieu and for communities with different values, dynamics and needs than today.

Residential neighbourhoods, or suburbs, were believed to be more livable than residing within the inner city and was also seen as a solution to overcrowding (Del Mistro, 1987: 61; Brown, Morris and Taylor, 2009: 162) and low density suburban sprawl became more evident as the popularity of the automobile and other private transportation grew. Thus, transportation and with this the design of road networks did not just fulfil the need to travel, but it became a tool for shaping and reshaping (willingly or unwillingly) the urban form (Brown, Morris and Taylor, 2009: 162).

In order to explore the impacts of enclosed neighbourhoods on residential areas or suburbs as they are known today, the context, history and the metamorphosis of neighbourhood design and road network design needs some further attention.

4.2. Historical Residential Road Network Design

During the twentieth century, and especially around the 1950s, guidelines for designing road networks (better known today as movement networks) were more or less standardised within developed countries such as Canada, England, Australia, and the USA as well as within South Africa (Del Mistro, 1987). Collectively, these guidelines boiled down to the following:

- Residential roads should be designed to limit speed and volume of traffic;
- Residential roads should minimise the danger and inconvenience to pedestrians and cyclists;
- Residential road design must make provision for pedestrian and cycle facilities;
- Residential roads must incorporate public transport (bus routes and stops);

- Residential road design must allow easy access to emergency vehicles and other services;
- Residential traffic, circulation and land patterns should not hamper or detract from the efficiency of bordering higher order roads;
- Residential roads should be functional and durable;
- Residential roads should be cost effective with logical layout patterns; and
- Residential road design should not lead to the degradation of the environment.

From a PhD study conducted during the 1980s to examine and determine the best practice for residential road networks for the South African context, produced a number of road network typologies typically used during the twentieth century when designing and proclaiming new neighbourhoods (Del Mistro, 1987: 132). Back then, residential neighbourhoods were planned to accommodate private vehicle usage in a 'tranquil' setting. Thus, all neighbourhoods were planned with predominantly two street levels; mobility roads and access roads. Different road network designs were implemented to achieve different levels of accessibility and mobility:

The grid network[4]

There are numerous advantages for using this type of road network. First of all, in terms of installing and maintaining services, this design is the most inexpensive and uncomplicated (Del Mistro, 1987). Secondly, it allows for easy orientation and navigation as well as easy connectivity with different higher order roads and intersections. This layout furthermore stimulates pedestrian and cyclist movement as it is uncomplicated and ensures the shortest distance between point A and B (Duany, 2003: 87; CSIR, 2000: 5.1-5).

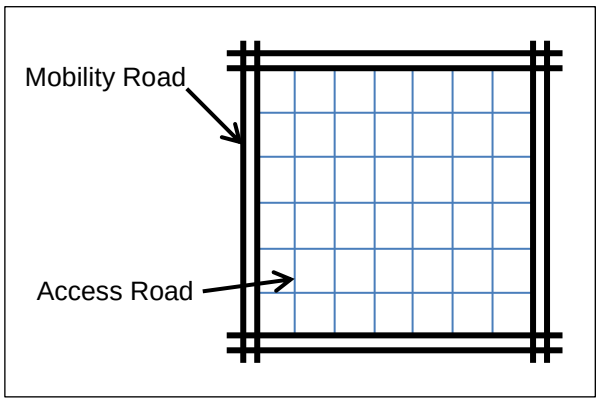


Figure 5: Illustration of the grid network

Negative aspects associated with this type of road network is the fact that it can generate fast moving through-traffic, the design is not practical for steep terrains and in some cases it has the potential to appear monotonous (Duany, 2003: 87; CSIR, 2000: 5.1-6).

[4] This residential road network referred to by the author as 'the grid network' has been referred to by different authors by different terminology such as 'the savannah pattern' (Duany, 2003) and 'the rectilinear multi-directional network' (CSIR, 2000).

The grid network was very popular during the early twentieth century in South Africa and during this time, automobile ownership was very limited, not only in South Africa, but across the globe (Moughtin and Mertens, 2003) and thus issues such as fast moving through-traffic in residential neighbourhoods was not yet a major concern.

The modified grid network[5]

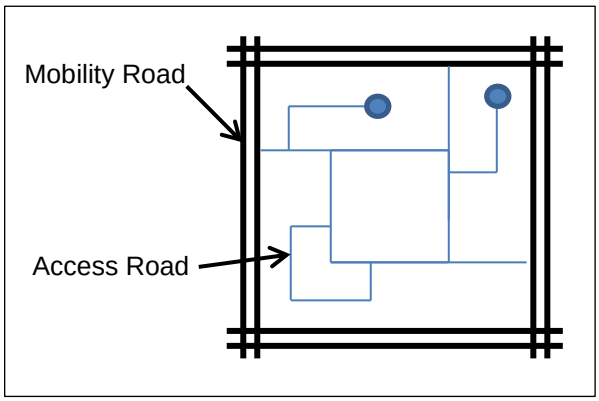


Figure 6: Illustration of the modified grid network

As is the case with the conventional grid network, the modified grid network is considered an 'open' network which implies a higher degree of mobility but at the same time limits the motorist choice through incorporating T-intersections (CSIR, 2000: 5.1-5; Del Mistro, 1987: 133; Langdon, 1994: 125). This Road network ensures a more diverse residential character, but at the cost of prolonged pedestrian and cyclist trips, making motorised trips more attractive.

This layout was considered a viable option for residential suburb design, as it was still considered relative inexpensive to supply and maintain bulk services, and it typically accommodated a single land use (residential) and a limited density (low to middle density). However, with the ever-changing nature of the economy, lifestyles and the built environment, this type of road network becomes more challenging when implementing small-scale mixed land use (CSIR, 2000: 5.1-6).

[5] This residential road network referred to by the author as the 'modified grid network' has been referred to by different authors by different terminology such as the 'distorted rectilinear multidirectional network' (CSIR, 2000) and…

The radial network[6] and the inner ring network

radial network and the inner ring network are similar in the sense that they provide a well-defined hierarchy of roads while still catering (to an extent) for through traffic and at the same time limiting the choice of motorised travel routes (Del Mistro, 1987: 133; Duany, 2003: 87).

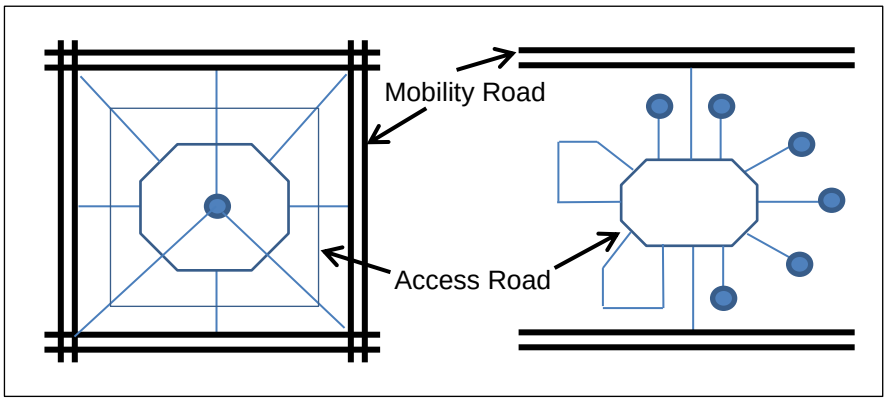


Figure 7: Illustration of the radial and inner ring network

The radial network and the inner ring network are similar in the sense that they provide a well-defined hierarchy of roads while still catering (to an extent) for through traffic and at the same time limiting the choice of motorised travel routes (Del Mistro, 1987: 133; Duany, 2003: 87).

The loops and lollipops network[7]

These two network typologies are known to be the most closed networks found within the South African context (excluding gated communities).

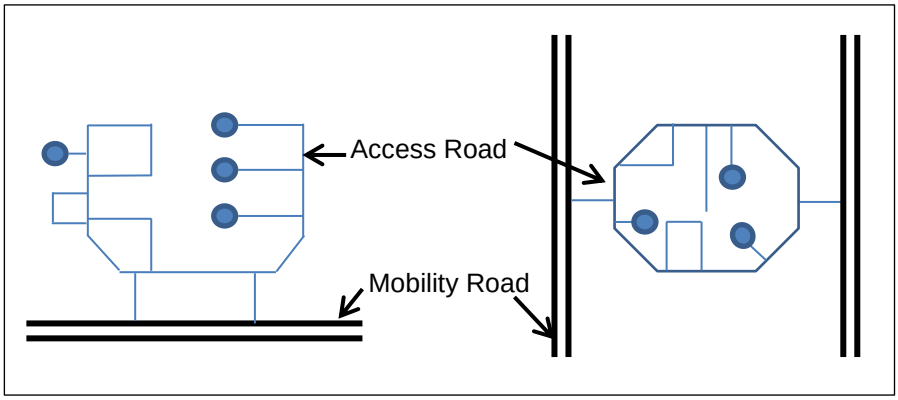


Figure 8: Illustration of the loops and lollipops network

[6] The 'radial road network' has been referred to by various authors as the 'Washington pattern' (Duany, 2003), the 'radial multi-directional network' (CSIR, 2000), and the 'inner ring network' (Del Mistro, 1987).

[7] The term 'loops and lollipops' used to describe this specific road network (Southworth and Ben-Joseph, 2003) have also been referred to as the 'Radburn pattern' (Duany, 2003), the 'outer ring-' and 'branching network' (Del Mistro, 1987) and the 'looped-' and 'branched hierarchical network' (CSIR, 2000).

These road networks consist of either a series of cul-de-sacs, looped roads or a combination of both, which limits or completely eliminates through traffic (mobility) through the neighbourhood as well as choice of travel route (CSIR, 2000: 5.1-5; Del Mistro, 1987: 133).

According to Behrens (2005: 164), this type of road network (and to an extent the radial and inner ring networks) which consist of crescents, cul-de-sacs and dead end roads with limited access points which were used to limit through traffic and traffic speeds within neighbourhoods, were favoured and advocated during the 1970s.

From a transportation point of view, this road network tend to discourage walking and cycling as a transport mode, as the road layout may cause disorientation and no few direct routes between point A and point B exist. Furthermore, this road network has the potential to cause traffic congestion at mobility road and access road intersections (CSIR, 2000: 5.1-5; Duany, 2003: 87).

Apart from the above, these residential road networks tend to cause isolation or segregation not only between sections of the neighbourhood, but also between the neighbourhood and the bigger residential area or town (Southworth and Ben-Joseph, 2003).

According to the Red Book (CSIR, 2000), road networks can be classified into scale, signifying how 'open' (in other words, how easy it is to move around between different levels of roads) or 'closed' these neighbourhoods are:

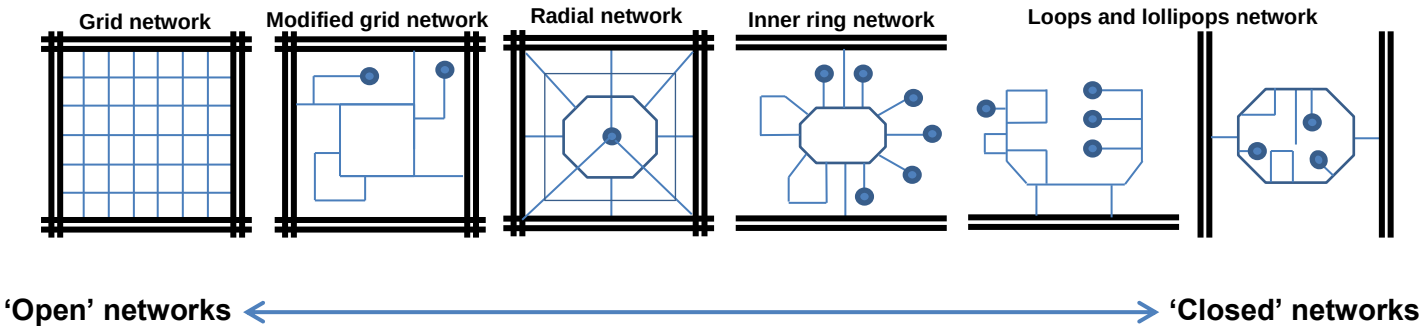


Figure 9: South African road network design scale (CSIR, 2000)

Road network design is a matter that should concern all town planners, as it dictates the structure and inevitably the character of a neighbourhood. The road network designs used in older suburbs such as seen in the eastern and southern regions of the

City of Tshwane, ensured that these suburbs could only really accommodate low densities, single zonings and in return dictated that car ownership is a necessity when living within these suburbs (Del Mistro, 1987: 12).

Another important set of factors that has to be taken into account when designing and possibly altering neighbourhood road networks, is the capacity of these roads. The Capacity of roads can further be broken down:

- Economic capacity: This refers to the smallest number of road users that need to use the road to make it economically viable in terms of implementation of the road and maintenance thereof.
- Environmental capacity: This refers to the maximum amount of traffic or vehicles that a road can carry (this includes stationary vehicles) without hampering minimum desired standards with regards to pollution, noise levels, aesthetics and pedestrian and cyclist safety.
- Traffic capacity: Traffic capacity merely refers to the maximum vehicles or traffic a road can accommodate per hour and still be able to maintain the integrity and conditions of the road.

(O'Flaherty, 1997a: 281-282)

It is thus important to acknowledge the intended capacity of roads when altering neighbourhood structure, as the typical suburban neighbourhood within the City of Tshwane was either planned with limited accessibility or unrestricted movement in mind.

When looking back at the guidelines set up for road networks during the twentieth century, it is easy to see that the typical South African road network designs do not adhere to all principles within one design. Furthermore, societal change has even further altered the dynamics and in some cases function of these road networks.

With regards to the principle "Residential roads should be designed to limit speed and volume of traffic", the 'closed' network design became very popular as the automobile became prominent. This, along with a range of other factors typical of the twentieth century, sparked the desire to live in suburbs (Sudjic, 1992).

4.3. Suburbia

When exploring the concept of Suburbia, its origins and how South African suburbs morphed into what we know suburbs as today, recognition is due to the Americans. The period directly after World War II, marks the birth of the 'modern' suburb (Langdon, 1994; Hall, 2003; Pacione: 2005: 87; Behrens, 2005: 166). With this phenomenon, the idea of community became an increasing selling point, and along with the promise of peace, tranquillity and natural beauty, suburbia became a utopian idea (Sudjic, 1992).
The problem with any utopia is that it is a utopia. Although a utopia strives to a rationalised future, based on values that are important to mankind (Friedmann, 2000: 462-463), it is also an "impossible ideal idea" (Johnson 2003: 286), implying that by striving towards this ideal, it is sure to fall short. Another challenge this utopian idea of suburbia face, is the fact that societal values constantly change, and with this, visions of utopia. To argue that desired suburbs implemented after the Second World War, and desired suburbs in the twenty first century, South Africa, is the same, is naïve.

As is evident from the road network designs (and densities) especially those designs that are more 'closed', suburban areas necessitate the ownership of a private vehicle. However half a century ago (or more) the single car ownership per household was the norm and therefore road network designs implemented were viable (Del Mistro, 1987). Back then, it was the rule and not the exception to have only one breadwinner (the patriarch) with the housewife running the household and taking care of the children, and very often these housewives accompanied their children to school on foot, and opted to walk to supermarkets (Moughtin and Mertens, 2003: 131). The limited car ownership in these middle-class suburbs also meant that streets were tranquil, and the streets became a social space (Del Mistro, 1987).

Other (social) factors that influenced (and are still influencing) individuals and households to reside within suburbs are the status gained by living within a suburb. Moughtin and Mertens (2003:131) argue:

> *"The suburban street reinforces people's social aspirations: movement 'up market' to a larger house, bigger garden. A 'better' street is all important and so the new street address becomes the symbol of self-esteem."*

This is confirmed in terms of the South African context by Del Mistro (1987):

> *"In choosing a place to stay, families will be influenced by what they perceive will be the social status of existing and potential residents."*

With the above, the promise of community and community cohesion is a great selling point or justification for moving to or residing within a suburb. This refers to the personal identification with the suburb, the interaction between residents, shared values amongst residents, shared use of local facilities such as parks and a shared pride in the suburb (Pacione, 2005: 377). This idea of community almost paints a nostalgic picture of suburbs, but suburbs today do not necessarily adhere to these values anymore.

All these factors contribute to the attractiveness of living within suburbs, but the reality is that although these factors are still used as 'selling points' for residing in a suburb, these factors are in most cases not viable anymore.

4.3.1 The reality of Suburbia in South Africa

As mentioned in the previous section, one of the reasons for the functioning of suburbs fifty odd years ago was the fact that streets were peaceful and motor vehicles weren't a nuisance within neighbourhoods, as car ownership was still very conservative.

Due to great levels of poverty and unemployment in South Africa, overall car ownership in the country are low, but projections show that from 1996 to 2020, car ownership will have grown by 60 per cent and it was also reported that between 2004 and 2005, that car sales grew by 30 per cent (Mokonyama and Venter, 2007: 2). Car ownership is also closely related to household income (Mokonyama and Venter, 2007: 4), and with middle income households typically residing in suburbs, the assumption is made that a great number of individuals and households purchasing motor vehicles, resides within suburbs.

The above again has implications on the capacity of road networks, and the intended purpose of these road networks. In some cases, as mentioned earlier, certain road networks such as the loops and lollipops network may cause congestion at intersections with higher order roads. With this, and the fast paced lifestyles associated with urban living, the suburban road loses its (intended) social role. According to Moughtin and Mertens (2003: 131) very few trips, if any, is done via foot, making the opportunities for neighbours to interact on the street level very slim. Interaction is more

likely to occur at a destination such as a supermarket, rather than during the journey. This, coupled with technological advances such as the internet and cell phones ensures interaction between two parties can occur instantly, further diminishing the need for neighbours with no direct relation to enter into any form of social contact.

In some cases, such as in the eastern region of the City of Tshwane, the character directly surrounding suburban areas have changed drastically, with mixed zoning and high densities becoming evident in this region, placing further pressure on these suburbs and the existing road networks (City of Tshwane, 2002).

The notion of community and community coherence as a justification to want to live in a suburb is according to Sudjic (1992) a great myth. According to Sudjic, the word community should imply sharing, sharing of communal amenities associated with a tight personal bond, while suburbs actually promote the exact opposite. The typical suburban home contains a private garden, residents make use of private modes of transportation, their homes are usually fenced off to exclude any unwelcome elements, making suburbs much less of a 'community' in this regard than an apartment block in the inner city. Many cases of neighbouring tension occur in suburban areas, such as intolerance to loud noises, disputes about pets and other petty issues driving a wedge between neighbours instead of solidifying the 'community' (Sudjic, 1992: 283).

Sense of community, on the other hand, may still occur in suburban areas, if the neighbourhood has a common interest or central idea (Dirsuweit and Wafer, forthcoming: 5; Sudjic, 1992: 282). In the case of South Africa, no other issue is more pressing or uniting than crime, and the fear of crime.

This brings us to the next issue regarding suburbia – the notion that the erection of gates, booms and walls will somehow preserve the character and tradition associated with suburbia.

4.3.2 Enclosing our neighbourhoods: taking back Suburbia?

This need that certain residents and communities have developed to close off their neighbourhoods and assert their identity is confirmation of the ever changing ideals of utopia. This 'never-never' land is one where crime is not an issue, where like-minded individuals reside, where administrative structures are fair and in place and children can play in the streets as traffic is minimal (Fabiyi, 2006; Hook and Vrdoljak, 2001).

Apart from crime being the main motivation behind the enclosure of neighbourhoods, a greater sense of community has been listed as motivation on numerous occasions as incentive to justify these enclosures (Landman, 2000a: 20; Landman 2000b; Landman, 2007a: 138; Landman and Du Plessis, 2007: 23; Lemanski, Landman, and Durington, 2008: 148).

Numerous sources have found that during the early 1990s in South Africa, and especially in the greater metropolitan areas (mainly those located within the Gauteng province), white suburbanites became increasingly uncertain regarding their future within South Africa and with this their identity. With the further increase in crime levels and the perceived inability of government to deliver services and secure its citizen's safety a definite mind-set was establish amongst white middle- to upper-class suburbanites to unite against crime and lack of service delivery by means of physically segregating themselves against the unwanted elements (Fabiyi, 2006; Hook and Vrdoljak, 2001; Dirsuweit and Wafer, forthcoming; Bénit-Gbaffou, 2007).

In a further attempt to preserve the suburban areas, these gates, booms and walls strive to control and divert unwanted traffic (vehicular and pedestrian) from their neighbourhoods to further strive to hold on to the ideals of living within a suburban neighbourhood (Fabiyi, 2006). But, as established, due to the ever changing nature of the built environment and the increase in car ownership in and around these suburban neighbourhoods, it is not viable to close off streets. This, in many cases merely results in further congestion of already over-burdened higher order roads, especially those located close to these enclosed neighbourhoods (Landman 2007a: 139; Hook and Vrdoljak, 2001).

Taking all of the above into consideration, the question that needs to be asked, is whether these suburbs, by judging from the road networks, influence travel behaviour and with that traffic congestion, or do travel behaviour and preference influence the decision to reside within a suburban neighbourhood? And if these already established suburban road networks already influence travel behaviour and possible traffic congestion, does the presence of gates, booms and walls truly have an additional impact on the travel behaviour of these residents, and with that an influence on traffic congestion?

Before truly delving into the impact of these gates, booms and walls, the impact of the built environment on travel behaviour and preference should be investigated.

4.4. The built environment and its influence on travel behaviour

Although it has been recorded by numerous authors that the built environment has a definite influence on travel behaviour and travel preference, it is more complicated than that, as the built environment (and with that the road networks) is not the only variable when examining individuals' or households' travel behaviour (Bohte, Maat and Van Wee, 2009: 325-326; Van Wee, 2009: 279; Cao, Mokhtarian and Handy, 2009: 359).

Other factors that may influence travel behaviour include choice/self-selection as well as income and purpose. This doesn't mean by any means that the built environment does not have an influence on travel behaviour, it just means that due to the diverse nature of the built environment (diversity of densities, different neighbourhood typologies and zoning) allows individuals or households to choose what mode of transport they prefer, as coupled by the relevant neighbourhood typology (Bohte, Maat and Van Wee, 2009: 326). Here, the chicken or the egg debate becomes relevant: What influences what? Does the built environment first and foremost influence travel behaviour, or does travel behaviour influence place of residence?

First of all, low densities, single zoning and 'closed' movement networks makes public transport less viable, as the cost of implementing public transport is too high if usage thereof is limited (Frank, 2000: 10). Therefore, the design of neighbourhoods and road networks already set the tone for travel behaviour, even before anyone lives there. This is further hampered by regulations and schemes as implemented by local councils that are very rigid with practices being enforced that are not very sustainable with definite parking minimums, strict densities and zonings. This not only encourage the usage of private transport, but it separates land use and transport planning (Levine, Inam and Torng, 2005: 318-319).

As referred to earlier, the motivation for most to move to a suburb is the status gained by doing so (Moughtin and Mertens, 2003: 131). Wittingly or unwittingly, this new address within this suburb, limits the households transport choices. Wittingly, individuals and households usually choose locations to stay based on their travel abilities, needs and preferences as has been found that individuals and households

with a higher income tend to own more cars and travel further distances (Van Wee, 2009: 279-280).

With physical characteristics associated with suburban neighbourhoods such as low density, and with population growth and the rapid increase in car ownership, traffic congestion becomes a great concern which forces people to alter their travel routes, patterns and thus behaviour (Del Mistro, 1987). By throwing road closures and physical barriers such as gates and booms into the mix, further altering of travel patterns are sure to follow. The altering of traffic patterns and behaviour may not only (if at all) affect the households residing within, but also the neighbouring residential areas as well as the greater public who make use of roads in and around the enclosed neighbourhood (Lemanski, Landman, and Durington, 2008: 151; Landman 2006: 139).

4.5. Enclosure: isolating land use and transport even further

The relationship between land use and transport planning used to be a symbiotic relationship, with these two disciplines relying on each other and working together. However, with the invention of the car, a gradual separation occurred which led to the alteration of the urban form as it was known in the early years of the twentieth century (Brown, Morris and Taylor, 2009).

The final divorce for these two disciplines became official the day the suburb became popularised. Suburbs were seen as a solution to overcrowding, a means of breaking away from the hustle and bustle and were sure to offer a better quality of life than what the inner city could provide (Brown, Morris and Taylor, 2009: 162; Martin, 1974). This resulted in sprawl within the cities, which led to other problems such as traffic congestion which contribute to air pollution and climate change, the scarcity of fuel and stress due to traffic congestion. It is ironic, but the conditions that were believed to be more livable have proved to be quite unsustainable, with better living or rather more sustainable living conditions now associated with a compact urban form (Moughtin and Mertens, 2003).

As the situation is currently with regards to road networks and transport planning, the damage has been done, and it would be impossible to physically change the whole integrity and form of suburbs, but the interaction between land use and transport can be managed and improved to a certain degree. However, by further making suburban

neighbourhoods inaccessible by enclosing them, totally shatters the relationship between these two disciplines.

Simply put, by enclosing neighbourhoods, the practices of transportation planning and land use management are isolated even further than it already is in South Africa today. Various authors (Kölbl; Niegl and Knoflacher, 2008: 273; Curtis, 2007: 104; Banister, 2008: 75) emphasise the importance of integrating the disciplines of transport planning and land use management to ensure sustainable cities. Curtis (2007: 107) further states that land use change must be accompanied by changes to transport operation or the land use change will not be successful or sustainable. In order to achieve sustainable transport within any scenario, four aspects must be adhered to (Zhao, 2010: 237). These are:

- A high level of accessibility to ensure shorter travelling distances and shorter travel duration;
- Transport modes that are environmentally efficient to ensure low emission and the usage of renewable energy sources;
- A functional public transportation system; and
- Ensuring social equity through transportation.

According to Kölbl; Niegl and Knoflacher (2008: 277) in order to achieve sustainability within a neighbourhood, a transport plan containing certain criteria needs to be adhered to. This can also be applied to existing neighbourhoods in the attempt to ease congestion and travel behaviour. Two of the seven objectives that deals with implications caused by enclosed neighbourhoods are set out below:

- Objective 1: Ensure and enhance accessibility and usability
  This objective are obtained through ensuring barrier free and equal access to public roads and space for all and by prioritising non-motorised mobility structures.
- Objective 2: Promote health and well-being
  In order to achieve this objective, pollution caused by traffic has to be reduced and non-motorised transport needs to be prompted by implementing appropriate infrastructure such as pedestrian walkways, cycle paths, street furniture, and unhampered walkways. It has been proven that if pedestrian and cycle facilities are not properly planned and designed, or if it serves as an obstacle or pose a threat to users, potential pedestrians and cyclist will make use of other modes of

transport such as private vehicles (Watson et al, 2004: 3.10-1 - 3.10-2). Open areas need to be promoted or created to function as soft open spaces like parks influence the micro-climate of cities and act as 'green lungs', which is necessary to lessen air pollution (Fraker, 2007: 62; Evans et al, 2007b: 59).

The above objectives are supported by various sources, as it has been found that travel behaviour and transport patterns are directly influenced by the quality and degree of directness with which one can access a destination (Frank 2000: 9). By enclosing a neighbourhood and only allowing residents to enter and exit at one or two points, and by forcing the greater public to travel around the neighbourhood instead of through it, travel behaviour will inevitably change and lead to other concerns such as longer time spent on roads, longer distances travelled, traffic congestion and increased air pollution.

Although the majority of residents who live within a neighbourhood have to support the initiative to enclose the neighbourhood, the blame for altering the built environment and driving a wedge between land use and transport planning is not entirely their fault. The problem starts much higher up at local government level.

Although the evidence points out that land use and transport planning need to be integrated to achieve more sustainable planning, it is not evident in daily planning operations. Local government might acknowledge the above and in some cases policy co-ordination occurs, but not true integration (Te Brömmelstroet and Bertolini, 2010: 86). There are many reasons for this, which includes the fact that different departments have different budgets and follow different procedures, there are weak or no communication between the different departments and no incentives for working together, departments may be reluctant to work together with the two professions (town planning and transport planning/engineering) speaking different professional languages (Te Brömmelstroet and Bertolini, 2010).

From this the importance of policies, strategies, plans and legislation relating to the transport - land use relationship as well as to the implementation and regulation of enclosed neighbourhoods and how (or whether) these strategies complement each other within the City of Tshwane.

4.6. Conclusion

It is clear that the built environment, together with attitudes towards the built environment, standards of living, income and attitudes towards transport mode has a profound influence on private transport usage. However, by enclosing neighbourhoods and subsequently restricting and denying access to or through neighbourhoods, travel behaviour will inevitably be altered.

CHAPTER 5: POLICIES, STRATEGIES, PLANS AND LEGISLATION

5.1. Introduction

As mentioned earlier, when applying for an enclosed neighbourhood, applicants do so in accordance to the Rationalisation of Local Government Affairs Act (Act 10 of 1998) by complying, as set out within the act, with the proposed terms of restriction as set out by the local council (Gauteng Provincial Legislature, 1998). The problem however is that even though applicants adhere to the legislation and guidelines, it does not mean that conflict between other pieces of legislation, policy objectives and rights does not exist.

This chapter is aimed at shedding some light on these conflicts. The human rights aspect will only be touched on briefly as the main focus will be on the objectives set out by policies from the City of Tshwane and how these different policies with regards to land use practices and transport planning fit into the trend of enclosing neighbourhoods (Te Brömmelstroet and Bertolini, 2010).

5.2. Hierarchy of legislation

Any piece of legislation dealing with a certain issue, are contained, or parts of it is contained in (or related to) other sources and acts (Van Wyk, 1999: 9). However, there exists a hierarchy within government (the different spheres of government: national, provincial and local) and with that different roles and procedures. Chapter three of the Constitution of the Republic of South Africa (1996) sets this out very clearly, and section 41(1)(h)(iv) of this chapter clearly stipulates that

> "All spheres of government and all organs of state within each sphere must-
>
> (h) co-operate with one another in mutual trust and good faith by –
>
> (iv) co-ordinating their actions and legislation with one another;"

Chapter one of the Constitution also states the supremacy of the Constitution and the fact that any law that is inconsistent with the Constitution is invalid (Republic of South Africa, 1996).

Legislation, policies and strategies that have a direct influence or connotation to enclosed neighbourhoods are the following, in hierarchical order:

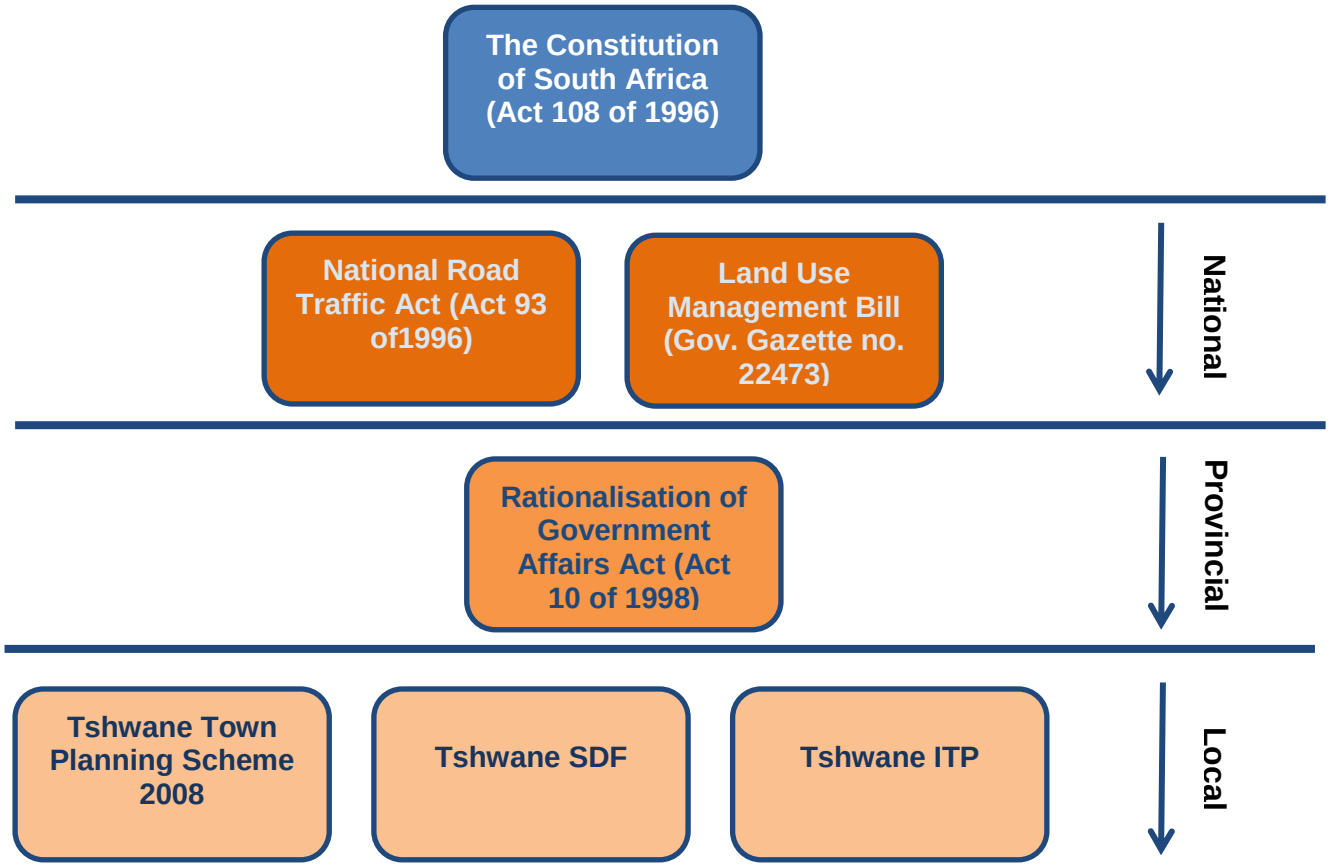


Figure 10: Hierarchy of legislation

The Rationalisation of Government Affairs Act, a provincial act applicable to the Gauteng Province should not only be in line with the Constitution and promote the Bill of Rights, but should also be in line with national legislation. Whether this is the case will now be investigated.

5.3. The Constitution and National legislation vs. the Rationalisation of Government Affairs Act.

Chapter seven, section 152 of the Constitution and section 4 of the Local Government Municipal Systems Act (Act 32 of 2000) provides specific objectives, rights and duties that local governments need to comply with to ensure socially, economical and environmentally viable and sustainable societies. One of the objectives to achieve this that are listed in both of these pieces of legislation is to “promote a safe and healthy

environment" (Republic of South Africa, 2000: 4(2)(i); Republic of South Africa, 1996: 152(1)(d)).

In the effort to achieve the above objective, and to promote the right of security and protection of persons and goods as according to the Bill of Rights (Republic of South Africa, 1996: 12(1-2)) the Rationalisation of Government Affairs Act allows for the restriction of access to public places for safety and security purposes with the procedures for local authorities to impose such restrictions set out in chapter seven of this act. The public areas referred to by this act has been in reality resulted in the closure of a number of public roads, barring access to many neighbourhoods not just in the City of Tshwane but also within the greater Gauteng area.

Although the above is in line with certain objectives set out in certain pieces of legislation, it is contrary to other human rights and regulations. The right of freedom of movement which is also stipulated within the Bill of Rights (Republic of South Africa, 1996: 12(21)(1)) is one such right. According to Bénit-Gbaffou (2008: 1937) this particular right is a very sensitive one with regards to apartheid rules that prohibited black people from moving freely about our cities.

The National Road Traffic Regulations as set out under section 75 of the National Road Traffic Act, 1996 (Act 93 of 1996), stipulates under regulation 319(1) that:

> "No person shall wilfully or unnecessarily prevent, hinder or interrupt the free and proper passage of traffic on a public road."

The Rationalisation of Government Affairs Act is contradicting and undermining a national act by allowing for public roads to be closed off and by allowing access restriction to neighbourhoods. This is a clear indication that conflict exist between national and provincial legislation, and that co-ordination and integration of objectives, or means of achieving certain objectives is non-existent.

When taking a look at the Land Use Management Bill (Republic of South Africa, 2001), a number of principles are set out to ensure fair and efficient spatial planning and land use management occurs. These principles to are set out under section 4(1) to ensure that land use management, land development and spatial planning are sustainable, equal, efficient, integrated and based on fair and good governance. Certain aspects of

these principles must be highlighted, as the Rationalisation of Government Affairs Act is contradictory towards a number of these principles, and what they entail. These include:

Sustainability

> 5(b) "The general interest as reflected in national, provincial and local policies should enjoy preference over private interests in spatial planning, land use management and land development processes and decisions."

Chapter seven of the Rationalisation of Government Affairs Act do not support the above, as the enclosure of neighbourhoods only benefit a small population with a private interest (Landman, 2007b: 7; Landman 2007a: 139).

Equality

> 6 "The principle of equality means that everyone affected by spatial planning, land use management and land development processes and decisions should enjoy equal protection and benefits and that no one should be subjected to unfair discrimination"

Enclosed neighbourhoods have become a physical representation of discrimination with residents living inside enclosed neighbourhoods being extremely suspicious of individuals who are on the outside (Fabiyi, 2006: 380). Also, the fact that only wealthy or middle to high income neighbourhoods can afford to enclose their neighbourhoods, security in a sense have become a financial privilege (Hook and Vrdoljak, 2001), leaving those who cannot afford this privilege to fend for themselves.

> (c) "land use management decisions should be determined taking into account its impact on society as a whole rather than only the narrow interest of those affected"

Once again it is clear that enclosed neighbourhoods only benefit a small population as only they reap the benefit due to the fact that crime as well as traffic is displaced to other neighbourhoods and higher order roads (Lemanski, Landman, and Durington, 2008: 151; Landman 2006: 139)

Efficiency

> 7(c) "Spatial planning, land use management and land development processes and decisions of contiguous municipalities and provinces should relate positively to each other"

The above just reinforce the point that the different spheres of government and the different legislation with regards to land use management, spatial planning, transport planning, human rights and social aspects are not interrelated and integrated as it should be.

Integration

> 8 "The principle of integration, which means that the separate and divers elements involved in spatial planning, land use management and land development should be combined and co-ordinated into a more complete or harmonious whole"

Although this is not explicitly described, this principle entails that all disciplines involved in spatial planning should be considered and integrated, and from literature it has been established that land use and transport planning should be integrated to truly encourage and maintain sustainable living conditions (Te Brömmelstroet and Bertolini, 2010; Kölbl; Niegl and Knoflacher, 2008: 273; Curtis, 2007: 104; Banister, 2008: 75).

> (a) "Spatial planning, land use management and land development processes and decisions should be co-ordinated and aligned with the policies of other organs of state in any sphere of government"

Once again the importance of integration and co-ordination between spheres of government, departments and legislation is emphasised.

> (b) "Spatial planning, land use management, and land development processes and decisions should promote efficient, functional and integrated settlements"

Efficient, functional and integrated settlements can entail an array of factors, but in terms of the physical attributes of settlements, accessibility to and from neighbourhoods ensures efficiency and integration (Kölbl; Niegl and Knoflacher, 2008: 277).

(d) “Spatial planning, land use management and land development processes and decisions should promote racial integration”

As was previously established, enclosed neighbourhoods can reinforce certain aspects of apartheid. Not necessarily in terms of race, but income. However, due to the fact that enclosed neighbourhoods exist in traditional white, established neighbourhoods, the majority of residents are white, which hinders racial integration (Horn, 2004; Landman, 2007b: 5; Lemanski, Landman, and Durington, 2008: 135; Landman, 2007a: 135; Jürgens, and Landman, 2006: 112; Sanchez, Lang and Dhavale, 2005: 283).

From this, it is clear that chapter seven of the Rationalisation of Government Affair Act evokes a great deal of controversy and constitutional issues. With regards to objectives of local government in terms of spatial planning and the issue of enclosed neighbourhoods, the following section will take a closer look at whether enclosed neighbourhoods also hamper these objectives.

5.4. Local government objectives vs. the Rationalisation of Government Affairs Act.

According to chapter seven of the Rationalisation of Government Affairs Act section 44(1)(a)&(b), the local authority, and in this case the City of Tshwane, has to determine and pass a resolution for the proposed terms of restriction. The City of Tshwane has as required compiled a document entitled: “Technical guidelines and criteria for enclosed neighbourhoods (City of Tshwane, 2001).

These guidelines state that the City of Tshwane prefer smaller applications, especially for areas that end in a cul-de-sac or crescent, as a precaution to minimise the impact on traffic circulation (City of Tshwane, 2001: 4). Even though it was discovered by the survey conducted that numerous of these “small” enclosed neighbourhoods exist, a great number of larger enclosed neighbourhoods also exist within close proximity to one another.

The above pose a problem as the guidelines require applicants in the case of big enclosures to conduct a traffic impact study on an individual basis (City of Tshwane, 2001: 7) but as the number of enclosed neighbourhoods rise within close proximity from

one another, the traffic congestion on higher order roads and adjacent open neighbourhoods become unbearable (Landman, 2007b: 7; Landman 2007a: 139).

One of the objectives of the City of Tshwane's integrated transport plan is to improve mobility and accessibility of transport networks (City of Tshwane, 2007a: 2-4) and if the number of enclosed neighbourhoods increases, this objective will not be achieved in great parts of the City of Tshwane. Furthermore, according to the City of Tshwane's spatial development strategy (2007b: 12), urban sprawl and segregation that occur within the city, generates a great amount of movement due to the fact that there is an extremely weak relationship between land use and transportation which already pose problems for the city, and this problem will prevail if enclosed neighbourhoods will just keep on contributing extra amounts of movements within the city.

The Technical Guidelines also stipulate that as traffic volumes within the enclosed neighbourhoods will change and decline which implicates that the City of Tshwane needs to alter the road maintenance to ensure that it remains in good condition (City of Tshwane, 2001: 13). This in a sense can be seen as unfair as time and money spent to ensure that roads that are underutilised remain in good condition for the benefit of only a small population, could have been better utilised to benefit the public as a whole.

With regards to the Town Planning Scheme, the main purpose is to ensure co-ordinated and harmonious development in an effective manner to promote health, safety, convenience and welfare amongst other things to ensure efficiency and economic development (City of Tshwane, 2008: 1). However by erecting gates and restricting access, convenience and health and efficiency is hampered for the greater public.

5.5. Conclusion

It is clear from the above that there are various issues regarding enclosure of neighbourhoods on all levels of government. At the same time, while objectives and principles from these different documents seem to contradict one another, another observation was made. In terms of legislation and frameworks that are concerned with land use/spatial planning and transportation, two entities that in theory should be closely related, none of these documents made any reference how these two disciplines impact on one another or how integration between the two should take place.

This begs to ask the question: Has the lack of realisation that these two disciplines should be integrated, or even become one discipline, within the different spheres of government, resulted in the ignorance with regards to the implications of enclosing neighbourhoods on both land use/spatial planning and transport planning?

CHAPTER 6: CASE STUDIES

6.1. Introduction

The main focus of the previous chapters was to explore the occurrence, extent and characteristics of enclosed neighbourhoods within the City of Tshwane, and to establish the practical impact of enclosed neighbourhoods on the urban form and more specifically, transport patterns and travel behaviour as well as exploring the influence of policies, strategies and legislation on the phenomenon of enclosed neighbourhoods.

This lead to the compilation of a classification table to theoretically evaluate each enclosed neighbourhood against a set of criteria to establish its level of impact. In order to further explore whether such a classification is valid, the need to take an in-depth look at transport patterns and travel behaviour of households residing within and around enclosed neighbourhoods became apparent. This was done by conducting a two-day retrospective travel survey and by distributing opinion based questionnaires to the selected sample of each area investigated.

A number of areas were identified, and case studies were built around them. This section is thus dedicated to the rationale for choosing these specific cases, their context, history, socio-economic dynamics and application for enclosure where applicable, as is typical when conducting case studies (Leedy and Ormrod, 2005: 135).

6.2. Selection criteria

The task of selecting enclosed neighbourhoods to form the basis of this study was done by taking certain aspects into consideration. First of all, both enclosed neighbourhoods had to consist of the same classification/level of impact (as indicated in the classification table set out in chapter 3) and had to consist of more or less the same amount of households and housing typologies (detached single family houses, townhouses/simplexes, duplexes, apartments/flats etc.). It was also important to choose one neighbourhood located within the southern region and one within the eastern region of the City of Tshwane.

On this basis, the two enclosed neighbourhoods selected were Lynnwood Glen Estate and Eldoraigne X18 Security Village, both classified as ‘4’ on the classification table

with a theoretical level of impact on transport patterns and travel behaviour listed as substantial. Other factors had to differ in order to make comparisons between the two neighbourhoods regarding transport patterns and travel behaviour. These were the number and location of streets open during peak times and location of public facilities in and around these neighbourhoods.

Below the performance matrix for Eldoraigne X18 Security Village and Lynnwood Glen Estate illustrates the score and thus the theoretical level of impact (level 4) of these neighbourhoods.

Enclosed neighbourhood:	**Eldoraigne X18 Security Village**				
Level of impact on traffic and travel behaviour	**1**	**2**	**3**	**4**	**5**
Number of residential dwellings	**≥4; <10**	**≥10; <25**	**≥25; <100**	**≥100; <200**	**≥200 (5.W)***
					X
Area of enclosed neighbourhood (Ha)	**<2Ha**	**≥2Ha; <10Ha**	**≥10Ha; <30Ha**	**≥30Ha; <50**	**≥50Ha**
				X	
Number of streets closed	**1**	**2**	**3 - 4**	**5**	**≥6**
					X
Highest class of street closed	**5**	**4**	**3**	**2**	**1**
	X				
Proximity to class 1-3 road (m)	**≥1000m**	**≥500m;<1000 m**	**≥150m;<500m**	**≥50m;<150m**	**<50m**
				X	
Number of public facilities within	**0**	**1**	**2**	**3**	**≥4**
		X			
Number of commercial activities within	**0**	**1**	**2**	**3**	**≥4**
		X			
Number of gates open during peak hours	**≥4**	**3**	**2**	**1**	**0**
		X			
Number of manned entrances	**≥3**	**2**	**1**	**-**	**0**
		X			
Total	**32**				
Cul-de-sac, crescent or dead end?	**Yes** [ ] (Total)(0.5)		**No** [X] (Total)(1)	**TOTAL**	**32**

* W (weight) = 2

Table 4: Performance matrix - Eldoraigne X18 Security Village

Enclosed neighbourhood:	Lynnwood Glen Estate				
Level of impact on traffic and travel behaviour	1	2	3	4	5
Number of residential dwellings	≥4; <10	≥10; <25	≥25; <100	≥100; <200	≥200 (5.W)*
					X
Area of enclosed neighbourhood (Ha)	<2Ha	≥2Ha; <10Ha	≥10Ha; <30Ha	≥30Ha; <50	≥50Ha
					X
Number of streets closed	1	2	3 - 4	5	≥6
					X
Highest class of street closed	5	4	3	2	1
	X				
Proximity to class 1-3 road (m)	≥1000m	≥500m;<1000 m	≥150m;<500m	≥50m;<150m	<50m
		X			
Number of public facilities within	0	1	2	3	≥4
			X		
Number of commercial activities within	0	1	2	3	≥4
			X		
Number of gates open during peak hours	≥4	3	2	1	0
					X
Number of manned entrances	≥3	2	1	-	0
		X			
Total	31				
Cul-de-sac, crescent or dead end?	**Yes** ☐ (Total)(0.5)	**No** X (Total)(1)		**TOTAL**	**31**

* W (weight) = 2

Table 5: Performance matrix - Lynnwood Glen Estate

In order to further explore the impacts of enclosed neighbourhoods on neighbouring open neighbourhoods' transport patterns and travel behaviour, another neighbourhood located directly adjacent to an enclosed neighbourhood had to form part of these case studies. The area selected were Lynnwood Glen, bordering Lynnwood Glen Estate to the east.

To be able to accurately measure the impacts of enclosed neighbourhoods on transport patterns and travel behaviour of households residing within and directly outside these enclosed neighbourhoods, an open neighbourhood not located close to an enclosed neighbourhood had to be included in the case studies to serve as the control group. As is normally required from a control group, this control group is similar to the other three neighbourhoods in terms of number of households residing within the neighbourhood

and housing typologies, but lack the component/stimuli i.e. gates, booms and/or fences restricting access to the neighbourhood or adjacent neighbourhood (Leedy and Ormrod, 2005: 220; Babbie, 2005: 231; Saunders, Lewis and Thornhill, 2007: 137). The neighbourhood chosen for this purpose is located in Doringkloof, Centurion.

Before being able to conduct any form of surveys within these areas, an in-depth look at each enclosed neighbourhood had to be taken. This is to be able to determine the socio-economic dynamics of each neighbourhood, in order to accurately compare these neighbourhoods and their respective transport patterns and travel behaviour. According to Leedy and Ormrod (2005: 135) it is typical when conducting case studies to collect extensive data on the subject and to understand its history and social and physical environment. In the following section, each case will be looked at individually.

6.3. Case studies in context

As mentioned, the case studies selected comprises of two enclosed neighbourhoods (Eldoraigne X18 Security Village and Lynnwood Glen Estate) one adjacent open neighbourhood (Lynnwood Glen) and one open neighbourhood not located within close proximity of any enclosed neighbourhood (Doringkloof) which serves as the control group. The context of each neighbourhood is as follows:

6.3.1 Eldoraigne X18 Security Village

Eldoraigne X18 Security Village in Centurion is located in the southern region of the City of Tshwane. Promulgated in 1952, Dorothy Kate Lorentz, owner of the original farm where this township, located at the west of Verwoerdburg (as Centurion was known back then) was established, chose the name Eldoraigne which was a merger of the names of family members and friends. Eldoraigne experienced rapid growth between 1960 and 1970, and slowly Eldoraigne shaped into the suburb and extensions as we know it today (Naudé, 1983: 116).

As established earlier, Centurion is characterised by medium to high income areas, well established infrastructure with an extensive road network (City of Tshwane, 2007c: 19-20). However, many residential areas in the Centurion area, including Eldoraigne X18 Security Village, are recognised by low density suburban sprawl and lack of mixed zoning and diversity, making public transport less viable and by default limit the choice

of travel mode to mainly private vehicle usage (Great Britain Department of the Environment and Department of Transport, 1995:2).

Eldoraigne X18 Security Village covers an area of approximately 44.5 ha, bordering to the east onto the Old Johannesburg Road (R101), classified as a metropolitan distributor, or class 2 road, which means it carries a considerable amount of traffic on a daily basis. To the south, neighbourhood borders onto Estcourt Avenue, classified as a class 4 road, which has been known to become extremely congested during peak hours. This section of Estcourt Avenue has lost its residential character with a number of properties rezoned for business or commercial purposes, and many others still zoned as residential but running commercial activities from these properties (please refer to the zoning certificate attached hereto as annexure F-H). To the west, the neighbourhood borders onto Howick Street and a block zoned for medium density residential units.

Figure 11: Pictures of properties in Estcourt Avenue illustrating the change in character from residential to commercial

Figure 12: Pictures of properties in Estcourt Avenue illustrating the change in character from residential to commercial

To the north western corner of the neighbourhood, a primary school, Laerskool Bakenkop is located with one of the main entrance to the neighbourhood located at one of the entrance gates to the school in Underberg Street. The northern side of the neighbourhood borders onto a nursery next to Hendrik Verwoerd Drive (a class 3 road) and onto an adjacent enclosed neighbourhood, Caper Estate, located in Eldoraigne X3.

The two main entrances are located at Goshawk street (just north of Estcourt Avenue), and Underberg Street.

The area in and around Eldoraigne X18 Security Village is not famous for its high crime rates, although series crimes have been known to occur. According to the application as submitted to the City of Tshwane in accordance to Chapter seven of the Rationalisation of Local Government Affairs Act, Act No. 10 of 1998 on behalf of the section 21 company, Biz Africa 1190, known as Eldoraigne X18 Security Village (2002), the crime rates within this neighbourhood is not alarming high, and that other advantages such as “lower short term insurance premiums, higher selling prices for houses in the security area and safer streets for children and pedestrians” should be considered when considering an aplication for an enclosed neighbourhood.

Eldoraigne X18 Security Village comprises of 376 households broken down to 260 detached residential dwellings and 116 townhouses and contains one commercial facility (pilgrims B&B) and one public facility (Kidz World nursery school).

From the areal photo below and the zoning plan attached as annexure F, it is clear that this neighbourhood has a strong residential character with an extensive road network.

Figure 13: Main entrance of Eldoraigne X18 Security Village – Underberg Street and Goshawk Street respectively

6.3.2 Lynnwood Glen Estate

Lynnwood Glen Estate is located within the Lynnwood Glen neighbourhood, forming part of the eastern region of the City of Tshwane. This region contains the greatest number of enclosed neighbourhoods within the City of Tshwane, and as briefly

mentioned in chapter three, it is the region with the highest income per capita (City of Tshwane, 2007b: 20). As is the case with Eldoraigne X18 Security Village, Lynnwood Glen Estate is characterised by low density, monotonous residential zoning. Most residents are thus reliant on private vehicle transportation as their main mode of transport.

Historically, Lynnwood, Lynnwood Glen and Lynwood Manor were established on the farm Hartebeespoort No. 308, which belonged to Mr F. E. B. Struben, with Lynnwood being proclaimed during the 1950s and Lynnwood Glen and Lynnwood Manor established during the 1960s by the executors of the estate after Mr F. E. B. Struben's death. The name Lynnwood is said to have been named by Mr Struben's wife, Mary as "Lynn-wood-Stream-trees", referring to a valley of water and trees (Andrews, 1961: 27). According to the Lynnwood Glen Residents Association Group (2006), during 1967, Lynnwood Glen developed more or less into the residential area as we know it today.

Lynnwood Glen Estate covers an area of approximately 85 ha and borders to the west onto the Danie Joubert Freeway (N1) and to the north it shares a boundary with the very busy Lynnwood Road, meeting at the north western corner with the onramp onto the Danie Joubert Freeway. As Danie Joubert Freeway is classified as a class 1 road, and Lynnwood Road a class 2 road, this intersection is extremely busy and congested during peak times.

Glenwood Road serves as the border between Lynnwood Glen Estate and the open part of Lynnwood Glen, both contained within the formal neighbourhood known as Lynnwood Glen. The southern boundary of Lynnwood Glen Estate is formed by Ingersol Road. Contained within this neighbourhood are Strubendam Bird Sanctuary and the Menlo Park Tennis Club surrounded by ample green open space.

The main entrances to Lynnwood Glen Estate are located in Delaware Street and Ilkey Road. The neighbourhood consist of 336 households of which 266 consist of single detached residential dwellings and 70 townhouses. Two of these residential properties are utilised for commercial or business purposes i.e. offices for SL Media, and 40 on Ilkey B&B.

During the period of 2000-2004, a number of incidents have reported of criminal activities and attempted crime. From a document set up in support of the application in accordance to Chapter seven of the Rationalisation of Local Government Affairs Act,

Act No. 10 of 1998, by the Lynnwood Glen West Residential Association, it is reported that over this period, approximately 119 crimes and attempted crimes have occurred within the area now known as Lynnwood Glen Estate. These activities range from petti crimes such as theft from clothes lines to serious crimes such as murder.

The location of Lynnwood Glen within the context of the City of Tshwane as well as the location of the main entrances to the enclosed neighbourhood is illustrated below.

Figure 134: Main entrances of Lynnwood Glen Estate - Delaware Street and Ilkey Road respectively

6.3.3 Lynnwood Glen

This section of Lynnwood Glen is also located within the eastern boundary of the City of Tshwane with similar characteristics as Lynnwood Glen Estate, as this was formerly one combined, open neighbourhood. Lynnwood Glen is situated east of Lynnwood Glen Estate, and shares its western boundary with the aforementioned Lynnwood Glen Estate.

The demarcated area chosen covers an area of approximately 88.2 ha. Lynnwood Road forms the northern boundary of the neighbourhood, with the north eastern boundary comprising of the Moreleta Spruit. General Louis Botha Drive forms the south eastern boundary and to the south it meets the western boundary, Glenwood Road.
The selected area contains 335 households, consisting of 280 detached residential dwellings and 55 town houses. St Albans College, a private school, is located within this neighbourhood, as well as the School for Practical Philosophy. Other land use activities include an animal hospital, a solar lighting company and a party shop, both run from residential dwellings, and patches of public open space. (Please refer to the zoning certificate attached as annexure H for further information regarding zoning).

Lynnwood Glen (including Lynnwood Glen Estate) is extremely well serviced and within close proximity to amenities and shopping facilities such as Menlyn Park and the recently completed Lynnwood Bridge Mall.

Figure 15: Aerial presentation of Lynnwood Glen (adjacent neighbourhood) (source: Google Earth)

Although no official crime rate for this part of Lynnwood Glen is available, it is assumed that this area, as the rest of the City of Tshwane experiences crime on a daily basis on different levels.

6.3.4 Doringkloof

Doringkloof is located within the southern region of the City of Tshwane and are situated in the northern part of Centurion. As is the case with the other three case studies, Doringkloof formed part of the former white suburbs and are thus equipped with proper services and road networks (City of Tshwane, 2007c: 19-20) characterised by low densities and thus a reliance on private vehicle usage. One characteristic of Doringkloof distinguishing it from the rest of the cases is the fact that this section of Doringkloof is not enclosed or situated directly adjacent to an enclosed neighbourhood. For this reason, Doringkloof was chosen as the control group.

The farm Doornkloof, where Doringkloof were established, belonged to Daniël Elardus Erasmus and served as the church farm for the former Transvaal area from 1848 to 1854. After his death, Daniël Elardus Erasmus left his farm to his three sons where two of them sold their inherited sections. The third section (the northern section) was sold much later to general J. C. Smuts, and Doringkloof was proclaimed (Naudé, 1983: 123; Laerskool Doringkloof Primary, 2011).

The section of Doringkloof chosen to form part of the control group, consist of 366 households, broken down into 291 detached residential dwellings and 75 townhouses, characteristics similar to the other three case studies. This section consists of an area of approximately 45.7 ha. This section of Doringkloof is contained within the boundaries of Limpopo Avenue to the north, Botha Avenue (M18) (a class 3 road) to the east, Sonja Street to the south and Glover Avenue to the west. This is illustrated by the image below:

Figure 16: Aerial presentation of Doringkloof (source: Google Earth)

According to the Doringkloof Residents Association (where the neighbourhood watch is incorporated), an average of two criminal incidents per week has been occurring over a period of six months from December 2010 up until June 2011, with the majority of incidents occurring during the daytime (Doringkloof Neighbourhood, 2011).

6.4. Population and Sample Selection

As four neighbourhoods with similar socio-economic characteristics are being studied, the population consists of the total households found within all four neighbourhoods. According to Leedy and Ormrod (2005: 205) a population can be defined as a "homogeneous group of individual units". Each household located within these neighbourhoods share a number of characteristics, such as:

- Each household is located within the City of Tshwane;
- Each household is located within a neighbourhood formerly classified as white neighbourhoods;
- Each household has access to sufficient services and infrastructure;
- Each household has access to an extensive road network; and
- Each household are located within middle- to high income neighbourhoods.

The total population consist of 1413 households, broken down into the four neighbourhood household sizes, which according to Saunders, Lewis and Thornhill

(2007: 606) is another description of a population. The respective number of households within each neighbourhood is:

- Eldoraigne X18 Security Village: 376 households
- Lynnwood Glen Estate: 336 households
- Lynnwood Glen: 335 households
- Doringkloof: 366 households.

General guidelines for identifying sufficient sample sizes to ensure it is representative of the population state that the greater the population, the smaller percentage is needed. In this specific case it is suggested that populations of more or less 1500 should have a sample size of twenty per cent of the population size (Leedy and Ormrod, 2005: 207). Due to financial and time constraints (as set out in *'1.4 Assumptions, scope and limitations'*), this study was limited to ten per cent of the population being sampled.

6.4.1 Sample Selection

There are numerous different sampling techniques at a researchers' disposal. However, it is important to choose the sample technique that will best reflect and represent the population (Babbie, 2005: 113). In this case it is vital to make use of probability sampling to ensure that every household has an equal chance to be selected to form part of the sample (Saunders, Lewis and Thornhill, 2007: 207).

Due to the size and dynamics of the population, the sampling technique chosen to select a sample, was the simple random sampling technique. This technique entails that each entity that form part of the population, be assigned a number. By means of a random sampling table or computer based random number generator, a number of random numbers are then chosen which will then comprise of the sample (Babbie, 2005: 209).

In this case, each neighbourhood were divided into smaller sections, each section of each neighbourhood containing more or less the same amount of households. Each household or residential unit within each section were assigned a number, starting at one. After this has been done, a sequence of numbers for each section for each neighbourhood was selected by using a random number generator:

In the case of Eldoraigne X18 Security Village, the sample selection occurred as follows:

Eldoraigne X18 Security Village

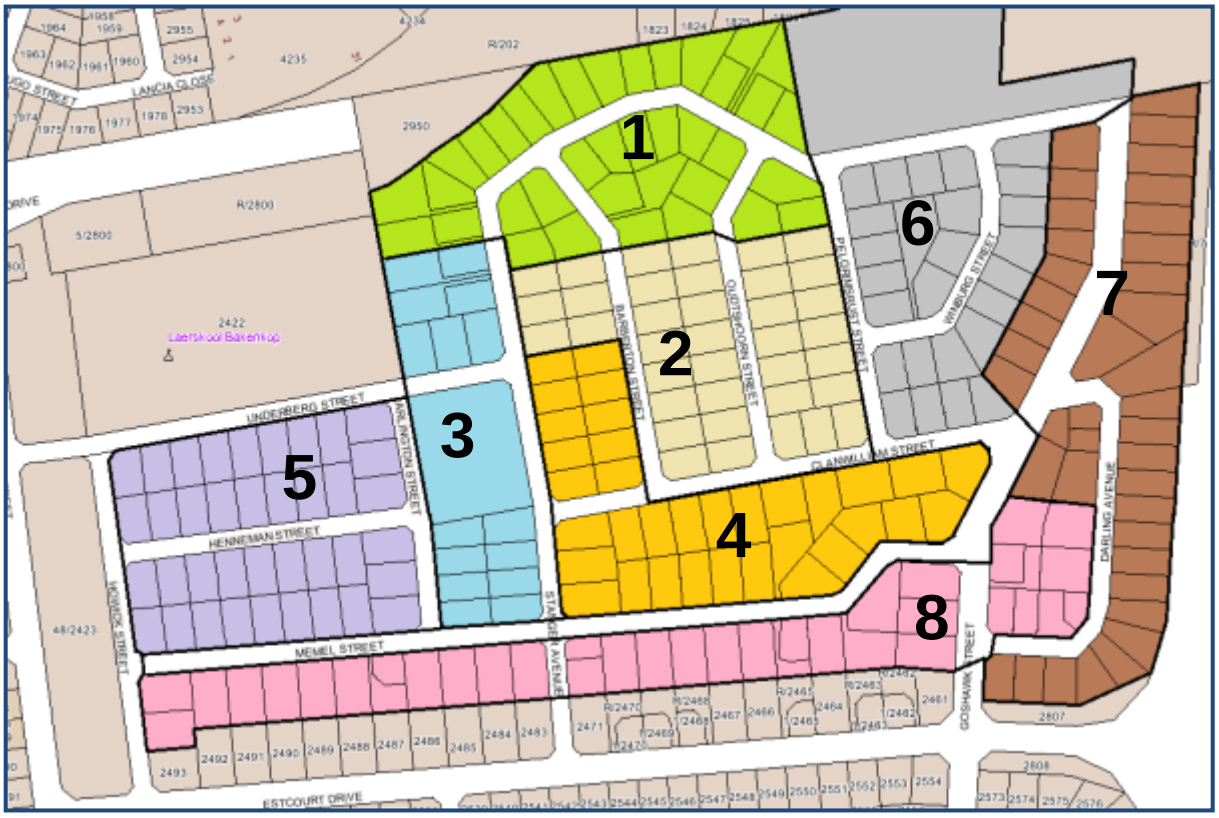


Figure 17: Illustration of the random selection process - Eldoraigne X18 Security Village

The neighbourhood was divided into eight sections, with each section containing more or less the same amount of households/residential dwellings. Each household within each section were assigned a number between one and thirty eight. Thereafter, a random number generator[8] were used to randomly select four to five households to participate in the travel survey and opinion based questionnaire, to form a sample size of thirty five.

The numbers randomly identified for each section were:

[8] http://www.randomizer.org/form.htm

Section 1
- 8
- 33 (substituted by 37)
- 27
- 30 (substituted by 38)
- 28

Section 2
- 24
- 36
- 28
- 6
- 38 (substituted by 37)

Section 3
- 36
- 6
- 10 (substituted by 19)
- 11

Section 4
- 26
- 1
- 3
- 2

Section 5
- 4
- 29 (substituted by 7)
- 31 (substituted by 36)
- 32

Section 6
- 35 (substituted by 26)
- 40 (substituted by 39)
- 41
- 7
- 12

Section 7
- 15
- 33
- 10
- 9

Section 8
- 13 (substituted by 14)
- 9
- 36
- 23

In order to adhere to the University of Pretoria's Code of Ethics, and to ensure anonymity of the respondents, none of the households within these sections were illustrated according to the allocated numbers.

In the event selected households unwilling to participate or unavailable, substitutions were made by every time selecting the residential dwelling to the right within the same section.

The same approach as was used for Eldoraigne X18 Security Village were used for selecting households to form part of the sample was used for all the neighbourhoods, to form a sample size of 140.

6.5. Survey Procedure

The word "survey" is often confused with the term "questionnaire", and although questionnaires is one aspect or component of surveys, there are an array of other methods used to collect primary data (Saunders, Lewis and Thornhill, 2007: 612). In this case, opinion based questionnaires as well as travel diaries were used to obtain data to make useful interpretations.

The process of conducting this survey was not without its challenges. As the issue of enclosed neighbourhoods are a controversial and in many cases a very sensitive issue, certain precautions had to be taken to ensure that all parties involved understood the aim and necessity of the research.

The first step was to contact Streetsafe, the managing company employed by a vast number of enclosed neighbourhoods within the City of Tshwane, to gain permission to include these two enclosed neighbourhoods in the study. Streetsafe established contact between the chairpersons of Eldoraigne X18 Security Village and Lynnwood Glen Estate. Permission to enter and conduct a survey was granted for both enclosed neighbourhoods after liaison established through phone calls, e-mails and face to face meetings.

As mentioned in Chapter 1, the survey had to be conducted within a school term to ensure that normal transport patterns and travel behaviour were captured. This occurred within the first school term of 2011. The execution of the survey[9] was dealt by a research company, Consulta, as funds were made available for exclusively this purpose. A 'research team' consisting of eight 'fieldworkers' and one 'supervisor' were deployed to complete the survey in the four different neighbourhoods. The team underwent a number of training sessions to ensure that they were informed on all aspects of the research and survey and to enable them to correctly approach all questions asked within the questionnaire and all possible queries that the respondents might have.

Where it was possible, interviews were conducted with each household members, but in some cases where this was not possible, proxy reporting were accepted as reported by the head of household.

During the course of the survey period, the chairperson of one of the enclosed neighbourhoods became concerned as an unknown number of respondents were uncomfortable with the nature of certain questions asked. This became a great threat as the possibility of all resident of this particular neighbourhood refusing to take part in the survey became a realistic prospect. However, each and every respondent that took part in the survey did so voluntary and signed a consent form whereby their anonymity were guaranteed and they agreed that the data gathered may be used for research

[9] Although a scientific research company was appointed to conduct the survey, the compilation of the survey and thus all intellectual components was done by the researcher under leadership of Prof Christo Venter and Dr Karina Landman

purposes. Additionally it was arranged that the nature of the research and the survey would be discussed and explained to all resident at their annual meeting. During this meeting, there was no objection or resistance regarding the research and survey conducted which allowed for the completion of the survey in all four neighbourhoods.

6.6.1 Significance of questions asked

The nature of this study required the inclusion of questions into specifically the travel survey that could be viewed (and indeed was viewed as thus in some cases by the respondents) as personal. However, according to Cao, Mokhtarian and Handy (2009: 363), in order to establish travel behaviour and characteristics, the socio-demographic factors and attitudes of individuals or households are of cardinal importance. Previous studies conducted regarding the relationship between the built environment and travel behaviour have found that economic income, choice of transit mode and location of residence is directly linked to economic dynamics of the household. If this information regarding the socio-demographic is not included in this travel survey, it might lead to bias or inconsistent estimations (Cao, Mokhtrian and Handy, 2009: 363).

Furthermore, numerous studies have found that when conducting travel surveys, it is of vital importance to include questions about travel behaviour, activity involvement, socio-economic characteristics (such as income, occupation, race, age), social relations and routines to accurately which might influence travel behaviour (Næss, 2009: 296; U.S. Department of Transport and U.S. Environmental Protection Agency, 1996). Travel surveys traditionally, and also in this case, comprise of respondents which are contacted in their homes and then questioned about their household characteristics, personal characteristics of members of the household (age, race, number of members of households, income, occupation etc.) and travel experiences of some or all household members (U.S. Department of Transport and U.S. Environmental Protection Agency, 1996: 3-1).

Questions asked and the justification for asking them is set out below. (For further detail on the surveys, please refer to Annexure A-D).

- **The number of members of each household** – This ensures that a holistic picture of each neighbourhood can be formed. This will allowed for comparison of the average household sizes and explain why certain areas may travel more

due to its average household dynamics (as making use of a case study to obtain data, the researcher may use one case study or make a comparison between a set of case studies (Neuman, 2006: 29-30)). As mentioned previously, this research comprises of case studies and when conducting a case study, the researcher typically collects extensive data on the individuals or phenomenon under question and factors such as history, the socio-economic climate and the physical environment are also typically taken into consideration (Leedy and Ormond, 2005: 135).

- **Number of domestic workers and whether they live on the premises** – Although domestic workers in some cases form part of the household and its dynamics, in other cases they need to travel to work each day. It was interesting to establish whether households that are located within enclosed neighbourhoods have more instances of domestic workers living on the premises compared to open areas, due to the fact that domestic workers need special permission to enter the neighbourhoods and can only make use of certain access points.

- **Housing tenure** – This question further ensures a holistic picture of each neighbourhood. This allowed for the comparison of neighbourhood dynamics and the establishment whether more households rent or own houses within the different neighbourhood types, and form an understanding of the socio-demographic dynamics. Furthermore, a study conducted by Greenwald (2003) to establish travel behaviour of 4235 individuals residing in Portland, residential tenure was used to classify and confirm their socio-economic position and found a relationship between housing tenure and travel behaviour (Cao, Mokhtrian and Handy, 2009: 378-379). Whether this is the case in South African neighbourhoods are yet to be discovered, and this study allowed for the opportunity to explore this within the greater study areas.

- **Number and detail of motor vehicles owned by the household** – This question required participants to state each vehicle which are in working condition, its make, year model, engine size and whether it consumes petrol or diesel. The purpose of this is to be able to take the trip made using this vehicle, and establish for each vehicle, what the amount CO_2 emissions were for a specific trip, and all trips made by the household. This information is thus important as each vehicle emit different levels of CO_2 (U.S. Department of

Transport and U.S. Environmental Protection Agency, 1996: 6-109). Næss (2009: 298) furthermore explains that it is common practice to include car ownership in such surveys as it acts as a control variable when keeping in mind that travel behaviour are influenced by mobility resources and that mobility choice and trip generation may be influenced by the desire to showcase individuality or status group.

- **Race, gender, age and occupation of each member of household** – These details, apart from the importance regarding the socio-demographic background and its relationship to travel behaviour, further set the scene of each neighbourhood and its dynamics as important when conducting case studies (Leedy and Ormond, 2005).
  - **Race**: This will be able to show us to what extent the neighbourhoods are racially integrated. It would further confirm or discredit claims made that certain neighbourhood types such as enclosed neighbourhoods are reinforcing apartheid type segregation, based not only on race, but income as well.
  - **Gender**: This will allow us to form a picture of each household and each neighbourhood.
  - **Age**: It has been found that persons of different ages have different travel needs, travel behaviour and habits. Households that consist of young families should in theory have a greater need to travel, compared to households for example that consist of a retired couple. Furthermore, the average age of the households within these neighbourhoods were compared when travel frequency differ for the different neighbourhoods.

- **Income of household** – As mentioned earlier, the socio-economic dynamics of individuals or households have a direct influence on travel behaviour. Also, this section is commonly found in travel surveys and are included as a vital section by the Travel Survey Manual that was compiled for U.S. Department of Transport and U.S. Environmental Protection Agency (1996)

- **Purposes of trip** – The exercise of conducting a travel survey in these four case studies were to accurately compare trip generation and travel behaviour. As sources have confirmed (Zhao, 2010), when accessibility are restricted, travel behaviour and transport patterns are altered. The aim was thus to record whether households that reside within and/or adjacent enclosed neighbourhoods, and who have to alter their routes due to limited access to and

from these neighbourhoods, and neighbouring open neighbourhoods, make less or more trips, and whether they combine trips due to the aforementioned accessibility constraints.

Apart from the questions asked within the travel survey, the questionnaires contained opinion based questions, which the respondents had little objection against answering. The opinions were then compared with the actual trips made. The findings for each household will now be discussed, and then compared against each other.

6.6. Findings

This section will present findings from the surveys. Firstly the household dynamics for each study area will be revealed, and compared to the context of these areas. After each of these areas has been discussed individually, the households will be compared. After this a section will be dedicated to the travel survey procedure, as well as an explanation of how it was analysed. Once again, the results for each case study will be looked at individually before comparing them. Thereafter the opinions regarding household travel behaviour and enclosed neighbourhoods will be examined and interpreted. Finally, all these results will be analysed, explained and compared and certain conclusion will then be derived from these.

6.6.1 Neighbourhood demographics and dynamics: Eldoraigne X18 Security Village

6.6.1.1 Household size and density

According to the survey conducted, the average household size for this area is 3.14 persons per household and according to the City of Tshwane's GIS; the average erf size is measured at 1155m^2 for Eldoraigne X18 Security Village. This is indeed an indication that the density is very low. Furthermore, the average number of private vehicles per household within this neighbourhood, was calculated, according to the survey, at 2.17, further proof that residents within this neighbourhood is dependent on private vehicle usage.

6.6.1.2 Household income, tenure, typology and market value

Respondents were asked to supply the total combined monthly household income for everyone forming part of the household (all sources of income: salary, pension, etc.) before tax and reductions. However, a great majority of respondents either did not know what this amount is, refused to answer the question, or simply gave an inaccurate account when observing their lifestyle and property. As a result, the average household income for Eldoraigne X18 Security Village is inaccurate. However, by taking other factors into account which the respondents reported or commented on, certain assumptions were made. For example, the housing typology, housing tenure and average year model of cars owned was used as a rough indication of 'external' wealth.

From the sample selected, only three per cent of households reside within a duplex, eleven per cent within a townhouse, and eighty six per cent within a single detached family unit. This is representative of the housing typology found within Eldoraigne X18 Security Village. With this said, according to the City of Tshwane's geographic information, updated in 2009, the average market value for property situated within this area, was R938 525. However, this was done before the enclosed neighbourhood were established, and according to numerous sources, property prices tend to increase as soon as a neighbourhood is closed off (Landman and Du Plessis, 2007: 23; Lemanski, Landman and Durington, 2008: 151).

This phenomenon of property prices increasing as soon as a neighbourhood is increased is supported when searching for properties situated within Eldoraigne X18 Security Village. According to privateproperty.co.za, the price for a property situated within this neighbourhood varies between R710 000 and R2 900 000. According to privateproperty.co.za, the average value of properties situated within Eldoraigne X18 Security Estate is R1 198 193. This amount is an estimate as supplied by Lightstone[10].

The majority of households surveyed (eighty six per cent), owned the property with a mortgage, while only fourteen per cent were renting. None of the households that took part in this survey had owned their property without a mortgage. This is also an indication that the area consist of a middle-income economic class, as households are able to qualify for home loans.

[10] "Lightstone is a specialised data and knowledge management company, serving a variety of sectors and clients. In the financial services industry, Lightstone provides property valuation technology and other risk management services to most South African Mortgage lenders and various insurance companies. Their house price index is seen as a key measure of house price movements by most property economists and commentators. In addition, Lightstone provides a range of data quality and spatial analysis solutions to other industries, including property developers" http://www.lightstone.co.za/portal/content/page.aspx?pid=7

6.6.1.3 Employment

Eldoraigne X18 Security Village has a very low unemployment rate. Only one per cent of all respondents were unemployed. Fifty four per cent of respondents listed that they were formally employed, while nine per cent were self-employed. Five per cent of respondents were not employed and fulfilled the role of a homemaker, while only two per cent of respondents were retired. The remaining twenty eight per cent of respondents were recorded as students.

The above is an indication that the neighbourhood is very much economic active (a good indication that this area is indeed a middle to high income area), and thus still very young. In fact, the average age of respondents was only thirty one.

6.6.1.4 Race and gender

According to the survey conducted, the majority of residents residing within Eldoraigne X18 Security Village were white. Eighty per cent of respondents indicated that they were white, while only twenty per cent were black. Fifty one per cent of respondent were male, forty nine per cent were female.

6.6.2 Neighbourhood demographics and dynamics: Lynnwood Glen Estate

6.6.2.1 Household size and density

From the survey conducted, it was found that the average household size within Lynnwood Glen Estate was 3.09 with the average erf size 1530m^2 according to the City of Tshwane's official geographic information. This indicates that this neighbourhood has a very low density which also indicates a greater ownership of private vehicles. According to the survey, the average household owns approximately two cars.

6.6.2.2 Household income, tenure, typology and market value

As was the case with Eldoraigne X18 Security Village, the respondents residing within Lynnwood Glen Estate was very reluctant to supply information regarding the total household income. Those who did supply this information, did so very conservatively, when comparing the stated income with their material possessions.

Nine per cent of households who took part in the survey resided within a duplex, while seventeen per cent resided within a townhouse. The majority of households - seventy four per cent - lived in a single detached family unit.

The average market value of properties within the Lynnwood Glen Estate area, is estimated (according to the City of Tshwane's geographic information) at R1 218 885. As is the case with Eldoraigne X18 Security Village, these valuations were made before the area was gated off, which influenced the property prices. When searching for properties located within Lynnwood Glen Estate, the prices ranged from R730 000 to R3 950 000. The average value of properties located within Lynnwood Glen Estate as calculated by Lightstone, is estimated at R1 670 698.

With regards to housing tenure, the number of households who own their property with a mortgage (forty six per cent) is very close to the number of households who own their property without a mortgage (forty three per cent). Only eleven per cent of households who participated in the survey were renting the property they reside within. The housing tenure situation further supports the claim that the households residing within Lynnwood Glen Estate falls under the middle to high income group.

6.6.2.3 Employment

In terms of employment, the number of respondents who were unemployed was three per cent. Twenty eight per cent of respondents claimed that they were formally employed and twenty per cent stated that they were self-employed. Seventeen per cent of respondents were retired and twenty two per cent were listed as students. Only one per cent of respondents' occupation was listed as 'other'.

From the above, it is logical to conclude that the average age of households will be slightly higher when looking at the number of respondents who are retired. The average age of respondents were recorded as forty four.

6.6.2.4 Race and gender

The survey conducted displayed that ninety two per cent of respondents within Lynnwood Glen Estate were white. Only eight per cent of respondents were black. Forty eight per cent of respondents were male, and fifty two per cent were female.

6.6.3 Neighbourhood demographics and dynamics: Lynnwood Glen

6.6.3.1 Household size and density

The survey conducted revealed that in Lynnwood Glen, the average household consists of 2.77 members with the average car ownership per household 2.11. According to the City of Tshwane's geographic information, the average erf size for this area is 1817m^2.

As with the previous two neighbourhoods, this is a good indication of low densities.

6.6.3.2 Household income, tenure, typology and market value

The respondents from Lynnwood Glen, was very wary of revealing their total household income, and as a result, a great number of respondents opted not to answer this question, or supplied a fictitious income, as was clear when comparing it to their lifestyle. As a result other measures were used to form a better idea of the respondents and thus the neighbourhood's socio-economic dynamics. Measures used to estimate the level of income, were housing typology, housing tenure, the market value of properties within the neighbourhood, as well as the average amount of private vehicles owned by the household.

The case of Lynnwood Glen revealed that twenty six per cent of respondents resided in townhouses, while seventy four per cent lived in single detached family units. From these, eighty three per cent of the households owned their property with a mortgage, and seventeen per cent of households owned their property without a household.

According to the City of Tshwane's geographic information for 2009, the average market value of a property situated within Lynnwood Glen is approximately R1 293 772. However according to numerous real estate websites, the average price properties within this area are advertised as, is between R1 650 000 and R2 300 000. Information gathered from Lightstone, indicated that the average property value for this area is estimated at R1 639 364.

6.6.3.3 Employment

From the surveys conducted within this study area, none of the respondents were unemployed. Just over half of the respondents (fifty three per cent) indicated that they

were employed on a formal basis. Eight per cent of respondents did not work but fulfilled the role of a homemaker, while eight per cent of respondents were retired. Twenty one per cent of respondents were listed as students and three per cent indicated that they were employed, but did not fall within one of the above categories.

6.6.3.4 Race and gender

The racial split within Lynnwood Glen was skewed, with eighty four per cent of respondents being white, while only sixteen per cent of respondents were black. However, the gender split within this area was even, with fifty per cent of respondents being female, and fifty per cent male.

6.6.4 Neighbourhood demographics and dynamics: Doringkloof

6.6.4.1 Household size and density

As was the case with previous three case study areas, Doringkloof have traditionally also been characterised by low densities and well serviced neighbourhoods. After the survey was conducted, it was found that the study area had an average household size of 2.77, with the average erf size being 936m^2. The number of cars per household for Doringkloof was found to be 1.91. This supports the notion of Doringkloof being a low density, single use zoned area.

6.6.4.2 Household income, tenure, typology and market value

A great number of respondents did not feel comfortable revealing their household's income which resulted in many cases of refusal to answer the question. This means that the total household income derived might be a skewed reflection of reality. Although the average total household income for the neighbourhood could not be accurately reflected, other measures were taken to form an idea of the economic situation of the neighbourhood. This was done by looking at the housing tenure and typology most commonly found within the neighbourhood as well as taking property prices into consideration.

The majority of respondents (eighty six per cent) reside within a detached single family unit, with the remaining fourteen per cent living in a townhouse. Ninety four per cent of the respondents owned their properties with a mortgage, with only three per cent owning their property without a mortgage, and three per cent renting.

According to the City of Tshwane's online geographic information, the average market value in Doringkloof during 2009 was R840 401. When looking at properties for sale within this area, the property prices range between R950 000 and R1 700 000. According to Lightstone, the estimated average property value were listed at R1 140 924.

6.6.4.3 Employment

Only one per cent of respondents who took part in the survey indicated that they were unemployed, with forty six per cent of respondents being employed on a formal basis. Six per cent of the respondents are self-employed and seven per cent indicated that they did not work, but considered themselves as homemakers. Eighteen per cent of respondents are retired and nineteen per cent are students. Three per cent of respondents indicated that they were employed but did not fall under any of the categories.

6.6.4.4 Race and gender

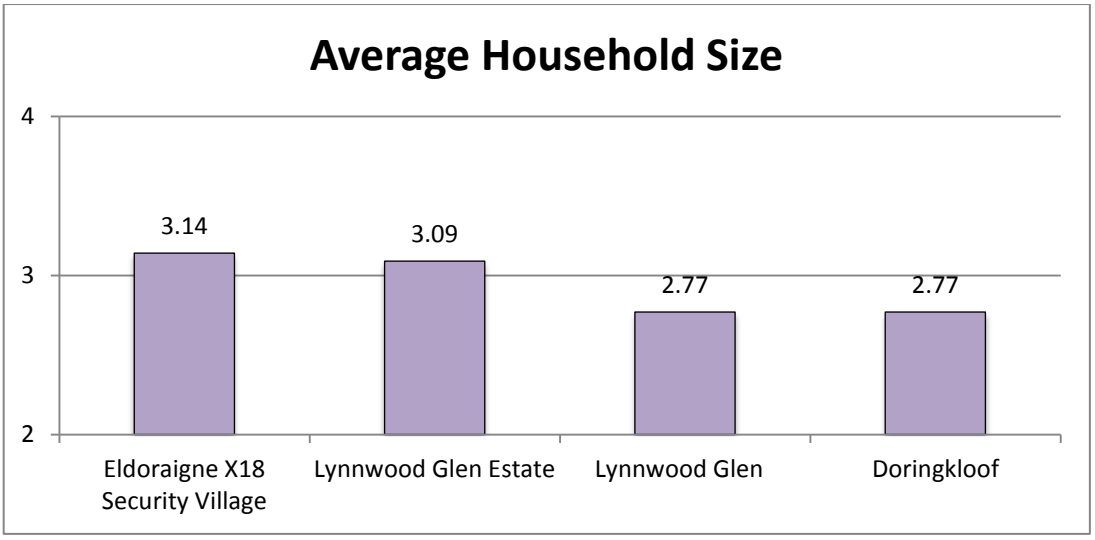
The majority of households consisted of white families, with seventy three per cent of respondents being white. Twenty five per cent of respondents within the neighbourhood were black, and two per cent coloured.

The gender split within the neighbourhood was very close, with fifty three per cent of respondents being male, and forty seven female.

6.6.5 Comparison of neighbourhood demographics and dynamics

6.6.5.1 Household size and density

The average household size for the selected study areas was similar, with households consisting of approximately three members per household. This is visually illustrated by the graph below:



Graph 1: Comparison of average household size

The average erf size for the respective study areas differed, but all four areas showed extremely low densities when expressing densities as average household size per average erf size:

Average Erf Size (m^2)	
Eldoraigne X18 Security Village	1155
Lynnwood Glen Estate	1530
Lynnwood Glen	1817
Doringkloof	936

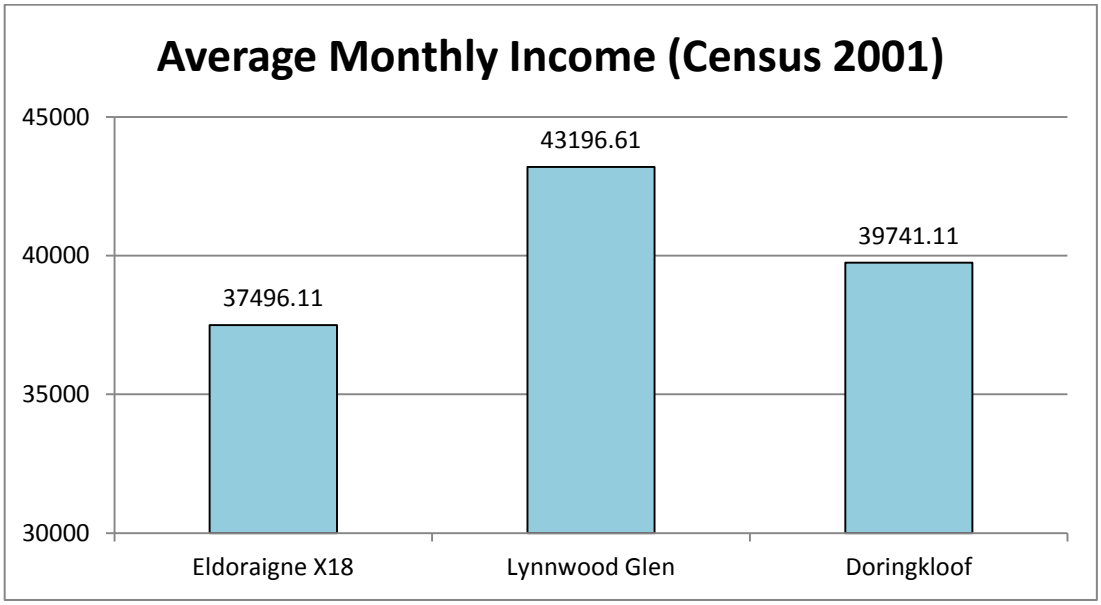
Table 6: Average Erf Size

Study area	Average densities	People per Ha
Eldoraigne X18 Security Village	3.14/ 1155m^2	27/Ha
Lynnwood Glen Estate	3.09/ 1530m^2	20/Ha
Lynnwood Glen	2.77/ 1817m^2	15/Ha
Doringkloof	2.77/ 936m^2	30/Ha

Table 7: Average densities

6.6.5.2 Household income, tenure, typology and market value

As was established earlier, the income data that was collected during the survey were unreliable. To form an idea of the average monthly income and a better understanding of the socio-economic dynamics of these four study areas, census data from 2001 were used. Although this data is greatly out-dated, and the fact that Eldoraigne X18 Security Village and Lynnwood Glen Estate were still open areas and integrated with their adjacent neighbourhoods, these statistics can provide a glimpse of what the possible socio-economic situation for these areas are.

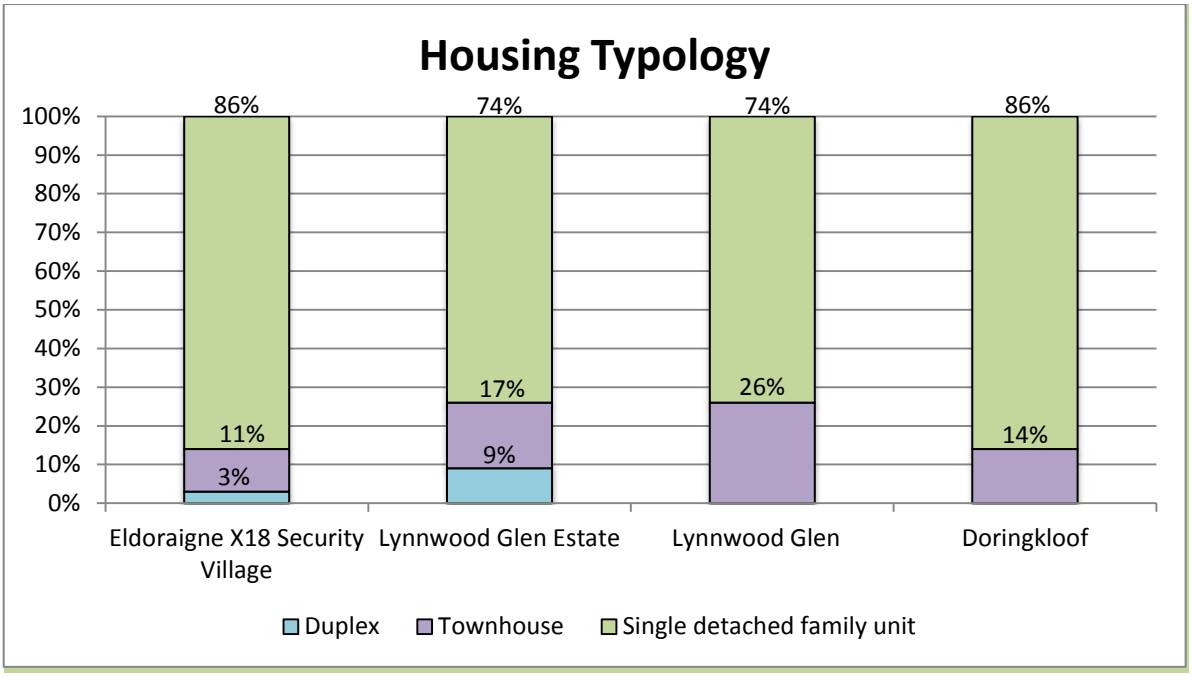


Graph 2: Average monthly income 2001

The above statistics show that the average monthly household income for the greater Eldoraigne X18 area (which Eldoraigne X18 Security Estate only form part of) was approximately R37 496 per month, the greater Lynnwood Glen area (Lynnwood Glen Estate combined with Lynnwood Glen) earned more or less R43 197 per month, while the greater Doringkloof area earned approximately R39 741 per month per household.

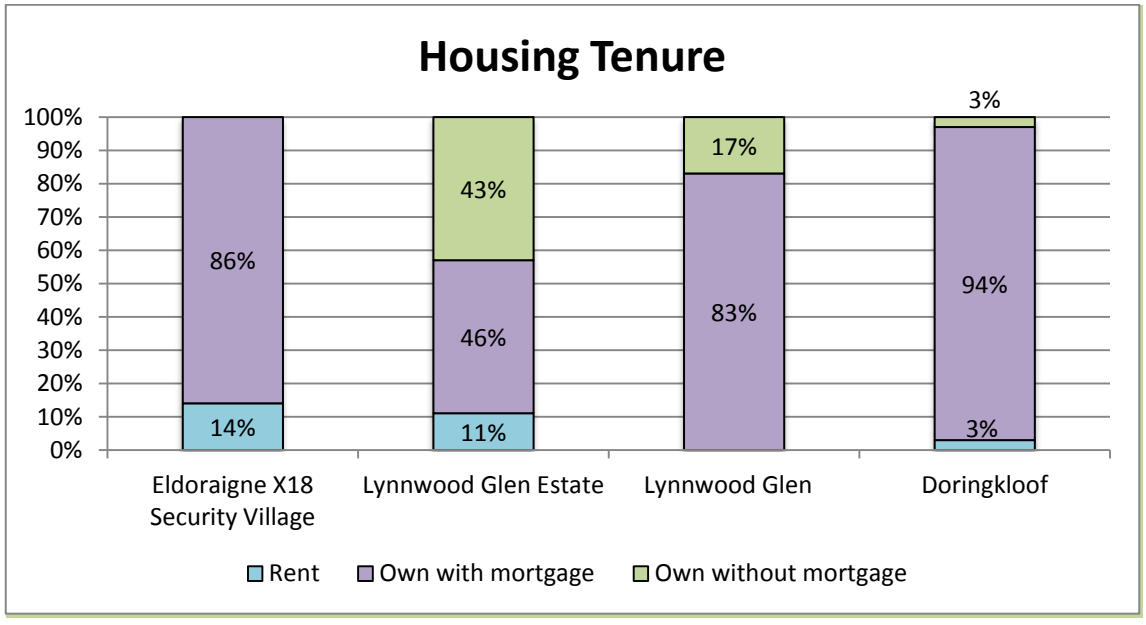
As established already, these areas have been known throughout the last fifty odd years to host middle income households (City of Tshwane, 2007b; City of Tshwane, 2007c) and by assuming that over the last ten years, the income for these areas has grown proportionally, and by taking material possessions into account, such as number and model private vehicles, type, value and tenure of residential dwelling, it can be concluded that these areas indeed fulfil the criteria associated with middle to high income neighbourhoods.

Below, a graph illustrating the housing typology split for the respective study further corroborates the lack of high density residential units within these neighbourhoods. This is also an indication of the trend of higher property values, as single detached family units are normally more expensive than townhouse complexes etc.



Graph 3: Housing typology per study area

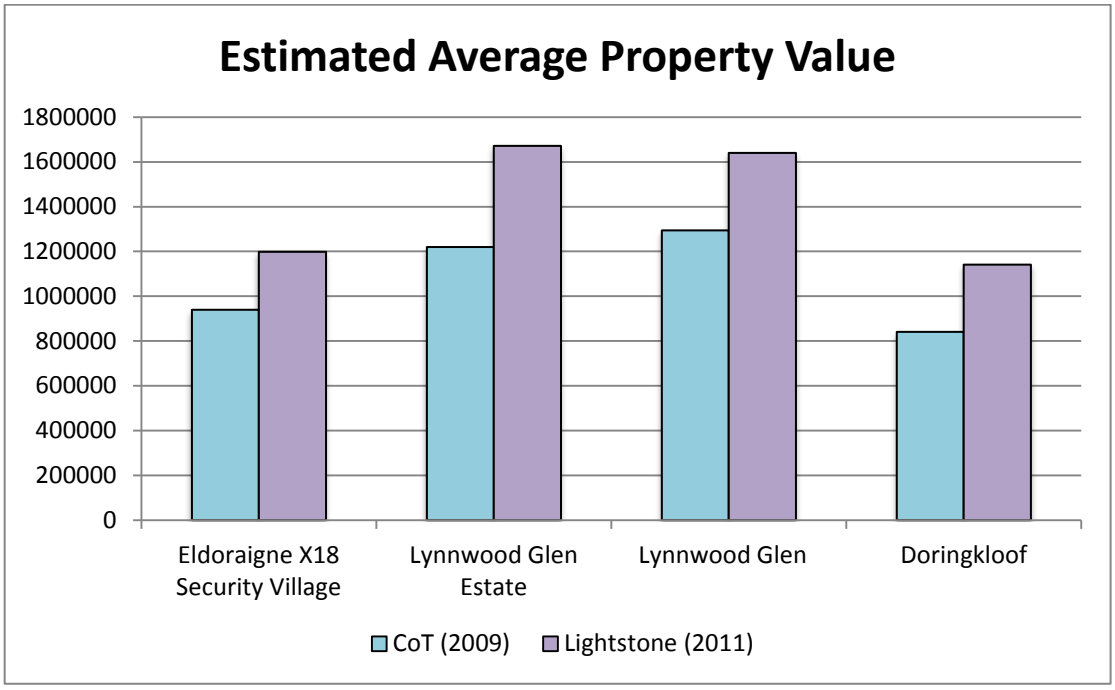
Housing tenure is also a good indication of the economic class of a neighbourhood. Below, the graph illustrates the housing tenure for the respective study areas. The categories indicate the percentage of households who are renting the property they are currently residing within, the percentage of households who own their property with a mortgage (in other words those who still have a bond registered over their property) and the percentage of households who own their property without a bond (in other words the property have been paid off, or the property was either inherited or donated).



Graph 4: Housing tenure per study area

It is clear from the above that the majority of households for all four study areas own their property. It is thus logical to conclude that the majority of households thus earn enough to qualify for mortgages to cover the property prices within these neighbourhoods, or have the means to have relieved or pay off the mortgages.

Property value is also a good indication of the socio-economic state of a neighbourhood. These figures illustrate in the graph below were obtained through the City of Tshwane's geographic information available online, which supplies the estimated value for each and every erf registered within the city's jurisdiction. This information was last updated during 2009, and has thus changed since then. Lightstone also supplies property value estimates for properties within the City of Tshwane, but these estimates are based on recent purchases (within the last twelve months) and bonds registered in accordance with the deeds office.



Graph 5: Average property value per study area

From the above, it is clear that the relationship between the 2009 estimates from the City of Tshwane and the information as presented by Lightstone, are proportional.

It is also interesting to note that the average property value for Lynnwood Glen Estate is slightly higher than that of the adjacent open Lynnwood Glen area. Since Lynnwood Glen Estate has only been officially closed off during the beginning of 2010, it would be interesting to see how the property prices will differ in a few years' time.

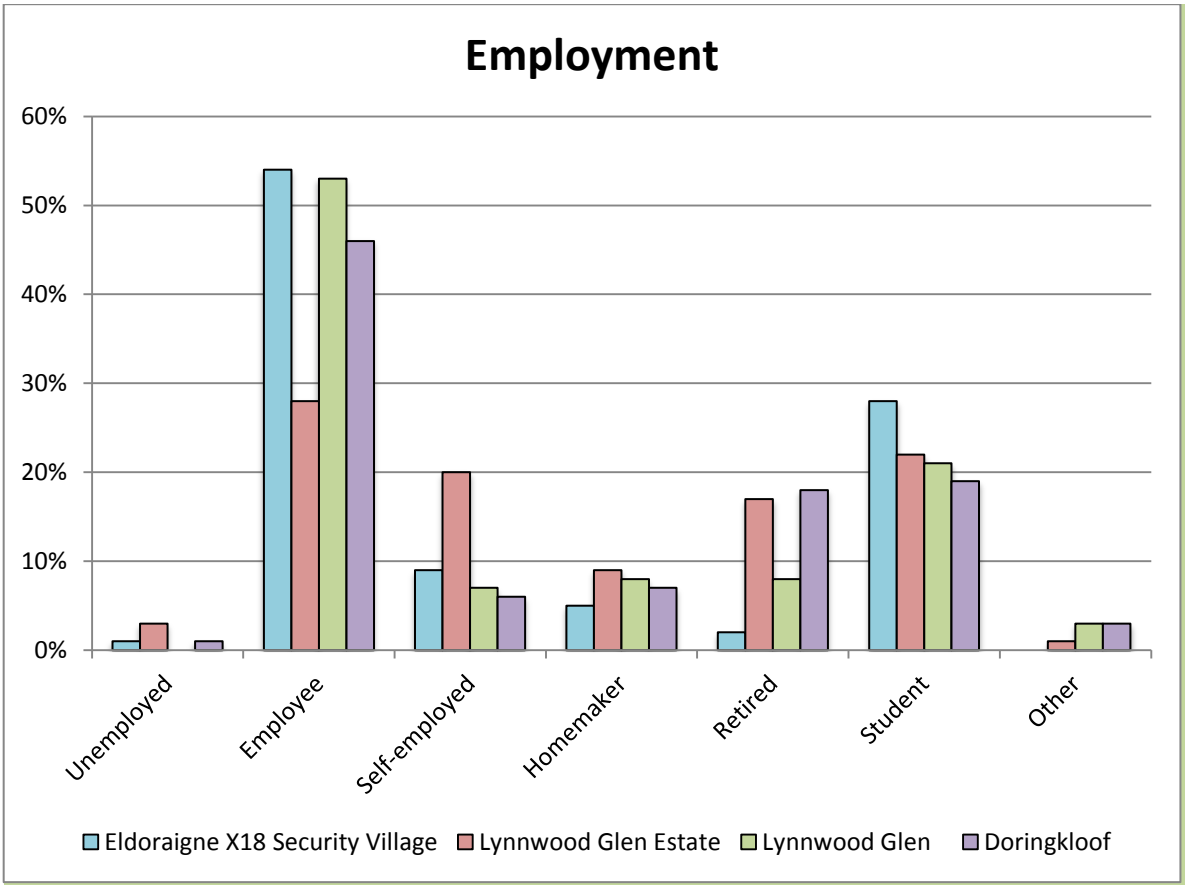
6.6.5.3 Employment

From the table and graph below, it is noted that the unemployment rate within these neighbourhoods is extremely low, with the majority of respondents being employed.

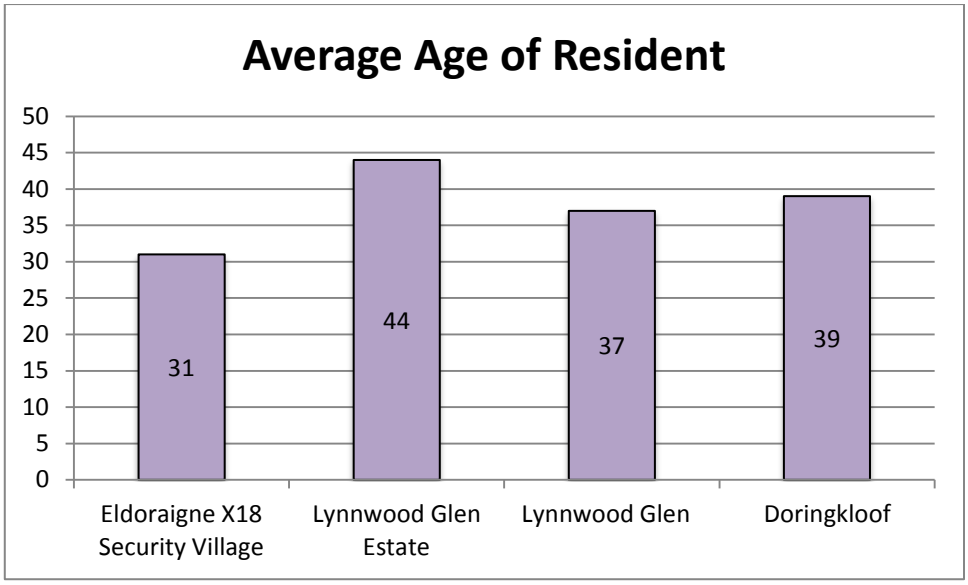
Employment				
	Eldoraigne X18 Security Village	**Lynnwood Glen Estate**	**Lynnwood Glen**	**Doringkloof**
Unemployed	1%	3%	0%	1%
Employee	54%	28%	53%	46%
Self-employed	9%	20%	7%	6%
Homemaker	5%	9%	8%	7%
Retired	2%	17%	8%	18%
Student	28%	22%	21%	19%
Other	0%	1%	3%	3%

Table 8: Employment split per study area

The employment areas further corroborates with the average age of the residents within these neighbourhoods, as the average age of the households are typically the age around when a person's career takes off.



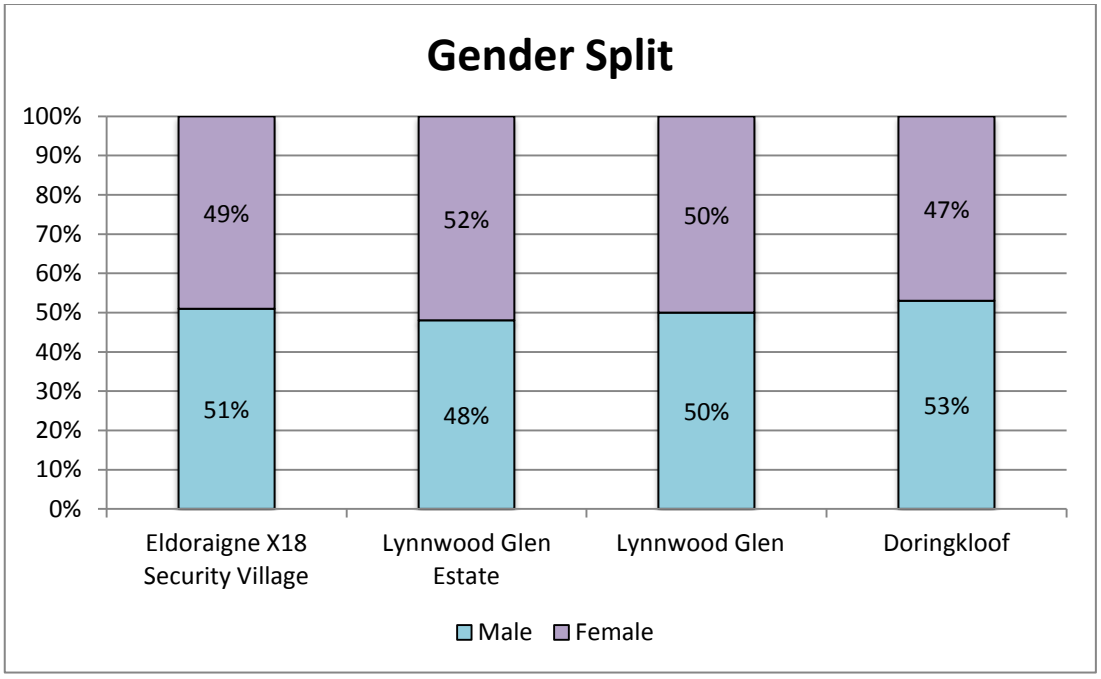
Graph 6: Employment split per study area



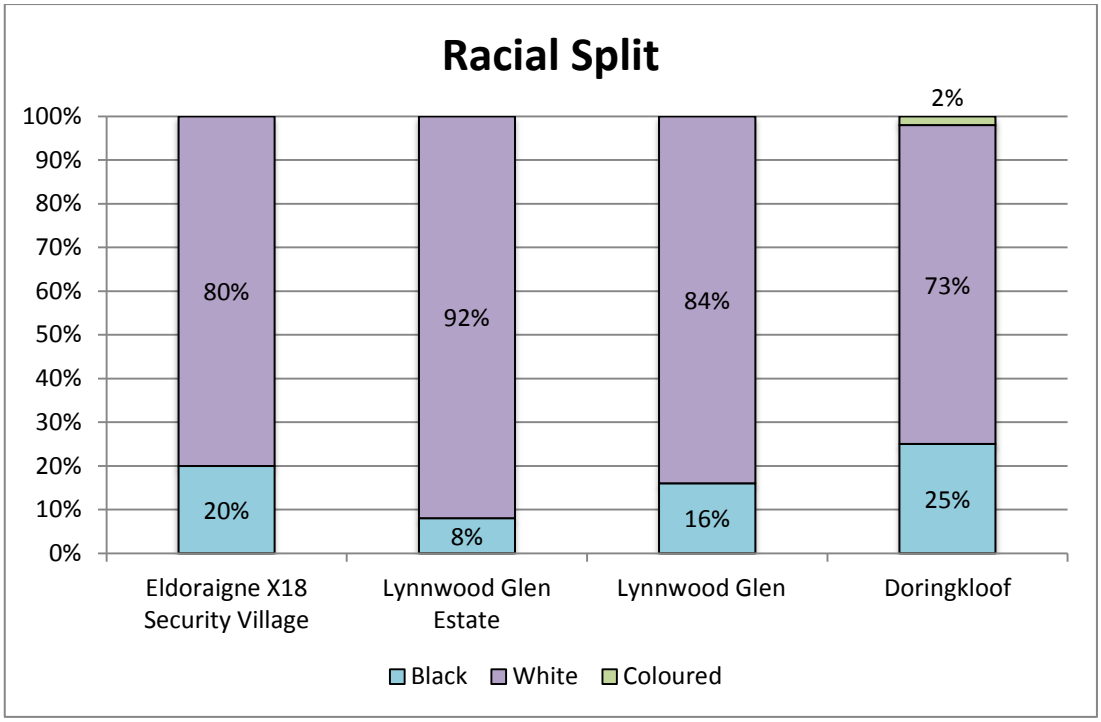
Graph 7: Comparison of average age of residents

6.6.5.4 Race and gender

Although the gender split for all the neighbourhoods are more or less even, the situation regarding the racial split is a whole different issue.



Graph 8: Gender split per study area



Graph 9: Racial split per study area

From the above, it is clear that the area that are the least integrated in terms of race, is Lynnwood Glen Estate, with the control group, Doringkloof, being the most integrated, although the majority of residents are white. As it has been discussed in depth, these areas were exclusively white residential areas during the apartheid regime, which makes it easy to understand why these areas are still divided like they are (Horn, 2004).

However, the claims made that enclosed neighbourhoods is a way of reinforcing apartheid (not just based on race but economic class) seems more viable (Landman, 2007b: 5; Lemanski, Landman, and Durington, 2008: 135; Landman, 2007a: 135; Jürgens, and Landman, 2006: 112; Sanchez, Lang and Dhavale, 2005: 283).

At this stage it can be concluded that the four areas are indeed similar enough in terms of demographics that comparisons between them would make sense.

6.6.6 Travel behaviour and patterns

This brings us to the next section which will take a look at each neighbourhood's average household travel behaviour and patterns. Aspects to be examined include number of private vehicle per household, average travel time, average VKT, purpose of trips, time of day trips were conducted, mode of travel, and subsequent CO_2 emissions

due to these variables. As with the household dynamics and demographic findings set out above, these findings will also be investigated individually for each study area, and thereafter a section will be dedicated to the comparison between the different study areas' results.

As have been widely reported and established, automobiles, and more specifically, the use of private vehicles, cause undesirable conditions such as congestion, air pollution and noise pollution (Barla, Miranda-Moreno and Lee-Gosselin, 2011: 423).

It has also been found that land use, or if you will, the built environment plays a great role with regards to private vehicle usage. Suburbs and other low density, single zoned neighbourhoods are usually the culprit for enabling or encouraging travel behaviour which favours the usage of private vehicles and its role in contributing to air pollution (Bohte, Maat and Van Wee, 2009).

The two-day retrospective diary was distributed to the selected households located within the four different study areas. All members of each household over the age of six provided detailed information on their travel activities over a period of two consecutive days within a normal work week (Monday to Friday). The information regarding travelling and related activities gathered included the following:

- The number of vehicles in working condition owned by the household;
- The make, model, year of production and engine size of all cars owned by the household which are still in working condition;
- The day of the week the trips were undertaken;
- The location of each initial trip, and the location of each destination;
- The mode of travel for each trip (private vehicle, public transport, walk, cycle, etc.);
- The specific vehicle details used for each trip when making use of a private vehicle;
- The purpose of each specific trip made;
- Time of departure and arrival for each trip made; and
- Whether the respondent were driving the vehicle, or merely a passenger.

The collection of all these details allowed for certain findings to be revealed to form a greater picture of each study area's travel behaviour and transport routes, and the subsequent contribution, through travel behaviour and routes, to CO_2 emissions.

The exact distance travelled for every respondent was simulated using Garmin's GIS software, MapSource, used to plan routes, create tracks and determine the length of routes travelled using the shortest distance routes.

When calculating CO_2 emissions for the respective study areas, the VKT for each car for each trip driven were recorded. The CO_2 figures were based on figures published within the CAR magazine, official information from motor vehicle manufacturers and in conjunction with the Society of Motor Manufacturers and Traders Limited (2001-2009). In the event of discrepancies or the inability to accurately determine the CO_2 produced (g/km) of a specific vehicle, the lowest possible value awarded to ensure that the total CO_2 produced in each case could in fact be more severe, but definitely not less.

As was the case with the previous section, the results gathered from all the study areas will first be discussed separately under relevant headings, and will thereafter be compared in a separate section.

6.6.6.1 Travel behaviour and patterns: Eldoraigne X18 Security Village

The total number of trips recorded over a period of two days for this area was 658, measuring in 4734km, which can be translated into the average distance travelled by households within Eldoraigne X18 Security Village per day as approximately sixty seven kilometres, with the average travel time per trip made by these residents being thirty one minutes per trip conducted.

From all the above trips recorded, approximately seventy six per cent were undertaken by means of driving a private vehicle, with only ten per cent of respondents conducting trips as passengers of private vehicles. Two per cent of trips recorded were undertaken via a motorcycle or scooter, while approximately seven per cent of trips were carried out by foot and one per cent by bicycle. Less than one per cent (0.8%) of trips were executed by a minibus taxi and the means of 0.1% of trips undertaken being unknown or by another means not listed.

The table below sets out the reasons or purpose for travelling, and displays the percentage of all trips made for a specific reason within the study area:

Purpose of trip	Percentage
Returning home	34.5%
Work	23.6%
Educational	12.1%
Shopping	9.6%
Eat/drink	7%
Work related	5.1%
Visiting someone	3.9%
Gym/sport	1.8%
Other	1.1%
Medical	0.8%
Social	0.6%
Total	**100%**

Table 9: Purpose of trips conducted for Eldoraigne X18 Security Village

From above, it is clear that the most prominent purpose for undertaking a trip (apart from returning home from a destination) was to go to work (approximately twenty three per cent). Educational purposes (attending school or university, and accompanying children to school) were the second most popular reason for conducting a trip with twelve per cent of all trips conducted for this reason. Almost ten per cent of respondents made a trip to do shopping, and seven per cent for the purpose of eating or drinking. Trips made that were related to work (attending meetings, collecting documents, meeting clients etc.) made out five per cent of all trips made. Almost four per cent of trips were undertaken to visit someone while not even two per cent of trips were made to visit a gym or take part in physical activities or sport. Medical reasons were listed as just less than one per cent for making a trip, and only 0.6% of trips were for social or recreational reasons. Approximately one per cent of trips undertaken were for other reasons than were listed above.

It was noted that the residents of Eldoraigne conducted the most trips between 'peak hours', with approximately twenty one per cent of trips made between 07:00 and 08:59 and almost twenty six per cent of trips made between 16:00 and 18:59. Approximately eighteen per cent of trips were made between 12:00 and 13:29, and fourteen per cent between 13:30 and 15:59. Only ten per cent of trips were conducted between 09:00 and 11:59 and the least trips were made between 05:00 and 06:59 (seven per cent) and 19:00 and 04:59 (three per cent).

The total CO_2 emitted for this area were measured by taking into account all the trips driven. This may mean, although a trip might have been listed twice, because a driver

and a passenger conducted the same trip, travelling within the same car, only the physical distance covered by that particular car was taken into account. Distances covered by other mode of travel such as by public transport, were recorded but the CO_2 emitted by these modes of transport were not taken into consideration. The total CO_2 emitted by the respondents from Eldoraigne X18 Security Village was 1003789 g/km (1.003789 T/km). This can be expressed as the average CO_2 emitted per household per day as 14339.84 g/km (14.3398 kg/km).

6.6.6.2 Travel behaviour and patterns: Lynnwood Glen Estate

As briefly mentioned earlier, the average number of cars per household within Lynnwood Glen Estate, is 2.06.

The total number of trips conducted by the respondents within this study area was 387, measuring a total distance of 6156 km. This means that the average household travels approximately eighty eight kilometres per day and the average trip takes around twenty four minutes.

Approximately seventy four per cent of all trips made were done by driving a private vehicle. Twenty three per cent of respondents made trips as passengers of private vehicles while the only other mode of travel (which accounted for only three per cent of trips conducted), was walking.

The table below sets out the reasons or purpose for travelling, and showcase the percentage of all trips made for a specific reason within the study area:

Purpose of trip	Percentage
Returning home	48.24%
Educational	20.1%
Work	13.57%
Shopping	8.79%
Other	3.02%
Work related	2.26%
Social	1.76%
Visiting someone	1.51%
Eat/drink	0.25%
Medical	0.25%
Accompanying Adults	0.25%
Total	**100%**

Table 10: purpose of trips conducted for Lynnwood Glen Estate

From the above, it is observed that apart from returning home from a destination, the most prominent reason - approximately twenty per cent - for undertaking a trip, is for educational purposes (attending school or university, and accompanying children to school). Almost fourteen per cent of trips conducted were for going to work, with nearly nine per cent of trips conducted with the intention of going shopping. Trips done for work related purposes, such as attending meetings, accounted for just more than two per cent of all trips made. Trips made for social or recreational reasons accounted for just less than two per cent, with trips conducted to visit someone accounting for 1.51% of all trips conducted. Less than one per cent (combined) accounted for trips made with the purpose of going to eat or drink something, medical purposes of accompanying children. Nearly three per cent of trips were conducted for other reasons than was listed.

The majority of trips made by respondents within Lynnwood Glen Estate were made between 07:00 and 08:59 (twenty six per cent) and 16:00 and 18:59 (twenty seven per cent) respectively. This was followed by seventeen per cent of trips made between 13:30 and 15:59 and fourteen per cent between 09:00 11:59. Eight per cent of trips were made between 12:00 and 13:29 and seven per cent of trips between 05:00 and 06:59. Only one per cent of trips were made between 19:00 and 04:59.

The total CO_2 emitted for this area were measured by taking into account all the trips driven. This may mean, although a trip might have been listed twice, because a driver and a passenger conducted the same trip, travelling within the same car, only the physical distance covered by that particular car were taken into account. Distances covered by other mode of travel such as by public transport, were recorded but the CO_2 emitted by these modes of transport was not taken into consideration. The total CO_2 emitted by the respondents from Lynnwood Glen Estate was 1238808 g/km (1.238808 T/km). This means that the average CO_2 emitted per household per day is approximately 17697.26 g/km (17.6973 kg/km).

6.6.6.3 Travel behaviour and patterns: Lynnwood Glen

The average number of private vehicles owned by households within Lynnwood Glen is 2.11. The total number of trips made by respondents residing within Lynnwood Glen was 543. All these trips combined, measured a total distance of 4943 km. This can be expressed as the average household accounting for 70.62 km travelled per day, with an average trip lasting thirty five minutes.

Almost eighty per cent of all trips undertaken by residents within Lynnwood Glen were done by driving a private vehicle, and almost fifteen per cent of trips were conducted as passengers. Less than one per cent of trips undertaken were done by driving a motorcycle or scooter, and just more than four per cent of trips made were done by walking. Almost one per cent of trips were done by making use of a bus or a school bus.

The table below sets out the purpose of each trip undertaken, and the frequency thereof.

Purpose of trip	Percentage
Returning home	36.0%
Work	23.1%
Educational	14.7%
Shopping	12.2%
Eat/Drink	5.0%
Work related	4.8%
Visiting someone	2.2%
Medical	1.6%
Social	0.4%
Total	**100%**

Table 11: purpose of trips conducted for Lynnwood Glen

Apart from returning home after visiting a certain destination, the greatest reason (twenty three per cent) for undertaking a trip, is to go to work. This is followed by almost fifteen per cent of trips being made for educational purposes (attending school or university, and accompanying children to school). Twelve per cent of trips were conducted for the purpose of going shopping, and five per cent were undertaken to eat/drink something. Trips that were related to work and work activities (such as attending meetings), made up five per cent of all trips made. Almost two per cent of trips were made with the intention to visit someone, and 1.6% of trips were made for medical reasons. Less than one per cent of trips were conducted for social or recreational reasons.

Afternoon ‘peak hours’ (between 16:00 and 18:59) generated the greatest number of trips made within Lynnwood Glen (twenty five per cent). This is followed by almost seventeen per cent of trips being made between 13:30 and 15:59. Nearly sixteen per cent of trips are conducted from 05:00 to 06:59, fourteen per cent between 07:00 and 08:59, and thirteen between 09:00 and 11:59. Approximately twelve per cent of trips are conducted between 12:00 and 13:29, with only 4.11% of trips conducted between 19:00 and 04:59.

The total CO_2 emitted for this area were measured by taking into account all the trips driven. This may mean, although a trip might have been listed twice, because a driver and a passenger conducted the same trip, travelling within the same car, only the physical distance covered by that particular car were taken into account. Distances covered by other mode of travel such as by public transport, were recorded but the CO_2 emitted by these modes of transport were not taken into consideration. The total CO_2 emitted by the respondents from Lynnwood Glen were 1112440 g/km (1.11244 T/km). This can be presented as the average CO_2 per household per day as approximately 15892 g/km (15.892 kg/km).

6.6.6.4 Travel behaviour and patterns: Doringkloof

The average number of cars per household for Doringkloof is 1.91. The total number of trips undertaken by respondents within Doringkloof was 465. The total distance of all these trips measured 3817 km. When applying this on household level, it means that the average distance travelled per household is 54.53 km per day, and the average trip lasting approximately thirty four minutes.

Approximately eighty two per cent of trips made by residents of Doringkloof was done by driving a private vehicle. Seventeen per cent of trips conducted within Doringkloof, was done as passengers within a private vehicle. Nearly a per cent of trips conducted are done by walking, 0.16% by cycling, and 0.33% by another means not listed.

Purpose of trip	Percentage
Returning home	38.2%
Work	21.2%
Shopping	14.7%
Educational	14.5%
Eat/Drink	2.9%
Visiting someone	2.5%
Medical	1.9%
Work related	1.5%
Social	1.5%
Gym/sport	1.1%
Total	**100%**

Table 12: purpose of trips conducted for Doringkloof

From the above, it is clear that, apart from undertaking a trip to return home from a destination, the greatest percentage of trips (21.2%) were conducted for the purpose of going to work. Almost fifteen per cent of trips were undertaken to do shopping, and fourteen and a halve per cent of trips were conducted for educational purposes,

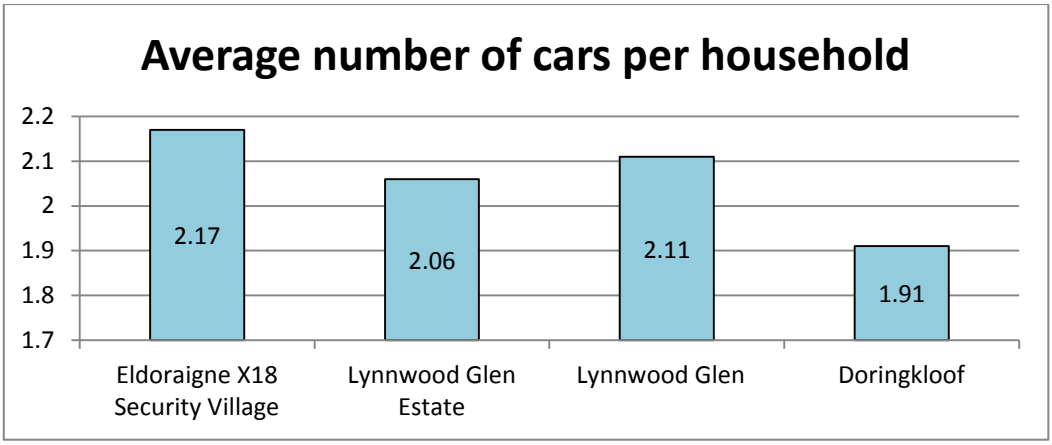
including accompanying children to school. Approximately three per cent of trips were made to go somewhere to eat or drink, while 2.5% of trips were made to visit someone. About two per cent of trips were made for medical reasons, while trips related for work, and trips made for social or recreational reasons, both made up 1.5% of trips. Only 1.1% of trips were made to take part in sport of exercise at a gymnasium.

Approximately thirty per cent of trips conducted, were made in the afternoon between 16:00 and 18:59, which is considered afternoon 'peak time', with the second highest number of trips made (16.08%) during the morning 'peak time', between 07:00 and 08:59. Approximately fifteen per cent of trips were made between 05:00 and 06:59, followed by 11.48% of trips conducted between 13:30 and 15:59. Between 09:00 and 11:59 and 12:00 and 13:29, almost nine per cent of trips were made respectively. The least amount of trips were made 19:00 and 04:59 (7.93%)

The total CO_2 emitted for this area were measured by taking into account all the trips driven. This may mean, although a trip might have been listed twice, because a driver and a passenger conducted the same trip, travelling within the same car, only the physical distance covered by that particular car were taken into account. Distances covered by other mode of travel such as by public transport, were recorded but the CO_2 emitted by these modes of transport were not taken into consideration. The total CO_2 emitted by the respondents from Doringkloof were 919270 g/km. This means that the average CO_2 emitted per household per day is 13132.43 g/km (13.132 kg/km).

6.6.7 Comparison of neighbourhood travel behaviour and patterns

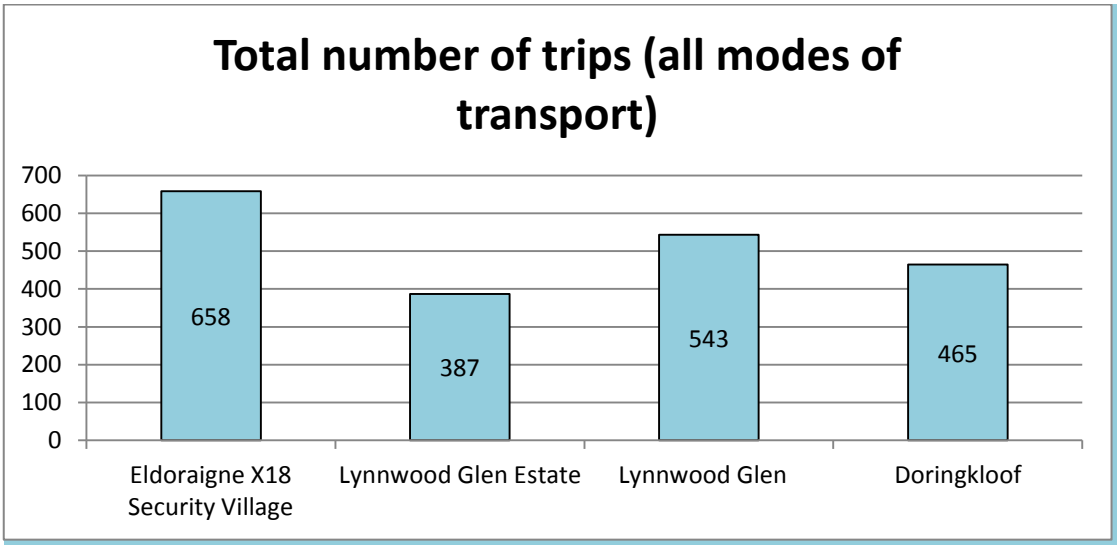
The average number of cars owned per household for all four areas is high when compared to the average car ownership figures for the whole of South Africa.



Graph 10: Average number of cars per household per study area

From the above, it is clear that households residing within Eldoraigne X18 Security Village owns on average slightly more cars than households residing within Lynnwood Glen. Households within Lynnwood Glen Estate owns on average slightly more cars than those residing within Doringkloof. However, these figures are very close together, and rounded off; all of these four areas have an average car ownership of more or less two cars per household.

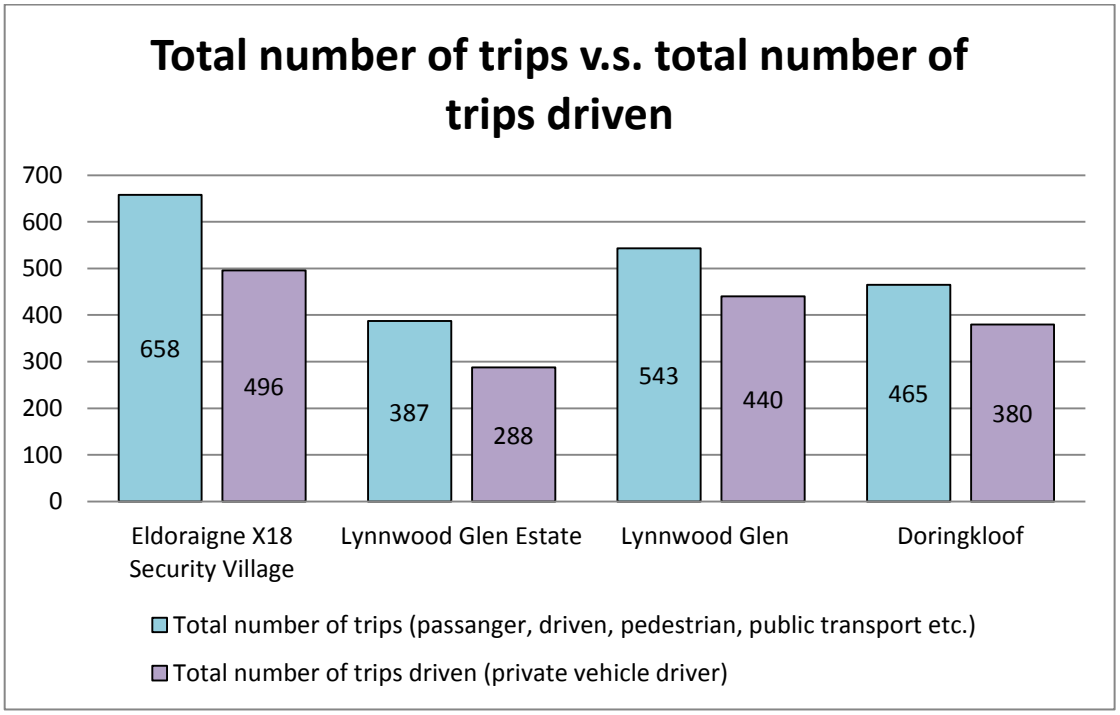
From the chart below, it is clear that residents within Eldoraigne X18 make the greatest amount of trips, followed by Lynnwood Glen, then Doringkloof and finally Lynnwood Glen Estate.



Graph 11: Average number of trips per household per study area

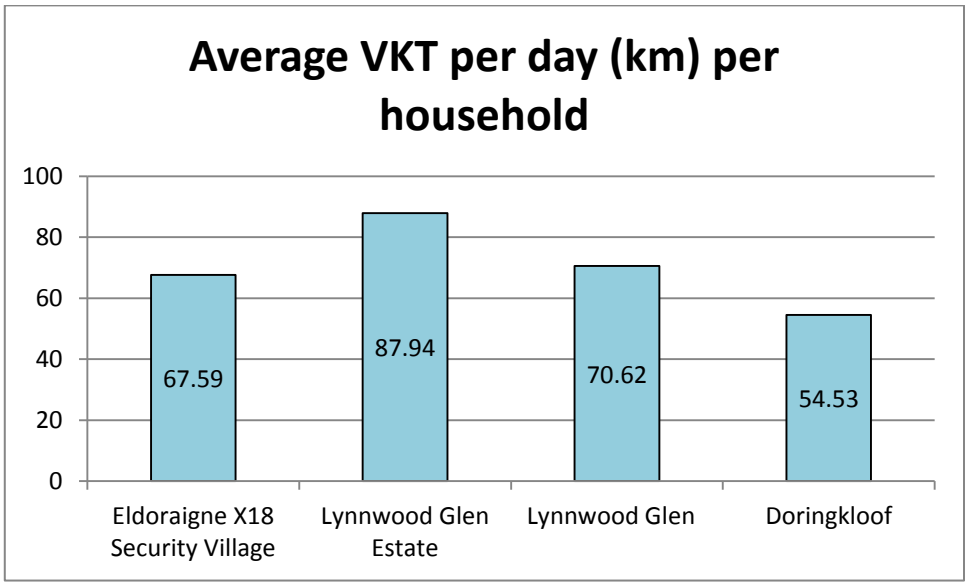
These trips include all trips, including trips that were undertaken by driving a private vehicle, by being a passenger within a private vehicle, making use of public transport

such as buses and taxis, or by walking or cycling. Below, the chart compares the total number of tips made, as set out above, with the total number of trips made by driving a private vehicle.



Graph 12: Total number of trips per household per study area

It is clear that the majority of all trips undertaken by all four study areas were trips that were conducted by means of driving a privately owned vehicle. From all these trips the VKT was determined which enabled for determining the average VKT per household per day.

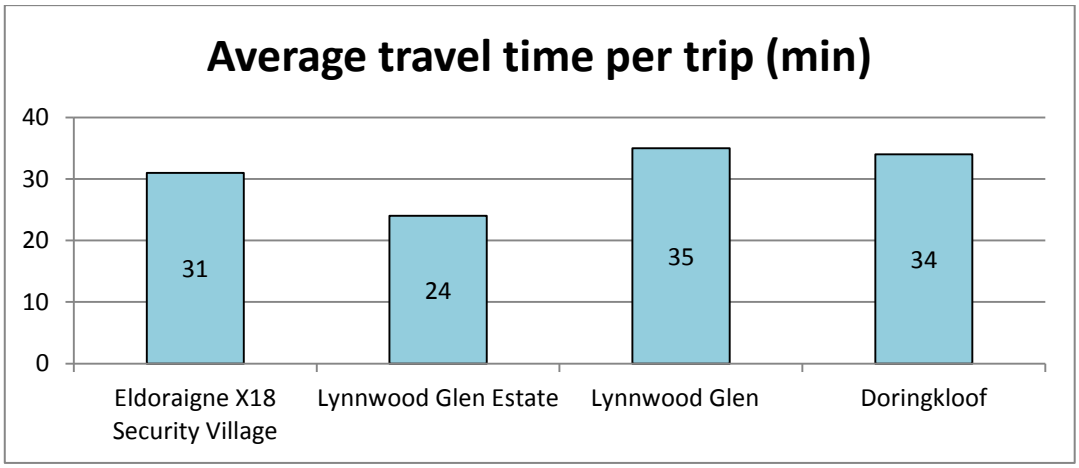


Graph 13: Average VKT per day per household per study area

From the above, it is clear that households residing within Lynnwood Glen Estate and Lynnwood Glen travel, on average, greater distances than households residing within Eldoraigne X18 Security Village and Doringkloof, with households within Lynnwood Glen Estate travelling the greatest distances, and households within Doringkloof driving the shortest distances.

This means that although households residing within Eldoraigne X18 Security Village's trip frequency are the highest, the trip distances are relatively short. The opposite can be said for households within Lynnwood Glen Estate, as the trip frequency is the lowest for all four study areas, while the distances travelled are the greatest. When looking at the average time it takes to undertake a trip, households within Lynnwood Glen Estate undertake trips within the least amount of time.

From the chart below, it is clear that the average trip for a household within Lynnwood Glen takes approximately 35 minutes to complete, with trips conducted by households in Doringkloof taking 34 minutes. Trips conducted by households within Eldoraigne X18 Security Village took 31 minutes and for Lynnwood Glen only 24 minutes.



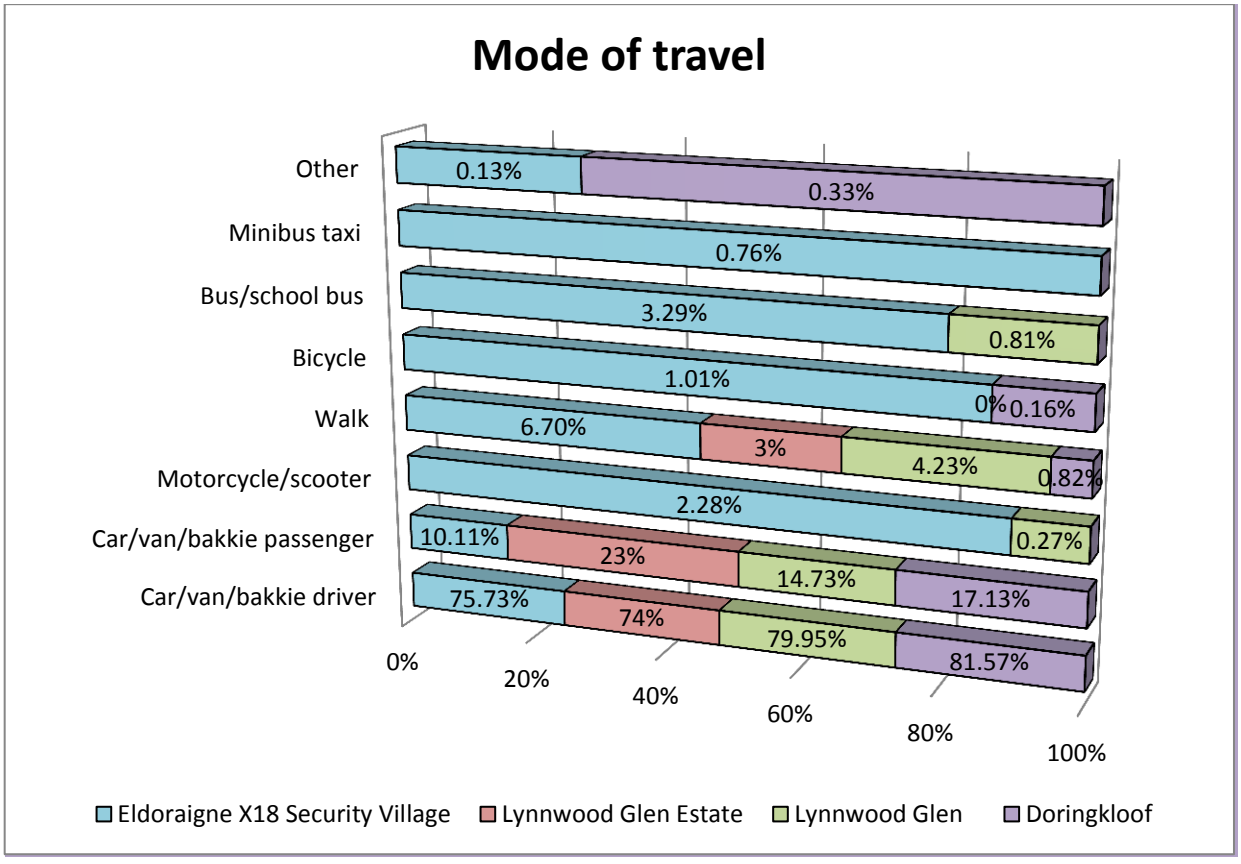
Graph 14: Average travel time per trip per study area

This indicates the following:

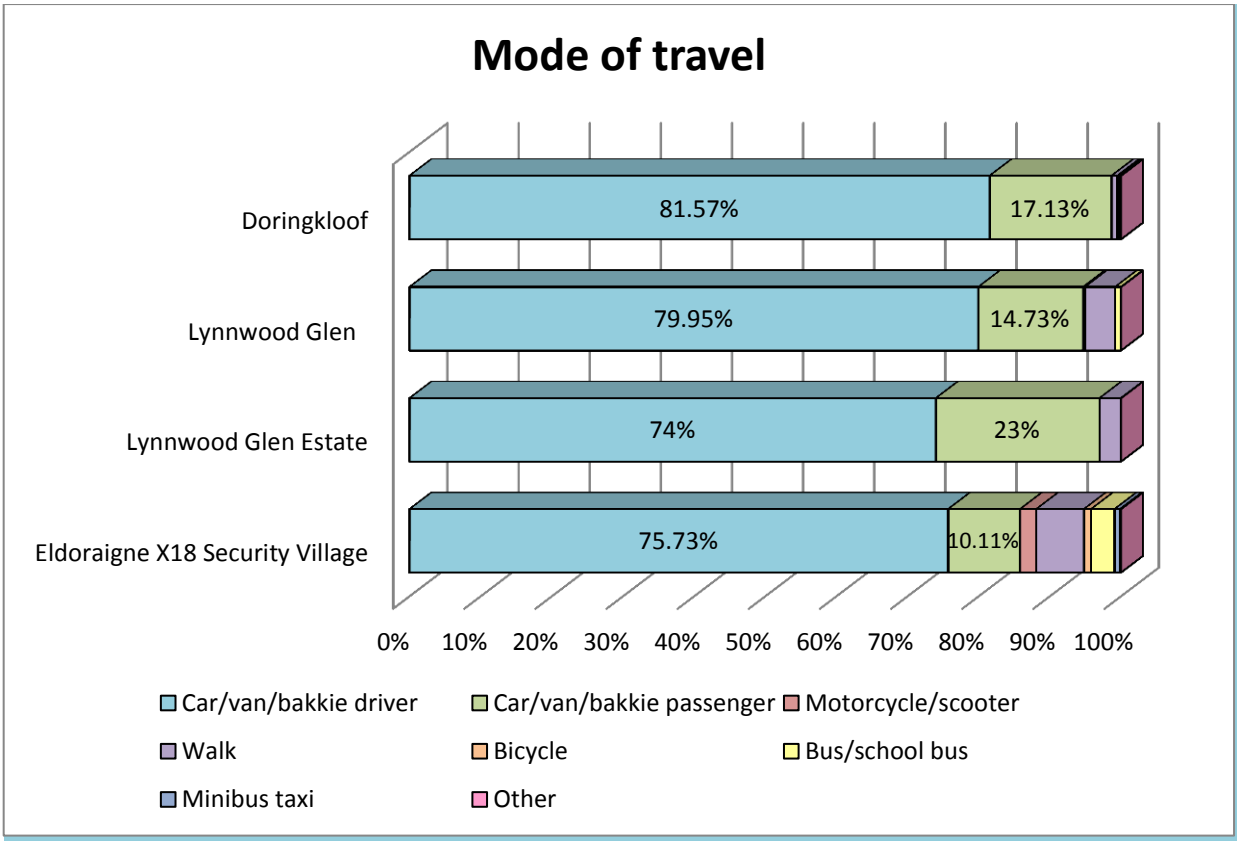
- Eldoraigne X18 Security Village: The average household makes approximately nine trips per day, with the average trip taking about thirty one minutes to complete. The average trip distance is approximately eight kilometres.
- Lynnwood Glen Estate: The average household makes approximately six trips per day, with the average trip taking approximately twenty four minutes to complete. The average distance covered for each trip is sixteen kilometres.

- Lynnwood Glen: The average household makes approximately eight trips per day, with the average trip taking approximately thirty four minutes to complete. The average distance covered for each trip is approximately nine kilometres.
- Doringkloof: The average household makes approximately seven trips per day with the average trip taking approximately thirty four minutes to complete. The average distance covered by each trip is approximately eight kilometres.

The different mode of travel used by the different study areas are very similar in the sense that the majority of trips conducted is by driving a private vehicle. For all four study areas, the second greatest mode of travel was as a passenger of a private vehicle. Except for the use of school buses by children living within Eldoraigne X18 Security Village, and Lynnwood Glen, use of 'public' transport were more or less non-existent. One respondent from Eldoraigne X18 Security Village did however make use of a minibus taxi to travel. Walking and cycling was not a popular mode of travel, with the greatest number of respondents opting to walk or cycle, residing within Eldoraigne X18 Security Village.



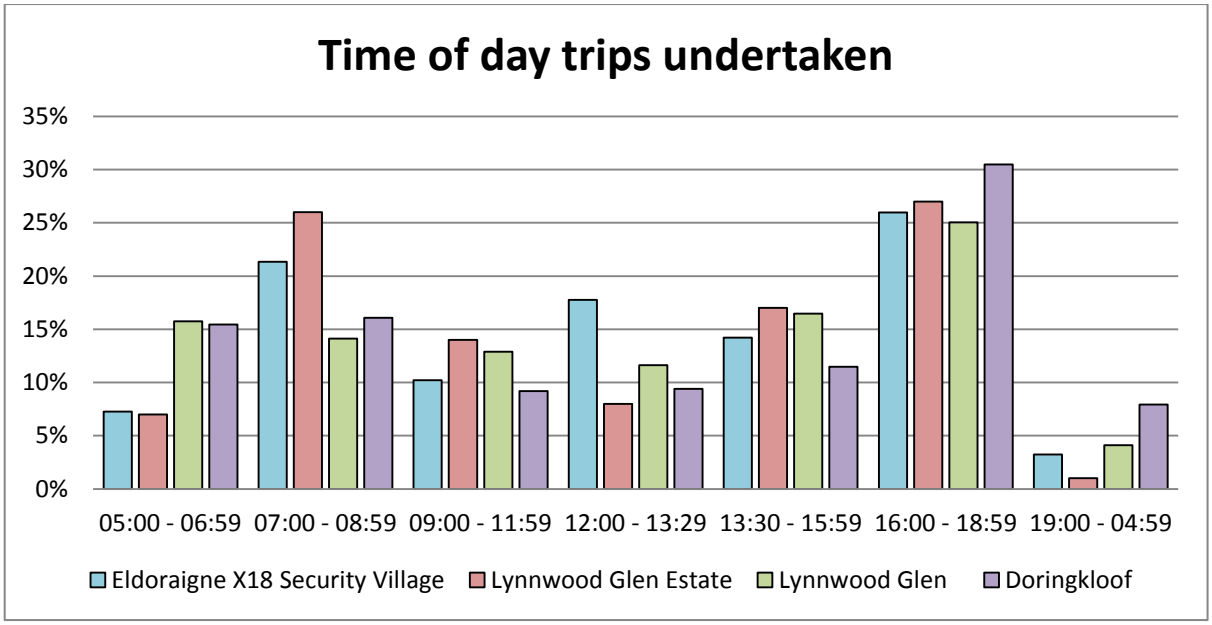
Graph 15: Mode of travel per household per neighbourhood



Apart from the above which helps form a picture to better understand the travel behaviour and patterns of households residing within the different neighbourhoods, the time of day that trips are undertaken, can reveal volumes.

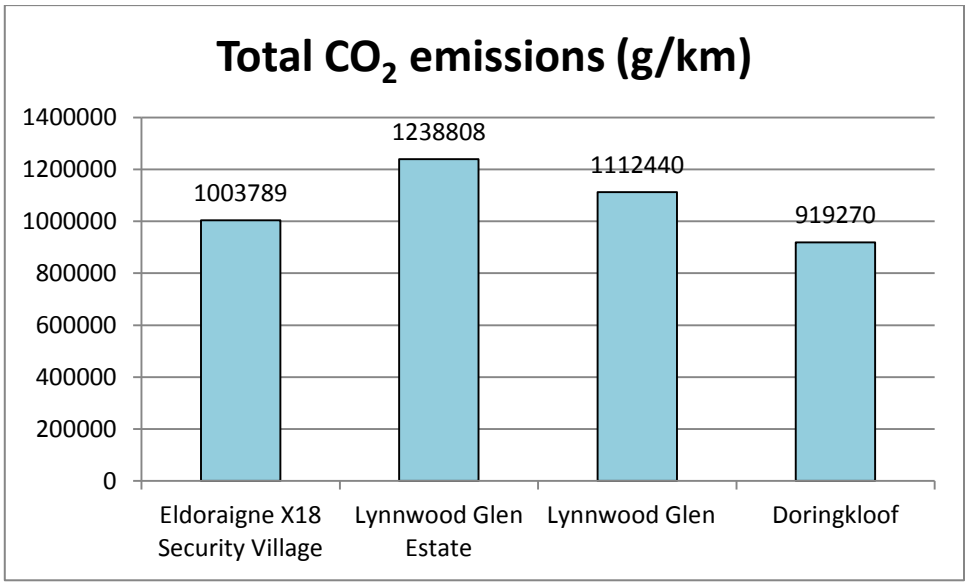
According to the data collected, as displayed in the graph below, the time of day trips are undertaken differ considerably between the four study areas. However, the majority of trips made for all for areas were made between 16:00 and 18:59.

It is interesting to note that households within Lynnwood Glen and Doringkloof (the two areas that are not enclosed) have more trips that were made between 05:00 and 06:59 than the two enclosed areas. The amount of trips between this time and 07:00 and 08:59 were almost the same for the two open areas, while less than ten per cent of trips were made between 05:00 and 06:59 by the two closed neighbourhoods and over twenty per cent of trips were made between 07:00 and 08:59.



Graph 16: Time of day trips were undertaken per study area

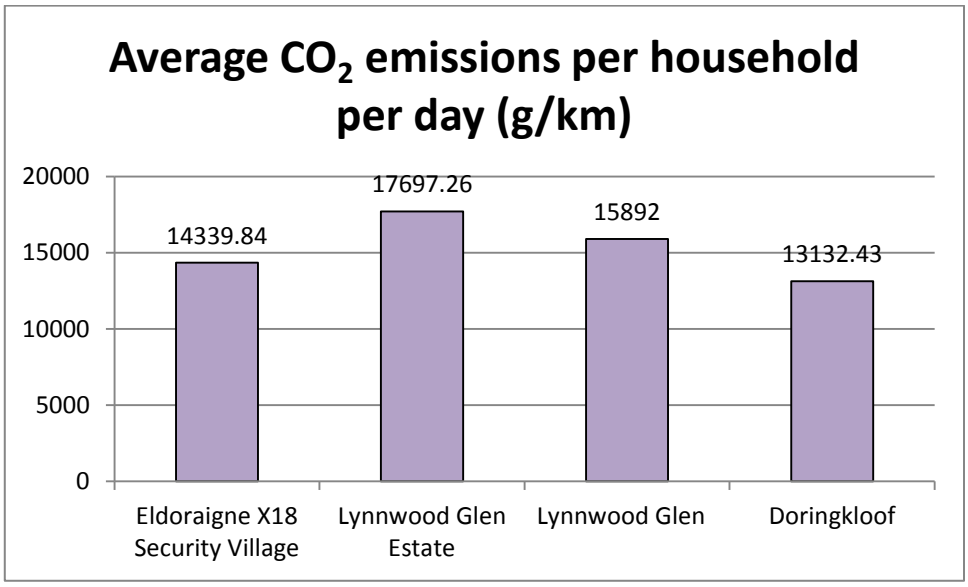
Finally, the total CO_2 emitted by each household due to their travelling were calculated. This was done by taking all trips made by driving a private vehicle into account. Only the physical distance covered by the specific car for each trip was taken into account. Trips made by other means were recorded, but the CO_2 emitted by those modes were not taken into consideration. The total CO_2 emitted by respondents for each study area were as follows:



Graph 17: Total CO_2 emissions per study area

From this, the average CO_2 for each household within each of these neighbourhoods were calculated.

As illustrated on the graph below, Lynnwood Glen Estate emits the most CO_2 (1238808 g/km) due to their travel behaviour, as households from this area travel the longest distances. Lynnwood Glen emits the second most CO_2 which is also confirmed by the average VKT per day for the area. Eldoraigne X18 Security Village emits the second least CO_2 (14339.84 g/km) with Doringkloof emitting the least (13132.43 g/km).



Graph 18: Average CO_2 emissions per household per day per study area

When looking at the figures above and at the average VKT for each of the study areas, a few observations can be made. When looking back at sub-question 2 “What is the impact of enclosed neighbourhoods on travel behaviour of individuals residing within an enclosed neighbourhood?”, it seems that the fact that only certain roads (two in this case) are open and used as entrances and exits, in the case of Lynnwood Glen Estate, cause households to travel further, but also cause them to make fewer trips.

In the case of Eldoraigne, three additional gates are open during peak hours (between 06:30 and 07:45 and between 16:15 and 17:45) making travelling during peak times less of a hassle than in the case of Lynnwood Glen Estate.

Lynnwood Glen on the other hand, emits the second most CO_2, and has the second highest VKT of the four areas. This is evidence that due to the fact that when an adjacent area becomes enclosed, traffic is displaced to the area. Also, households are no longer able to drive through the enclosed neighbourhood, and thus have to travel

longer distances to get to their destinations (Zhao, 2010). This, to an extent answers sub-question 3: “What is the impact of enclosed neighbourhoods on travel behaviour of individuals residing within an open neighbourhood adjacent to an enclosed neighbourhood?”

As expected, Doringkloof has the least VKT and CO_2 emitted, as it is the control group, missing the key factor, gates and road closures.

The following section will test the opinions of households residing within these different neighbourhoods, regarding enclosed neighbourhoods and subsequent travel and traffic implications.

6.6.8 Opinions regarding enclosed neighbourhoods: Eldoraigne X18 Security Village

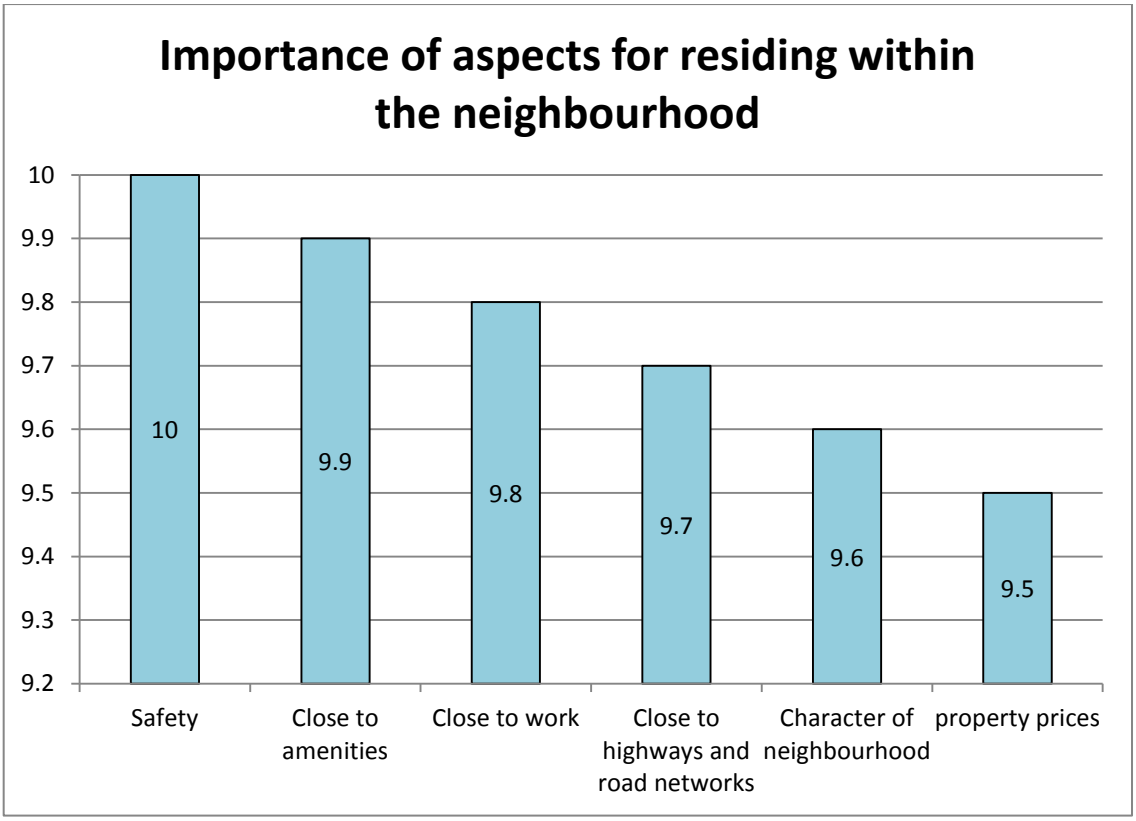
The average time respondents have been residing within their homes is nine years. This means that the average household who took part in this survey have lived in the neighbourhood before it has been enclosed, and would thus still be able to remember how traffic conditions were before the enclosure.

The respondents were asked to list the importance on a scale from one to ten (one being the least important, 10 being most important) of certain aspects within the neighbourhood, when they chose to live there.

The aspects that the respondents had to consider were the safety within the neighbourhood, whether the neighbourhood was close to amenities such as shops, schools, hospitals etc., whether it was close to their place of work, whether it was close to highways and other major road networks, the character of the neighbourhood and property prices.

All of the aspects mentioned above were important to the respondents, with all aspects scoring higher than 9.5. The most important aspect, however, was safety, scoring an average of 10.

The aspects and their scores are illustrated in the graph below.



Graph 19: The importance of specific aspects for residing within Eldoraigne X18 Security Village

The respondents were asked what the main reason was for applying for an enclosed neighbourhood, and ninety seven per cent of respondents claimed it was for safety and security. The remaining three per cent did not have an opinion.

It was reported that sixty per cent of the respondents were involved in the closing process. From this sixty per cent, seventy one per cent said that they had attended the meetings; twenty four per cent were part of the management body, and five per cent did not reveal how they took part in the closing process.

Forty per cent of respondents from Eldoraigne X18 Security Village claimed that they were not involved in the closing process. Thirty six per cent of respondents who were not involved claimed this was because they were not able to attend any of the meetings held in this regard. Seven per cent claimed that they were just renting the property, and did not see the need to get involved. Fourteen per cent claimed that at the time they moved to the neighbourhood, the gates were already erected. Seven per cent indicated that although they were not involved initially, they would now like to get involved by attending the scheduled meetings. The remaining thirty six per cent did not give any reason for their lack of involvement.

With regards to travel behaviour and patterns, respondents were asked whether they felt that the enclosing of the neighbourhood influenced their usual travel routes or patterns. Only six per cent of respondents felt that it has, claiming that the gates cause them to travel further to exit and enter the neighbourhood. Ninety one per cent reported that the enclosure did not influence their normal travel routes in any way. The remaining three per cent did not have any opinion about this.

None of the respondents felt that they made any more or less trips since the enclosure, but fourteen per cent of respondents did however feel that enclosed neighbourhoods have an impact on traffic congestion. On average, the respondents who shared this opinion, rated traffic congestion due to enclosed neighbourhoods as 5.3 on a scale from one to ten, one being little, ten being very severe.

None of the respondents thought that it was an inconvenience to drive through the booms. Ten per cent of respondents justified this statement by arguing that there is no congestion at the booms, while fifty five per cent stated that safety outweighs congestion and therefore the gates are not an inconvenience to them. Thirty five per cent of respondents did not have an opinion about this matter.

When asked whether respondents have to wait in queues to enter or exit the neighbourhood through the booms, the majority – eighty per cent – of respondents claimed that they never wait in queues. From those (twenty per cent) who felt they sometimes wait in queues, fifty seven per cent reported that they wait in queues between 7 am and 9 am, while twenty nine per cent reported that they wait in queues between 4 pm and 7 pm. The remaining fourteen per cent of respondents claimed that they wait in queues to enter and exit the neighbourhood during morning and afternoon peak hours (from 7 am to 9 am and from 4 pm and 7 pm).

Respondents were asked to state how long, on average, it takes them to enter and exit the neighbourhood. Fifty seven per cent claimed that it is very quick to enter and exit the neighbourhood, and that it only takes a few seconds. Six per cent said that it sometimes takes a few seconds and sometimes a few minutes to enter and exit the neighbourhood. Eleven per cent of the respondents stated that it takes a minute or less, while six per cent said it takes two to three minutes to enter and exit the neighbourhood. Seventeen per cent of respondents stated that the time it took to enter and exit the neighbourhood depended on the time of day and three per cent said that it depends whether there are visitors at the gate.

Finally, at the end of the interview, respondents were asked to take everything asked in the questionnaire into account, and thereafter to indicate on a scale from one to ten how negative or positive (one being very negative, five being neutral and ten being very positive) they are towards enclosed neighbourhoods. The average feeling towards enclosed neighbourhoods was very positive, with the average score being 9.9.

6.6.9 Opinions regarding enclosed neighbourhoods: Lynnwood Glen Estate

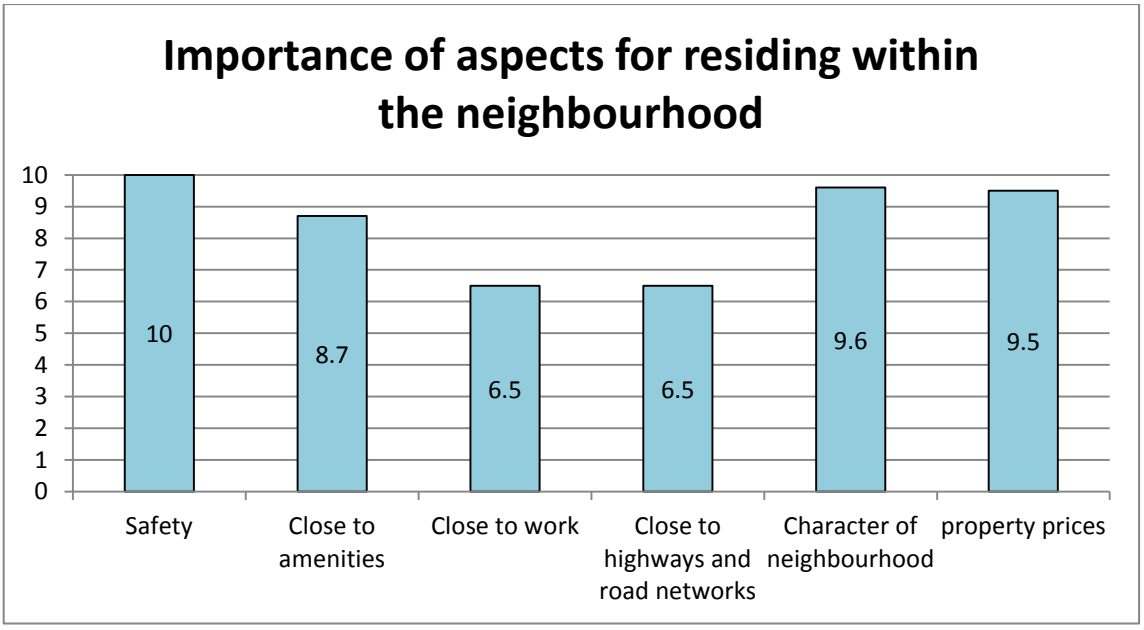
The respondents residing within Lynnwood Glen Estate have been living within this neighbourhood for an average of thirteen years. As in the case of Eldoraigne X18 Security Village, this means that the majority of the respondents who took part in the survey, lived in the neighbourhood before it was enclosed, and would thus be able to compare conditions (specifically traffic conditions) before and after the enclosure.

The respondents were asked to list the importance on a scale from one to ten (one being the least important, 10 being most important) of certain aspects within the neighbourhood, when they chose to live there.

The aspects that the respondents had to consider were the safety within the neighbourhood, whether the neighbourhood was close to amenities such as shops, schools, hospitals etc., whether it was close to their place of work, whether it was close to highways and other major road networks, the character of the neighbourhood and property prices.

It was clear that the respondents valued safety the most when deciding to reside within this neighbourhood, with the average score being 10. The character of the neighbourhood was important as the average score was 9.6, and the property prices were also seen as important with a score of 9.5. The location of the neighbourhood relative to highways and road networks, as well as to the respondent's place of work were not seen as very important, scoring 6.5 respectively, while the location with regards to amenities were seen as quite important with a score of 8.7.

The results are illustrated below:



Graph 20: The importance of specific aspects for residing within Lynnwood Glen Estate

When asked why the neighbourhood was enclosed, ninety one per cent of respondents claimed it was due to safety and security reasons, while nine per cent claimed it was to lessen through traffic, or prevent ‘rat racing' from occurring, with special emphasis on minibus taxis.

Only forty six per cent of respondents were involved in the process of enclosing the neighbourhood. From these, sixty nine per cent attended the meetings, and six per cent were part of the management body. Nineteen per cent of respondents who were involved in the enclosing process claimed that they had supported the initiative financially. A total of fifty four per cent of respondents were not involved in the process, with five per cent of these claiming that they did not think it was important to get involved. The rest of the respondents did not offer any reason for not being involved in the process.

When discussing factors pertaining to enclosed neighbourhoods that might influence travel behaviour and patterns, the question of whether or not the enclosing of the neighbourhood had an influence on the respondents normal travel routes and patterns, twenty three per cent of respondents indicated that it had indeed. From this group who felt it had influenced their normal travel routes, eighty seven per cent claimed that the gates cause them to travel further than they used to enter and exit the neighbourhood. Thirteen per cent said that traffic congestion occurs at the gates due to visitors and the general public passing by the entrance.

Since the enclosure, nine per cent of respondents within Lynnwood Glen Estate believe that they make more trips than before, while three per cent claim to make fewer trips than before the enclosure. Eighty eight per cent of respondents feel that they make the same amount of trips after the enclosure than before.

Respondents were asked whether they thought enclosed neighbourhoods have an impact on traffic congestion, and only six per cent thought that it had. Those who did agree that enclosed neighbourhoods cause traffic congestion, scored the extent of traffic congestion on a scale from one to ten (one being little, ten being very severe) four.

From the survey, it was found that six per cent of respondents found it inconvenient to drive through booms to enter and exit the neighbourhood. From these respondents, halve claimed that the inconvenience is caused when the tags to enter and exit the neighbourhood, does not work. The other halve claimed it is due to congestion occurring at the booms. From the ninety four per cent of respondents who did not find it inconvenient to drive through the booms, twelve per cent of them claimed that it is due to the fact that there is no congestion at the booms. Twenty one per cent claims that the safety gained by the gates outweighs any congestion that might be experienced.

Only twenty six per cent of respondents indicated that they sometimes wait in queues when entering or exiting the neighbourhood, while seventy four per cent claimed to never wait in queues. From those who claimed to wait in queues, thirty seven per cent of respondents indicated that queuing occurs between 7 am and 9 am. Fifty per cent believes that queuing occurs during the morning peak times (7 am to 9 am) as well as during afternoon peak times (4 pm to 7 pm), while thirteen per cent noted that they wait in queues to enter and exit the neighbourhood throughout the entire day.

When respondents were asked to indicate on average, how long it took them to enter and exit the neighbourhood, thirty seven per cent reported that it takes very little time to enter and exit the neighbourhood, on average only a few seconds. Thirty one per cent indicated that it takes a minute or less to enter and exit, while twenty six per cent said it takes between two to three minutes. Six per cent felt that it took between three to eight minutes to enter and exit the neighbourhood.

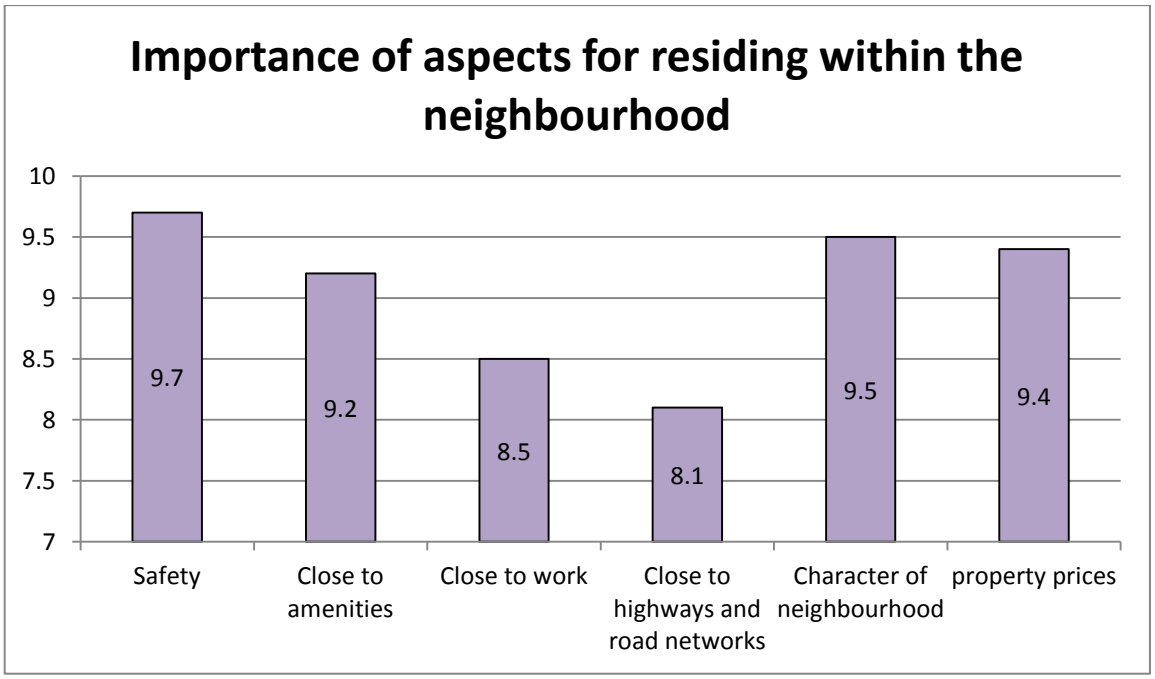
Respondents were asked to take a moment to take everything pertaining to enclosed neighbourhoods, and everything asked in the questionnaire into consideration and

thereafter indicate on a scale of one to ten (one being very negative, five being neutral and ten being very positive) how positive or negative they were towards enclosed neighbourhoods. The result was very positive, with the average score being 9.9.

6.6.10 Opinions regarding enclosed neighbourhoods: Lynnwood Glen

Households residing within Lynnwood Glen, situated adjacent to Lynnwood Glen Estate, who took part in the survey lived within this neighbourhood for an average of ten years. Since the enclosure of Lynnwood Glen were implemented within the last two years, the households residing would be able to notice differences in their neighbourhood (such as increased traffic volumes) and be able to compare it with conditions prior to the enclosure of Lynnwood Glen.

Respondents were asked to list the importance of a series of aspects why they chose to reside within this specific neighbourhood by indicating it on a scale of one to ten, with one being least important, and ten being most important. The results are illustrated in the graph below.



Graph 21: The importance of specific aspects for residing within Lynnwood Glen

Safety was the main concern when deciding to live in this neighbourhood which scored an average of 9.7, followed by the character of the neighbourhood with an average 9.5. Property prices scored 9.4 which indicated that it was more important than being close

to amenities which scored 9.2. Being close to work was the least important consideration when deciding to reside within this neighbourhood as the average score was 8.5.

With enclosed neighbourhoods being a trend within the City of Tshwane, and considering the displacement of crime and traffic due to the neighbouring area being enclosed (Landman, 2000a: 20; Landman, 2000b: 3), it was deemed appropriate to ask whether the respondents have ever considered moving to/living in/applying for an enclosed neighbourhood. Twenty nine per cent of respondents indicated that they have considered it. From this group that indicated they have considered it, ninety per cent indicated that they considered it for safety reasons. From the seventy one per cent of respondents who have not considered moving there, sixteen per cent stated that they already felt safe and felt no need to apply or live in an enclosed neighbourhood. Forty four per cent claimed that they were happy with the current state of the neighbourhood and did not feel it was necessary to apply for enclosure. Four per cent claimed that enclosed neighbourhoods merely cause an inconvenience to residents, while four per cent claimed that it was too expensive to implement. Twenty per cent just claimed that they were not interested in living or applying for an enclosed neighbourhood. The rest of the respondents did not wish to comment on this.

When asked whether the enclosure of the adjacent neighbourhood, Lynnwood Gen Estate, has influenced their normal travel routes or patterns, only three per cent stated that it has, claiming that since the gates have been erected, they are not able to move through the adjacent neighbourhood as it takes too long to sign in when they want to drive through the neighbourhood. All of the respondents felt that since Lynnwood Glen Estate was established and enclosed, they did not make more or fewer trips than before the enclosure, stating that they still made the same amount of trips, with only fourteen per cent of all respondents claiming that have been inconvenienced by not being able to drive through an enclosed neighbourhood.

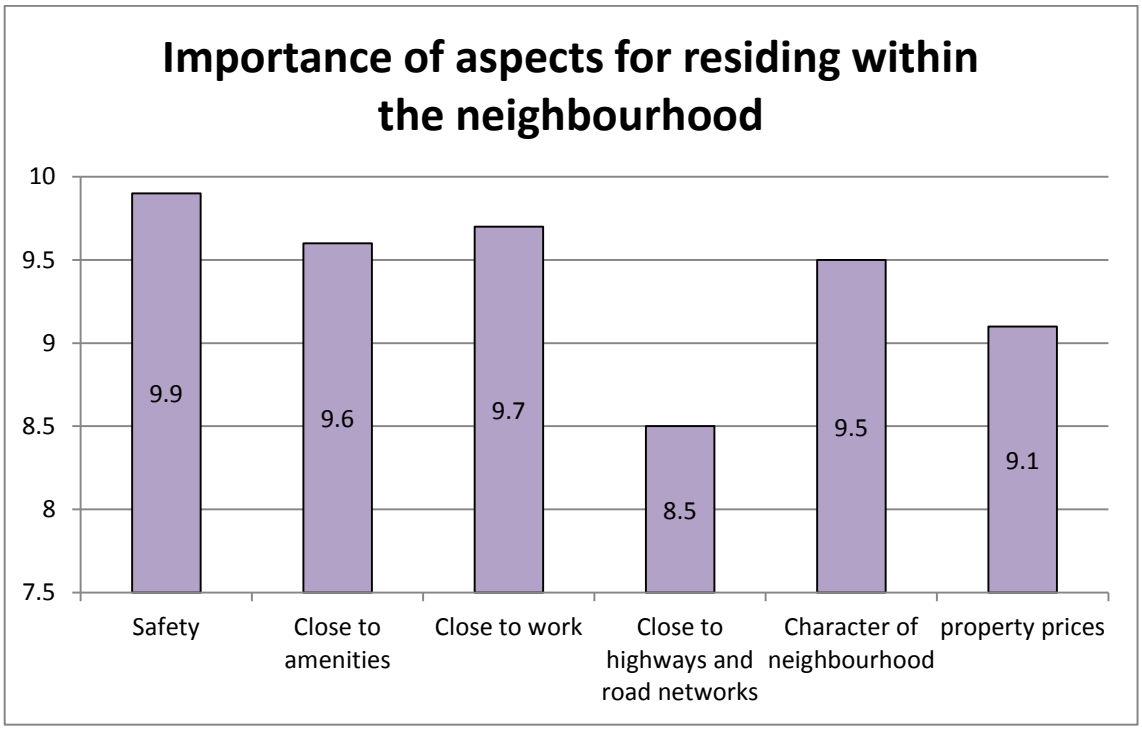
Forty three per cent of respondents thought that enclosed neighbourhoods had an impact on traffic congestion, rating it on a scale of one to ten (one being little, ten being severe) as six.

At the end of the questionnaire, respondents were asked to consider all of the questions asked, and indicate on a scale of one to ten (one being very negative, five being neutral and ten being very positive) how they felt about enclosed neighbourhoods. The

average feeling was 7.5, indicating that the respondents are fairly positive towards enclosed neighbourhoods.

6.6.11 Opinions regarding enclosed neighbourhoods: Doringkloof

The average time that respondents have been residing within Doringkloof has been sixteen years, making this a very 'stable' neighbourhood. The respondents were asked to list, on a scale from one to ten (one being least important, ten being very important) how important they thought certain aspects was when they considered moving to this neighbourhood:



Graph 22: The importance of specific aspects for residing within Doringkloof

As with all the neighbourhoods forming part of the study, safety was the most important aspect considered when deciding to move to this neighbourhood, with the average score being 9.9. The respondents indicated that being close to work (9.7) and close to amenities such as schools, shops and hospitals (9.6) were important factors they looked at when deciding to reside within the neighbourhood. The character of the neighbourhood was also important as the average score was 9.5, with property prices also deemed important, scoring 9.1. The aspect least important, were being close to highways and major road networks, which scored 8.5.

When asked whether the respondents have ever considered moving to/living in/applying for an enclosed neighbourhood, only six per cent indicated that they have, stating that the reason for applying for or living in an enclosed neighbourhood would be for safety reasons.

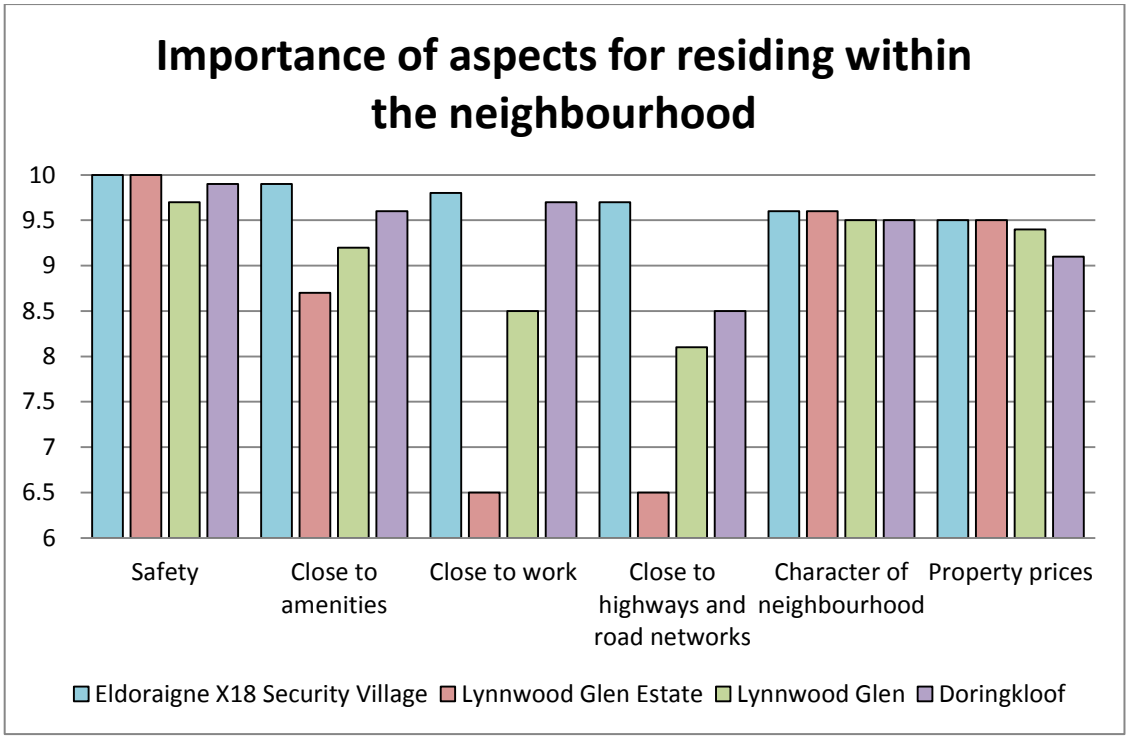
Forty nine per cent of respondents indicated that they felt that enclosed neighbourhoods has an impact on traffic congestion, rating it on a scale from one to ten (one being little, ten being very severe), as 7.6. Six per cent of respondents claimed that they have been inconvenienced before by not being able to drive through an enclosed neighbourhood.

Respondents were asked to consider all the questions asked, and then indicate on a scale from one to ten (one being very negative, five being neutral and ten being very positive) what their attitude was towards enclosed neighbourhoods. The average score was 4.9, indicating that respondents were slightly negative (almost neutral) towards enclosed neighbourhoods.

6.6.12 Comparison of opinions regarding enclosed neighbourhoods

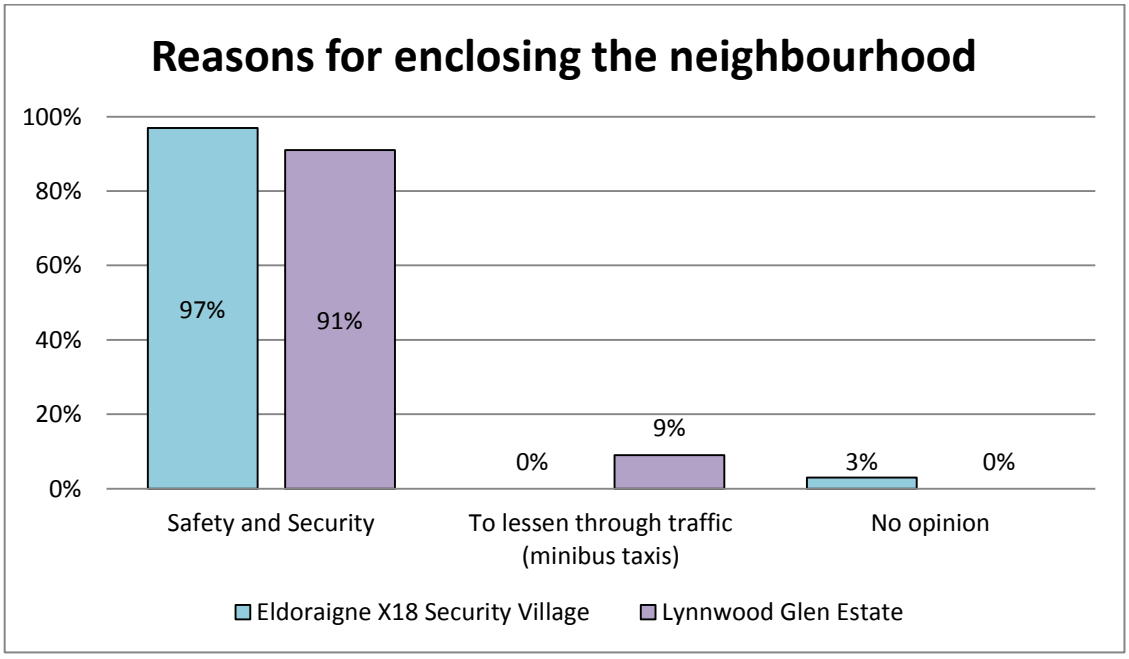
All the respondents from all four study areas can be described as ‘stable’, as the average period that the residents have been staying within the neighbourhood for all four areas are considerable, with the shortest average period being nine years within Eldoraigne X18 Security Village, and the longest average time being sixteen years within Doringkloof.

When comparing the importance of aspects when deciding to reside within a neighbourhood for all four areas, it is clear that safety is the most important aspect households look at. It is interesting to note that although safety scored the highest, in Eldoraigne X18 Security Village and Lynnwood Glen Estate all the respondents scored it as 10, while safety scored 9.7 in Lynnwood Glen and 9.9 in Doringkloof.



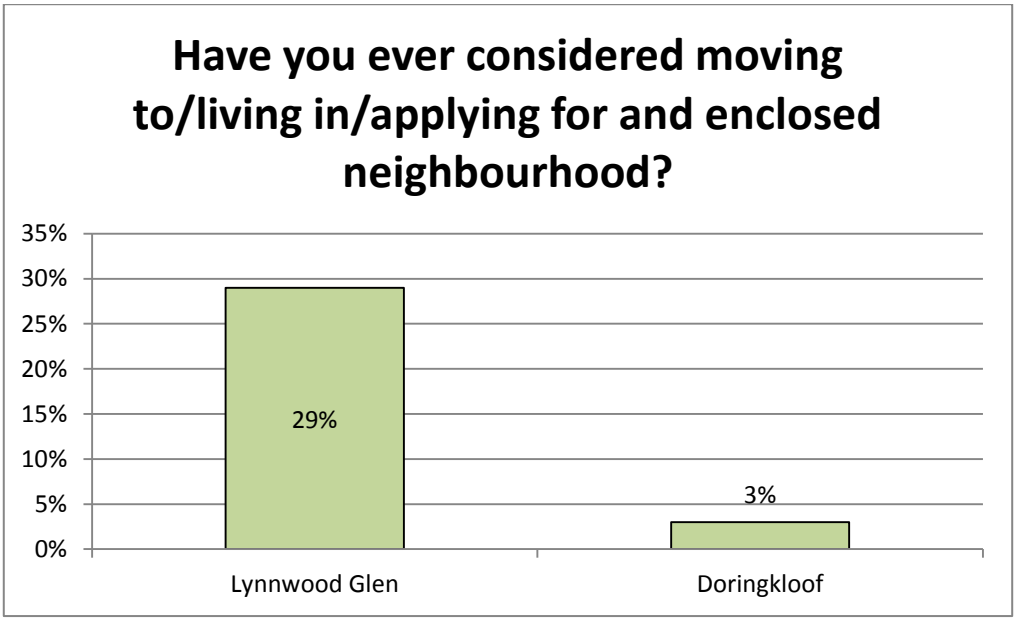
Graph 23: The importance of specific aspects for residing within the neighbourhood per study area

It was also clear when asking why Eldoraigne X18 Security Village and Lynnwood Glen Estate decided to enclosed their neighbourhood that it was mainly for safety reasons. A few respondents from Lynnwood Glen Estate did however indicate that the neighbourhood was enclosed to stop through-traffic or 'rat running' from occurring within their neighbourhood that is mainly caused by minibus taxis.



Graph 24: Reasons for enclosing the neighbourhood per enclosed neighbourhood

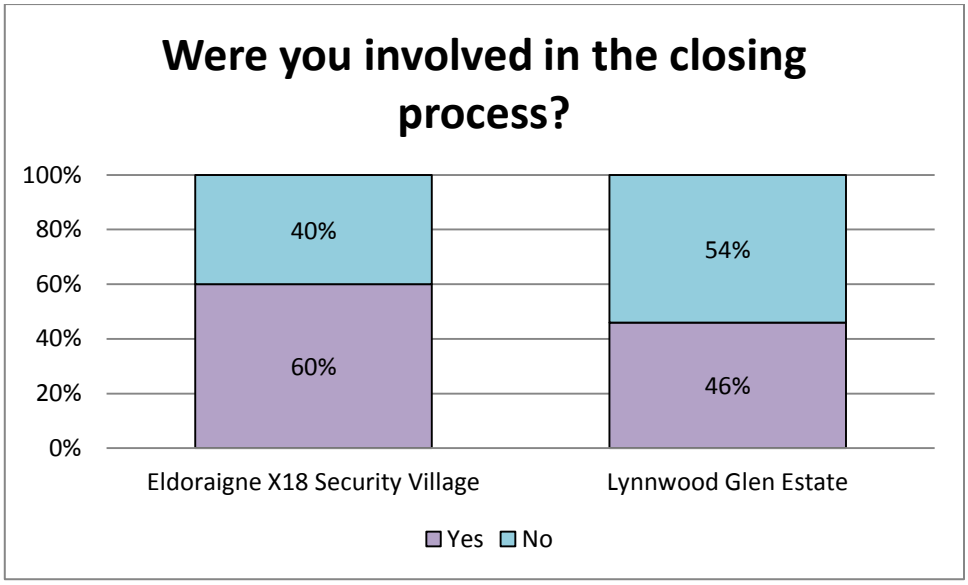
When focussing attention to Lynnwood Glen and Doringkloof, it was interesting to see, although a relative low number (twenty nine per cent) of respondents from Lynnwood Glen claimed to have considered living within or applying for an enclosed neighbourhood, it was considerably higher than the three per cent of respondents from Doringkloof. This once again confirms the trend of enclosed neighbourhoods snowballing, as one neighbourhood encloses, a number of other neighbourhoods within a short distance of each other tend to also enclose to avoid the displaced crime and traffic.



Graph 25: Illustration of respondents considering enclosing their neighbourhood, per open neighbourhood

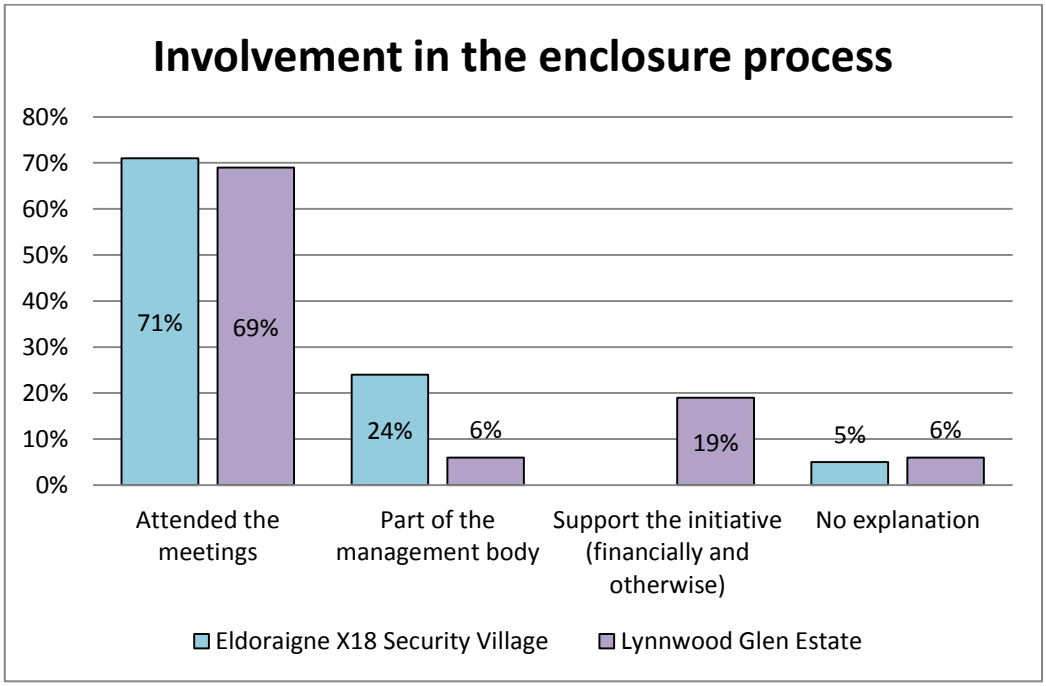
The majority of the respondents from Lynnwood Glen and Doringkloof who have considered moving to or applying for an enclosed neighbourhood have indicated that the greatest reason to do so would be for safety reasons.

Respondents from Eldoraigne X18 Security Village and Lynnwood Glen Estate were asked to indicate if, and how they were involved in the process of enclosing the neighbourhoods. It was interesting to note that the majority of respondents interviewed from Lynnwood Glen Estate were not involved in the enclosing process.



Graph 26: Percentage of respondents involved in the enclosing of the neighbourhood per enclosed neighbourhood

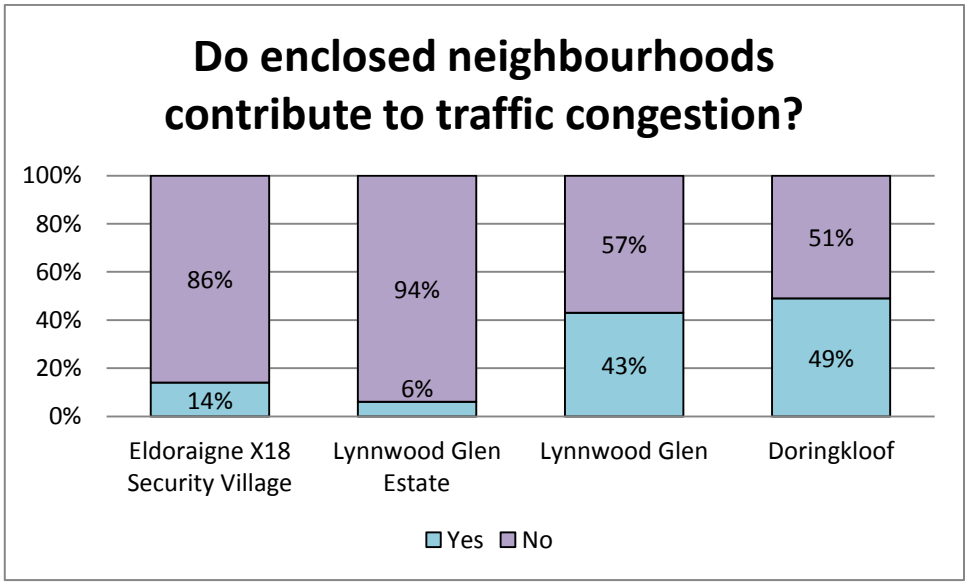
From those who were involved, the majority from both Eldoraigne X18 Security Village and Lynnwood Glen Estate indicated that they had attended the meetings.



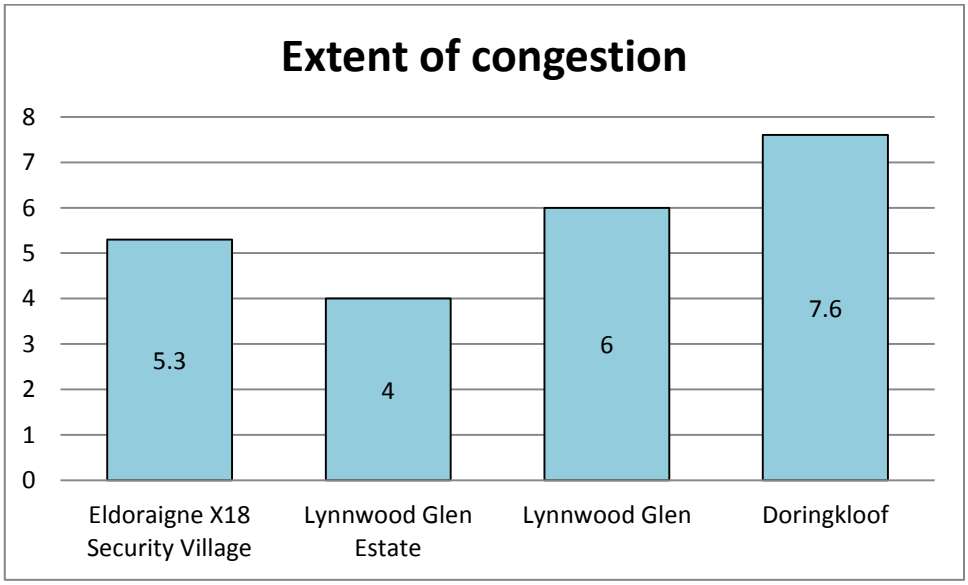
Graph 27: Involvement in the enclosure per enclosed neighbourhood

Respondents from all four neighbourhoods were also asked whether they believed that enclosed neighbourhoods have an impact on traffic congestion, and to what extent. As illustrated below, the majority of respondents who said that they believed it did were the respondents from the open neighbourhoods, who also believed the congestion due to

enclosed neighbourhood, were more severe than the respondents from the enclosed neighbourhoods.



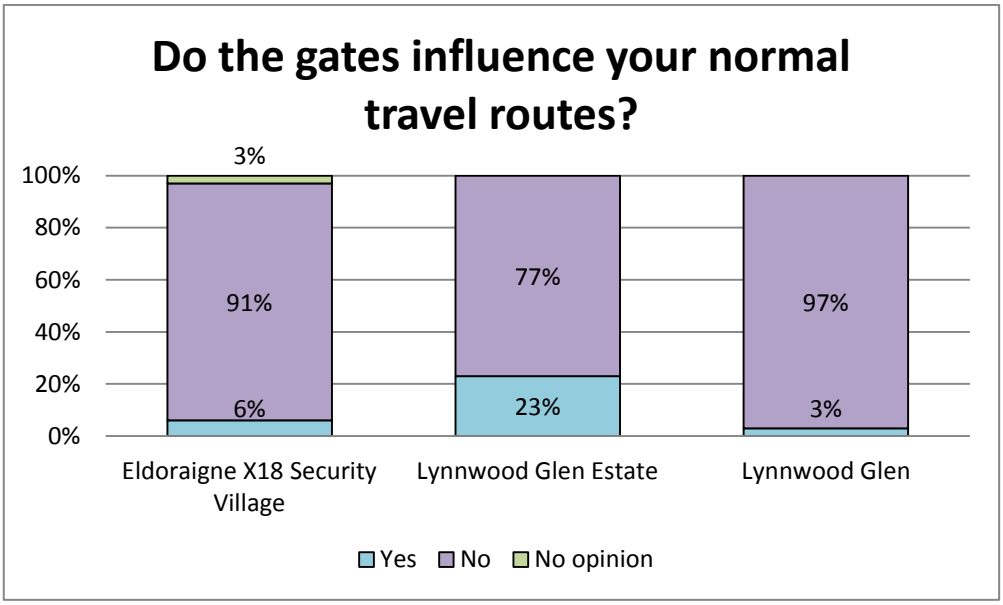
Graph 28: Illustration of number of respondents who believe enclosed neighbourhoods contribute to congestion per study area



Graph 29: level of congestion as perceived by respondents per study area

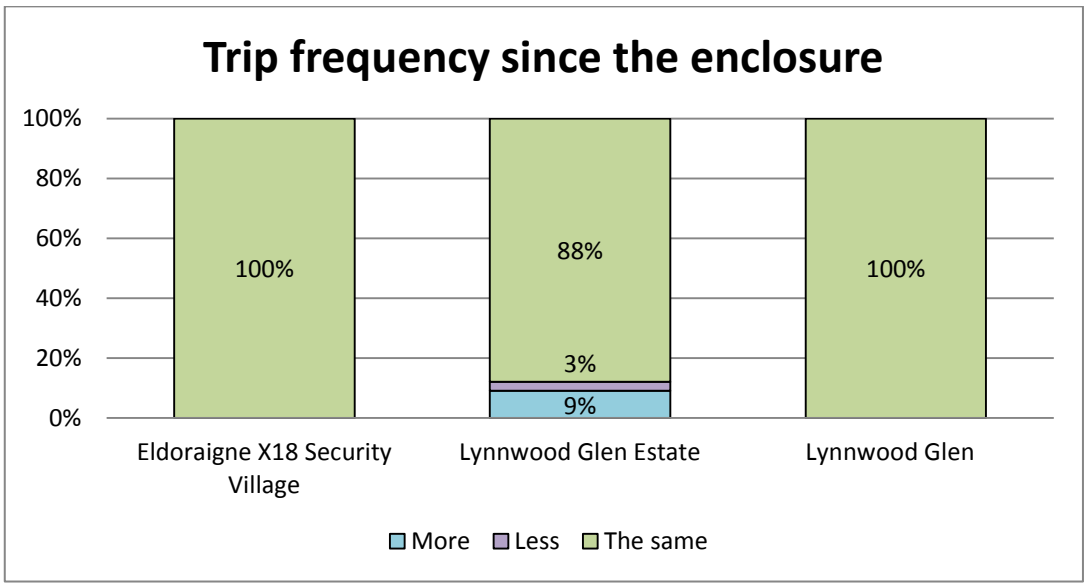
Respondents from Eldoraigne X18 Security Village and Lynnwood Glen Estate were asked whether the gates and booms influenced their normal travel routes (as opposed to before the gates were erected), but the majority thought that it didn't. The same question was posed to residents from Lynnwood Glen, as in theory, the fact that the adjacent neighbourhood were enclosed normal travel routes would be disrupted. It was interesting to find that the majority of respondents did not seem to think that it did. From

those who did indeed think that the gates influenced their travel patterns and routes, the majority resides within Lynnwood Glen Estate:



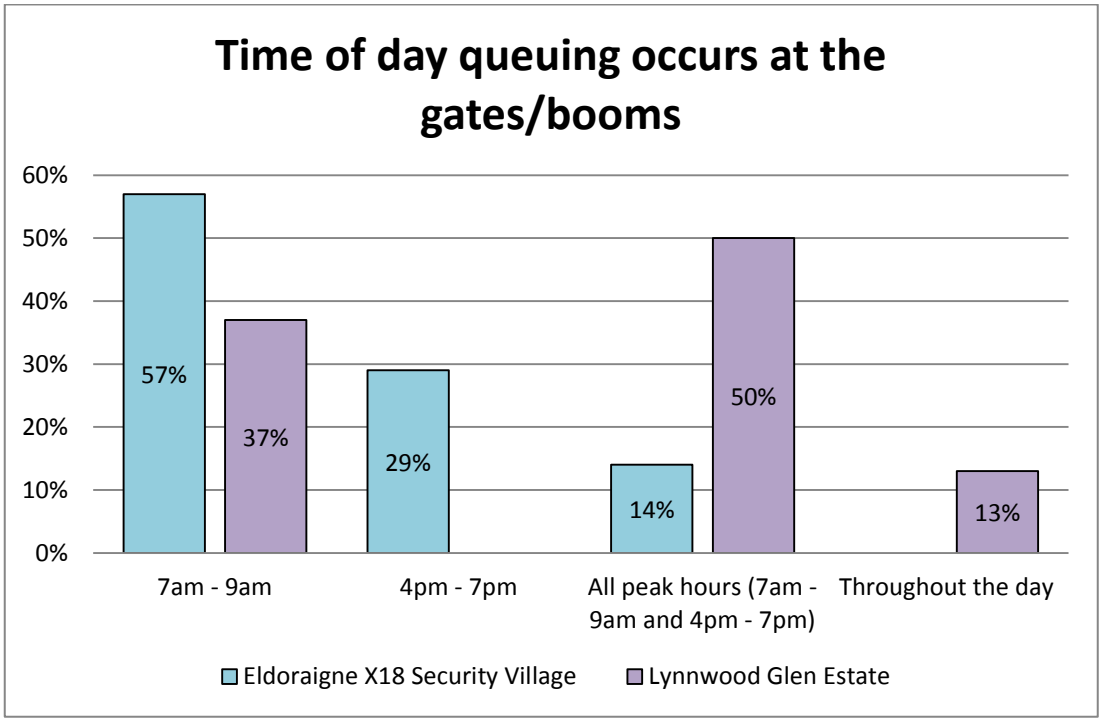
Graph 30: percentage of respondents who belive gates incluence their travel routes per study area

These three neighbourhoods were also asked if they felt that they made more, less or the same amount of trips since the enclosure, and once again it was only residents from Lynnwood Glen Estate who felt that they did not make the same amount of trips. In fact, nine per cent of respondents indicated that they made more trips and three per cent felt they made fewer trips since the neighbourhood was enclosed.



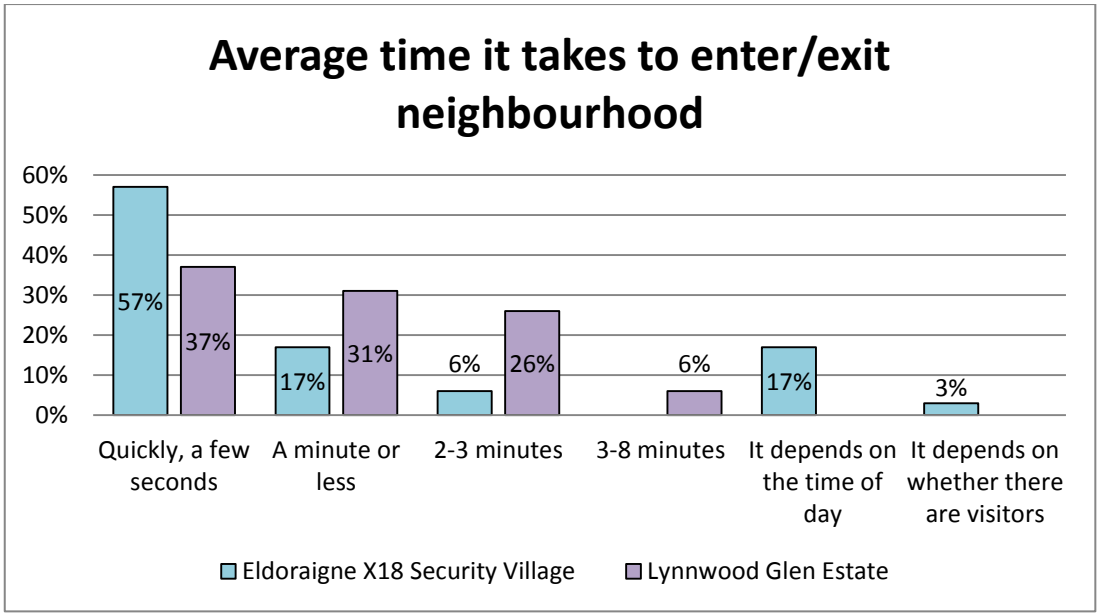
Graph 31: Trip frequency since the enclosure per study area

The majority of respondents from Eldoraigne X18 Security Estate as well as respondents from Lynnwood Glen Estate did not see it as an inconvenience to drive through booms at selected points in order to enter or exit the neighbourhood, stating that safety outweighs the possible congestion that occur at these entrances and exits. Although most respondents from both enclosed neighbourhoods indicated that they never need to wait in queues when entering or exiting the neighbourhood, those who do have identified certain times of the day when congestion at the gates or booms are the worst. Twenty per cent of respondents from Eldoraigne X18 Security Estate stated that they sometimes wait in queues while at Lynnwood Glen Estate twenty six per cent claimed they sometimes had to wait to enter or exit the neighbourhood. From these the time of day as listed by these respondents for the two neighbourhoods were as follows:



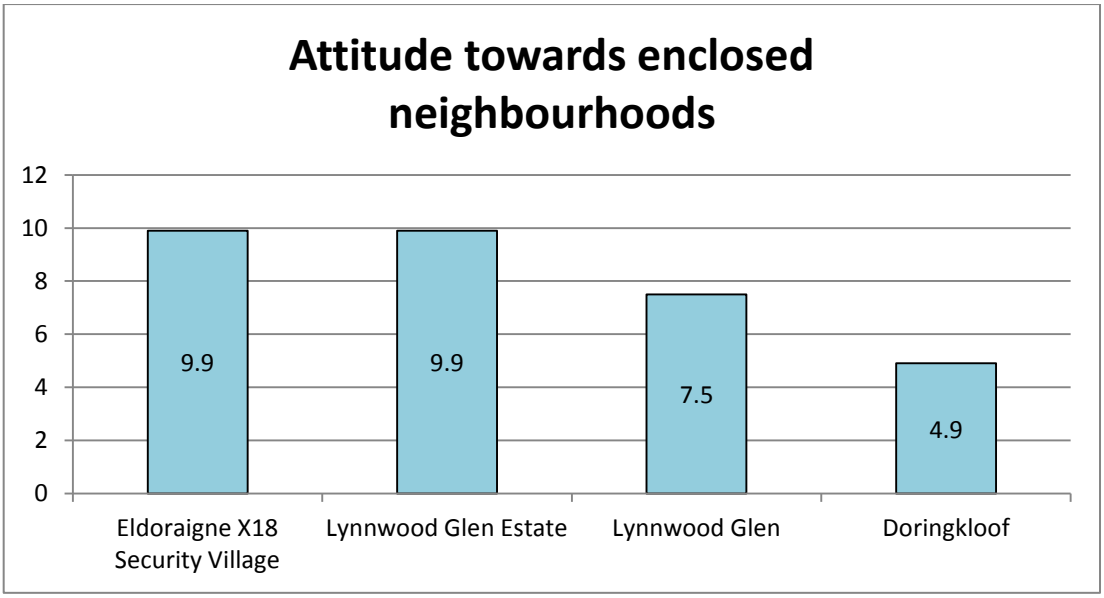
Graph 32: Time of day indicated that queuing occurs per study area

Respondents from the two neighbourhoods were asked to indicate on average how long it takes to enter and exit the neighbourhoods. It seems that the respondents residing within Lynnwood Glen Estate perceive the time it takes to enter and exit the neighbourhood on average as much longer than those residing within Eldoraigne X18 Security Village. This may be ascribed to the fact that during peak times Eldoraigne X18 Security Estate has additional gates that are open, thus relieving congestion at the main entrances.



Graph 33: perceived time it takes to enter and exit the neighbourhood per enclosed neighbourhood

From the questionnaires, it was found that the residents from the enclosed neighbourhoods were very positive towards enclosed neighbourhoods, which makes sense as the majority of residents living within an enclosed neighbourhood needs to support it in order for the application to be approved. The fact that Lynnwood Glen, the neighbourhood situated adjacent to Lynnwood Glen Estate was positive but not quite as positive as the enclosed neighbourhoods may be for a number of reasons. First of all, it is positive as with the trend of enclosing neighbourhoods usually start snowballing within a region as soon as an area has been enclosed, and neighbouring residents may like the idea of possibly enclosing their own neighbourhood. The other side might also be true, and that is that enclosed neighbourhoods create a spin-off effect such as displacement of traffic, and traffic congestion and thus air pollution, which might leave residents in neighbouring areas feeling negative towards enclosed neighbourhoods. The fact that respondents from Doringkloof are basically neutral towards enclosed neighbourhoods are a further indication that as a control group, with no direct contact to enclosed neighbourhoods and all the emotions and politics surrounding it, they may not have strong opinions towards it as those living within or directly outside enclosed neighbourhoods.



Graph 34: Attitude towards enclosed neighbourhood per study area

6.7. Conclusion

This section is a comprehensive reflection of the fieldwork section of this research with extensive findings. The following chapter will be aimed at synthesising these findings to reveal its validity when compared to literature.

CHAPTER 7: CONCLUSION

7.1. Introduction

The purpose of this chapter is to synthesise the major findings of the research in relation to the objectives and research question and sub-sub questions. This chapter also provide a conclusion and recommendations on certain aspects and for future research.

7.2. Synthesis

This study aimed at establishing the impact of enclosed neighbourhoods on transport patterns and travel behaviour and subsequent CO_2 emissions within the City of Tshwane. As indicated in Chapter 1, five objectives were set out to guide the study to ultimately answer the research question and sub-questions. The findings will thus be synthesised in relation to the research objectives.

Objective 1: The trend of enclosing neighbourhoods within the City of Tshwane

In order to establish the trend of enclosing neighbourhoods within the City of Tshwane, a survey was conducted to establish the number of enclosed neighbourhoods located within the city, where they are located, why they are located where they are. Specific focus was put on the extent and frequency of enclosed neighbourhoods within the City of Tshwane to create a classification table to theoretically establish the level of impact enclosed neighbourhoods have on the transport patterns, travel behaviour and traffic congestion.

Furthermore, this classification system as applied to enclosed neighbourhoods within the City of Tshwane gave some interesting insights into the range and severity of enclosed neighbourhoods. It is clear that the majority of enclosed neighbourhoods (thirty seven per cent) are classified as having a considerable impact on the urban form and traffic patterns, with approximately thirteen per cent of neighbourhoods are considered to have a substantial impact while only one per cent of neighbourhoods have a severe impact. This means that almost fifty per cent of enclosed neighbourhoods have little impact or little to no impact on the urban form and traffic patterns and travel behaviour.

Case studies were selected from the neighbourhoods classified as having a substantial impact on travel behaviour, transport routes and traffic congestion. After looking at the findings, it seems that Eldoraigne X18 Security Village and Lynnwood Glen Estate may in actual fact not be classified as the same, with Eldoraigne X18 Security Estate having a smaller impact on travel behaviour than Lynnwood Glen Estate. The reason for this may be due to the fact that Eldoraigne X18 Security Village opens a number of streets during peak hours to relieve traffic congestion during these times.

After making these observations, it must be revealed that further research must be undertaken to refine the classification table. This might open the door to opportunities for further studies to be undertaken. These include:

- In-depth traffic impact assessments and simulations for different scenarios
- Comprehensive investigation into the regulatory measures on local government level
- In-depth opinion-based assessment of the enclosed neighbourhood population within the City of Tshwane in terms of the perception of enclosed neighbourhoods and its impacts on the urban form
- Comprehensive measure of the average CO_2 contribution and trip frequency before and after the conversion from an open neighbourhood to an enclosed neighbourhood

It was established through the literature that the main reason for enclosing neighbourhoods was due to the fear of crime and to ensure their own safety. Through the fieldwork, it was established that the main reason for all residents to choose to reside within the specific neighbourhoods even before it was enclosed was for the same reason. From this, the conclusion can be made that these neighbourhoods used to be safe, or perceived as safe, and in an effort to preserve that characteristic, the residents opted to enclose.

When comparing the number of residents form Lynnwood Glen, the neighbourhood situated adjacent to Lynnwood Glen Estate, to the number of residents from Doringkloof, the control group, who have considered enclosing their neighbourhood, the difference is quite substantial. Twenty nine per cent from Lynnwood Glen compared to three per cent form Doringkloof indicates that the theory of enclosed neighbourhoods having a snowball effect on neighbouring areas seems plausible (In both cases, the reason for considering this was safety). This is further confirmed by comparing the

attitudes towards enclosed neighbourhoods with Lynnwood Glen being quite positive and Doringkloof neutral.

Objective 2: Transport networks and its significance within a neighbourhood

It was found that road networks or movement networks plays a major part in terms of movability and accessibility within neighbourhood. Furthermore, as indicated through the classification system, neighbourhoods consisting of 'closed' road networks such as loops and lollipops (crescents and cul-de-sacs) do not have a severe impact on travel behaviour once they are enclosed. Suburban road networks were planned during a time where it was believed that compact urban forms were unsustainable, which resulted in large scale sprawl. This coupled with an ever-changing society and built environment threatened the idea of suburbia, causing many neighbourhoods wanting to preserve this 'out-dated' idyllic idea.

When looking back at the results obtained from the fieldwork, it is interesting to note that respondents from Lynnwood Glen Estate also indicated that the second greatest reason for enclosing was to stop through traffic in their neighbourhood, especially minibus taxis. This is an indication of the above statement of residents trying to preserve the character of the neighbourhood without being willing to accept the change happening around them.

This revelation can also serve as evidence that traffic that did move through Lynnwood Glen Estate is now displaced to other neighbourhoods or higher order roads like Glenwood Road.

Objective 3: The influence of urban structure characteristics on travel behaviour

It has been found from the literature that the built environment has a definite influence on travel behaviour, but it has also been found that socio-economic factors play an equally important role with regards to travel behaviour. From this it can be concluded that although road networks and suburbs play a role in travel behaviour most residents, as it was in these case studies, can choose to live there because they can afford private vehicle transportation.

Furthermore, it was found that land use and transport planning are not integrated, thus road networks encourage low densities and single zonings and the ignorance towards the true influence of enclosing roads and restricting access.

Although respondents living within enclosed neighbourhoods and respondents living adjacent to enclosed neighbourhoods mostly believe that they did not make any more trips than they did prior to the enclosure and that they gates do not influence their travel behaviour, the trip rate for these areas tell a different story.

Respondents from Eldoraigne X18 Security Village made the most trips, followed by Lynnwood Glen. Respondents form Lynnwood Glen Estate made the least amount of trips, but they also had the greatest VKT, followed by Lynnwood Glen and Eldoraigne, proving that residents from enclosed neighbourhoods and neighbourhoods adjacent to enclosed neighbourhoods do indeed travel longer distances than respondents from open neighbourhoods.

From the time of day travelling occurred the most frequent from the respondents from the enclosed neighbourhoods and the adjacent neighbourhood (peak hours, between 07:00 to 08:59 and between 16:00 to 18:59), and the times of day indicated by the respondents from both enclosed neighbourhoods when they had to wait in queues to enter or exit the neighbourhoods, confirms that enclosed neighbourhoods do indeed contribute to traffic congestion, especially during peak hours.

The opinions of respondents differed greatly on whether enclosed neighbourhoods indeed contribute to traffic congestion. The majority felt it didn't. Although this is what the opinion was, it could be that the respondents tried to 'protect' the integrity of their neighbourhoods as almost half of the respondents from the adjacent and open neighbourhoods believed that enclosed neighbourhoods contribute to traffic congestion, and also to a considerable extent.

Objective 4: The relationship between vehicle transport and GHG emissions

Literature

An important correlation between literature and the findings from the fieldwork was that by the enclosing neighbourhoods, not only are spatial fragmentation encouraged, but public roads are decreased which translates into congestion and increased travelling time. This in turn increases air pollution (CO_2 emissions). When altering the structural characteristic such as movement patterns of a neighbourhood by closing off public roads, individuals are forced to find alternative routes. Thus, a growth in trip distance occurs that will directly affect the growth rate of CO_2 emissions.

It was also proven that enclosed neighbourhoods contributed more to GHG emissions (CO2) than open neighbourhoods not located near an enclosed neighbourhood, and that neighbourhoods situated next to enclosed neighbourhoods emit a great amount of CO2 due to the fact that they travel longer distances because of the limited travel options and increased congestion as caused by the enclosed neighbourhood.

Objective 5: Policies, strategies, plans and legislation

Legislation regarding enclosed neighbourhoods is very controversial with claims of basic human rights being infringed and enclosed neighbourhoods being connected to the reinforcement of apartheid planning. Numerous literatures referred to this issue, and by comparing the different household dynamics, claims made that enclosed neighbourhoods consist of mainly white middle to high income households with little racial integration, is proven to be true. The greatest racial integration was seen within the control group. Although still very skewed, three racial groups were present with almost a quarter of residents being black.

A number of legislation and policy objectives with regards to spatial planning indicate that the enclosing of neighbourhoods are in contrast to ensuring sustainable, compact and equitable societies.

7.3. Implications

To ensure that this study is useful for further studies, a number of implications must be highlighted.

Implications for theory

From this study, it was found that by enclosing neighbourhoods and restricting traffic flow, transport patterns are indeed altered. In some cases this might not be such a bad event as with population growth increasing at a rapid rate and car ownership rocketing, some of these residential streets have lost their character and were burdened by unplanned through traffic, and enclosures are merely ensuring that through traffic is funnelled back into the main arterials.

This however can also result in traffic being displaced to other neighbourhoods and further congestion on high order roads and main arterials, as these neighbourhoods were designed for a certain density and are only able to accommodate a certain amount

of traffic, but with 'leap-frog' development and the character around these neighbourhoods drastically changing and being utilised for commercial and retail purposes, it is unrealistic to try and preserve these neighbourhoods without acknowledging the change.

The need to thus redefine or even recreate the concept of a neighbourhood and its function and position within the greater urban area exist that will incorporate greater safety design elements without being invasive. Simple design measures such as unhampered views of streets, enhancement of pedestrian facilities to ensure eyes on the street (Evans, *et al*, 2007b) combined with community watch initiative and police forums can make a huge difference in terms of bringing down the crime rate within an area (Evans *et al*, 2007a). Case studies that compare the crime rate of enclosed neighbourhoods versus areas that implement safety design principles and community watch initiatives could be compared to establish the validity of implementing enclosed neighbourhoods within the City of Tshwane.

Implication for transport planning and spatial restructuring

Seeing as the evidence points out that by enclosing neighbourhoods, transport patterns are inevitably altered, it would be beneficial and more cost effective for residents to implement other measures of physical traffic control such as street calming measures like speed humps, speed tables, road narrowing and throttling, chicanes, raised surfaces and road markings (O'Flaherty, 1997b), before resorting to drastic measures such as road closures.

Last but not least, alignment of objectives and principles between different pieces of legislation needs to occur to ensure sustainable and harmonious environments within the city. Spatial planning/land use and transport planning objectives need to be integrated to ensure sustainable planning and the influence of enclosed neighbourhoods on the objectives of spatial planning needs to be investigated in detail.

7.4. Conclusion

This study have affectively established that by enclosing neighbourhoods, a definite alteration in transport patterns occur, and with that the degradation of the city's urban form and integrity. Despite this, the phenomenon that is enclosed neighbourhoods and its impact on the urban form cannot be summarised in a few brief sentences. The

erection of enclosed neighbourhoods will in all likelihood remain a reality in South Africa for considerable amount of years, despite the evident impact on not only the urban form, but on a social level as well. The reason for this is deeply rooted in this vibrant country's complex history.

South Africa has made tremendous strides towards democracy and equality, but despite this some perceptions of individuals or groups today, are based on which side of the regime they were located and whether or not they were benefitted, consciously and subconsciously. This cause in many cases an irrational fear of the 'outside' world – the 'Us-versus-Them Effect' - resulting in physical objects such as walls, gates and booms which are rationalised by the belief of government inability to serve and protect. This hampers integration (and strengthen the realistic conflict theory) – not only social integration of communities and cultures, but physical integration on a much more practical level – segregation of land use management, transport planning and mixed use developments with implications such as traffic congestion and an increase in GHG contribution.

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Annexure A: Opinion Based Questionnaire – Enclosed Neighbourhoods

Enclosed Neighbourhoods

Section A: General questions

1. How long have you been residing within this neighbourhood?

2. On a scale of 1 to 10 (1 being least important and 10 being most important), how important was the following aspects when you chose to reside within this neighbourhood?

	Least important										Most important
	0	1	2	3	4	5	6	7	8	9	10
2.1 Safety and security											
2.2 Close to amenities (schools, shops, hospitals, etc.)											
2.3 Close to place of work											
2.4 Close to highways and other major roads											
2.5 Character of neighbourhood											
2.6 Property prices											
2.7 Other: Specify											
2.8 Other: Specify											

3. What was the main reason for closing off this neighbourhood?

4. Were you involved in the process of enclosing this neighbourhood? How?

Section B

5. Has the enclosing of this neighbourhood influenced your usual travel routes or patterns? How?

6. Since the enclosing of this neighbourhood, do you think you make _____ number of trips than before it was enclosed?

Less	More	The same

7. Do you believe that enclosed neighbourhoods have an impact on traffic congestion?

Yes	No

7.1 If yes, indicate on a scale from 1 to 10 (1 being little, 10 being very severe)

	Little						Very severe				
How severe do you perceive congestion due to enclosed neighbourhoods?	0	1	2	3	4	5	6	7	8	9	10

8. Do you find it inconvenient to drive through booms/gates to enter and exit this neighbourhood? Why/why not?

9. How often do you need to wait in queues in order to enter and/or exit this neighbourhood

Never	Sometimes	Everyday

10. If waiting at the gates/booms do occur, what time of day does the queuing occur?

Peak morning hours (7am – 9am)	Peak afternoon hours (4pm – 7pm)	All peak hours	throughout the whole day	Other specific times

10.1 Please specify “Other specific times”

11. On average, how long does it take you to enter and exit this neighbourhood?

12. Taking everything into account, on a scale of 1 to ten (1 being very negative, 5 being neutral and 10 being very positive)

	Very negative						Very positive				
How positive or negative are you towards enclosed neighbourhoods?	0	1	2	3	4	5	6	7	8	9	10

Annexure B: Opinion Based Questionnaire – Adjacent Neighbourhoods

Open Adjacent Neighbourhoods

Section A: General questions

1. How long have you been residing within this neighbourhood?

2. On a scale of 1 to 10 (1 being least important and 10 being most important), how important was the following aspects when you chose to reside within this neighbourhood?

	Least important										Most important
	0	1	2	3	4	5	6	7	8	9	10
2.1 Safety and security											
2.2 Close to amenities (schools, shops, hospitals, etc.)											
2.3 Close to place of work											
2.4 Close to highways and other major roads											
2.5 Character of neighbourhood											
2.6 Property prices											
2.9 Other: Specify											
2.10 Other: Specify											

Section B

3. Have you ever consider moving to/living in/applying for an enclosed neighbourhood?
(Enclosed neighbourhood refers to an existing neighbourhood that has been gated off with controlled access via gates or booms across existing roads)

Yes	No

3.1 If yes, why?

3.2 If no, why not?

4. Has the enclosing of the (adjacent) neighbourhood influenced your usual travel routes or patterns? If yes, how?

5. Since the enclosing of the (adjacent) neighbourhood, do you think you make less, more or the same amount of trips?

Less	More	The same

6. Do you believe that enclosed neighbourhoods have an impact on traffic congestion?

Yes	No

6.1 If yes, indicate on a scale from 1 to 10 (1 being little, 10 being very severe)

	Little						Very severe				
How severe do you perceive congestion due to enclosed neighbourhoods?	0	1	2	3	4	5	6	7	8	9	10

7. Since the enclosing of the (adjacent) neighbourhood, do you travel longer distances to reach daily destinations (e.g. work, school)?

8. Have you ever been inconvenienced by not being able to drive through an enclosed neighbourhood? Please explain.

9. Taking everything into account, on a scale of 1 to ten (1 being very negative, 5 being neutral and 10 being very positive)

	Very negative						**Very positive**				
How positive or negative are you towards enclosed neighbourhoods?	0	1	2	3	4	5	6	7	8	9	10

Annexure C: Opinion Based Questionnaire – Open Neighbourhoods

Open Neighbourhoods

Section A: General questions

1. How long have you been residing within this neighbourhood?

3. On a scale of 1 to 10 (1 being least important and 10 being most important), how important was the following aspects when you chose to reside within this neighbourhood?

	Least important										Most important
	0	1	2	3	4	5	6	7	8	9	10
2.1 Safety and security											
2.2 Close to amenities (schools, shops, hospitals, etc.)											
2.3 Close to place of work											
2.4 Close to highways and other major roads											
2.5 Character of neighbourhood											
2.6 Property prices											
3.7 Other: Specify											
3.8 Other: Specify											

Section B

4. Have you ever consider moving to/living in/applying for an enclosed neighbourhood?
(Enclosed neighbourhood refers to an existing neighbourhood that has been gated off with controlled access via gates or booms across existing roads)

Yes	No

3.1 If yes, why?

3.2 If no, why not?

5. Do you believe that enclosed neighbourhoods have an impact on traffic congestion?

Yes	No

4.1 If yes, indicate on a scale from 1 to 10 (1 being little, 10 being very severe)

	Little						Very severe				
How severe do you perceive congestion due to enclosed neighbourhoods?	0	1	2	3	4	5	6	7	8	9	10

6. Have you ever been inconvenienced by not being able to drive through an enclosed neighbourhood? Please explain.

7. Taking everything into account, on a scale of 1 to ten (1 being very negative, 5 being neutral and 10 being very positive)

	Very negative						Very positive				
How positive or negative are you towards enclosed neighbourhoods?	0	1	2	3	4	5	6	7	8	9	10

Annexure D: Travel Survey (Extract)

Travel Survey

Section A: Household location

Type of Neighbourhood

Enclosed	Open	Adjacent

Section B: Personal particulars of household

(Register all the residents, including minors).

1. Number of persons residing within the household (excluding domestic workers and gardeners):

2. Number of domestic workers and gardeners working at this premises

3. Do the domestic workers and gardeners

Live on the premises	Travel here daily

4. Type of dwelling:

Single family house detached	Townhouse/simplex	Duplex	Apartment/flat

5. Housing tenure:

Own with mortgage (bond)	Own without mortgage	Rent	Provided by job

6. Total number of motor vehicles (in working condition) owned by the household

7. Make and model of each motor vehicle:

	Make (e.g. Toyota Tazz)	Petrol / Diesel	Engine size (e.g. 1600 cc)	Model (e.g. 2003)
1				
2				
3				

4				
5				
6				

8. Household Roster:

Respondent:						
	1	2	3	4	5	6
Complete questionnaire?						
Gender:						
Male						
Female						
Race:						
Asian						
Black						
Coloured						
White						
Year of Birth:						
Year						
Occupation:						
Employee						
Self-employed						
Student						
Unemployed						
Retired						
Not employed (homemaker)						
Other						
Other Specify						

Section C: Travel information

1	Respondent 1 (Head of Household)
	Day 1

Section C1: Origin of initial trip

Please fill me in on all trips undertaken by you (if over the age of 6 years old) for the past 48 hours, including trips by foot and trips undertaken where you were only a passenger.

Day of the week survey conducted:

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday

Day of the week referred to by respondent:

Monday	Tuesday	Wednesday	Thursday	Friday

1.

Trip originated from address where the survey was conducted	
Trip originated from another address	

2. In the case of origin of initial trip differs from the address where the survey was conducted; indicate the address/name of the initial origin:

3. Mode of travel:

Car/van/bakkie driver		Car/van/bakkie passenger		Motorcycle/scooter	
Walk/wheelchair		Bicycle		Bus/school bus	
Train		Minibus Taxi		Taxi/shuttle	

4. In the event of driver/passenger, what motor vehicle were you driving? (1-6)

1	2	3	4	5	6

5. Time of departure

:

Section C2: Travel diary

1	Respondent 1 (Head of Household)
TRIP 1	

1. Purpose of the trip

Work		Work related		Home	
Eat/drink		Medical		Gym/sport	
Educational/ school/university		Shopping		Accompanying children	
Social/recreational		Visiting someone		Accompanying Adults	
Other		Other Specify			

2. Time of arrival

:

3. Address of activity (destination) or nearest street corner to activity (destination) or name of destination (University of Pretoria, Unitas Hospital, Hoërskool Garsfontein etc.)

4. Mode of travel:

Car/van/bakkie driver		Car/van/bakkie passenger		Motorcycle/scooter	
Walk/wheelchair		Bicycle		Bus/school bus	
Train		Minibus Taxi		Taxi/shuttle	

5. In the event of driver/passenger, what motor vehicle were you driving? (1-6)

1	2	3	4	5	6

6. Time of departure

:

1. Purpose of the trip

1	Respondent 1 (Head of Household)
TRIP 2	

Work		Work related		Home	
Eat/drink		Medical		Gym/sport	
Educational/ school/university		Shopping		Accompanying children	
Social/recreational		Visiting someone		Accompanying Adults	
Other		Other Specify			

2. Time of arrival

:

3. Address of activity (destination) or nearest street corner to activity (destination) or name of destination (University of Pretoria, Unitas Hospital, Hoërskool Garsfontein etc.)

4. Mode of travel:

Car/van/bakkie driver		Car/van/bakkie passenger		Motorcycle/scooter	
Walk/wheelchair		Bicycle		Bus/school bus	
Train		Minibus Taxi		Taxi/shuttle	

5. In the event of driver/passenger, what motor vehicle were you driving? (1-6)

1	2	3	4	5	6

6. Time of departure

:

1. Purpose of the trip

1	Respondent 1 (Head of Household)
TRIP 3	

Work		Work related		Home	
Eat/drink		Medical		Gym/sport	
Educational/ school/university		Shopping		Accompanying children	
Social/recreational		Visiting someone		Accompanying Adults	
Other		Other Specify			

2. Time of arrival

:

3. Address of activity (destination) or nearest street corner to activity (destination) or name of destination (University of Pretoria, Unitas Hospital, Hoërskool Garsfontein etc.)

4. Mode of travel:

Car/van/bakkie driver		Car/van/bakkie passenger		Motorcycle/scooter	
Walk/wheelchair		Bicycle		Bus/school bus	
Train		Minibus Taxi		Taxi/shuttle	

5. In the event of driver/passenger, what motor vehicle were you driving? (1-6)

1	2	3	4	5	6

6. Time of departure

:

---

1. Purpose of the trip

1	Respondent 1 (Head of Household)
TRIP 4	

Work		Work related		Home	
Eat/drink		Medical		Gym/sport	
Educational/ school/university		Shopping		Accompanying children	
Social/recreational		Visiting someone		Accompanying Adults	
Other		Other Specify			

2. Time of arrival

:

3. Address of activity (destination) or nearest street corner to activity (destination) or name of destination (University of Pretoria, Unitas Hospital, Hoërskool Garsfontein etc.)

4. Mode of travel:

Car/van/bakkie driver		Car/van/bakkie passenger		Motorcycle/scooter	
Walk/wheelchair		Bicycle		Bus/school bus	
Train		Minibus Taxi		Taxi/shuttle	

5. In the event of driver/passenger, what motor vehicle were you driving? (1-6)

1	2	3	4	5	6

6. Time of departure

:

---

1. Purpose of the trip

1	Respondent 1 (Head of Household)
TRIP 5	

Work		Work related		Home	
Eat/drink		Medical		Gym/sport	
Educational/ school/university		Shopping		Accompanying children	
Social/recreational		Visiting someone		Accompanying Adults	
Other		Other Specify			

2. Time of arrival

:

3. Address of activity (destination) or nearest street corner to activity (destination) or name of destination (University of Pretoria, Unitas Hospital, Hoërskool Garsfontein etc.)

4. Mode of travel:

Car/van/bakkie driver		Car/van/bakkie passenger		Motorcycle/scooter	
Walk/wheelchair		Bicycle		Bus/school bus	
Train		Minibus Taxi		Taxi/shuttle	

5. In the event of driver/passenger, what motor vehicle were you driving? (1-6)

1	2	3	4	5	6

6. Time of departure

:

1. Purpose of the trip

1	Respondent 1 (Head of Household)
TRIP 6	

Work		Work related		Home	
Eat/drink		Medical		Gym/sport	
Educational/ school/university		Shopping		Accompanying children	
Social/recreational		Visiting someone		Accompanying Adults	
Other		Other Specify			

2. Time of arrival

:

3. Address of activity (destination) or nearest street corner to activity (destination) or name of destination (University of Pretoria, Unitas Hospital, Hoërskool Garsfontein etc.)

4. Mode of travel:

Car/van/bakkie driver		Car/van/bakkie passenger		Motorcycle/scooter	
Walk/wheelchair		Bicycle		Bus/school bus	
Train		Minibus Taxi		Taxi/shuttle	

5. In the event of driver/passenger, what motor vehicle were you driving? (1-6)

1	2	3	4	5	6

6. Time of departure

:

---

1. Purpose of the trip

1	Respondent 1 (Head of Household)
TRIP 7	

Work		Work related		Home	
Eat/drink		Medical		Gym/sport	
Educational/ school/university		Shopping		Accompanying children	
Social/recreational		Visiting someone		Accompanying Adults	
Other		Other Specify			

2. Time of arrival

:

3. Address of activity (destination) or nearest street corner to activity (destination) or name of destination (University of Pretoria, Unitas Hospital, Hoërskool Garsfontein etc.)

4. Mode of travel:

Car/van/bakkie driver		Car/van/bakkie passenger		Motorcycle/scooter	
Walk/wheelchair		Bicycle		Bus/school bus	
Train		Minibus Taxi		Taxi/shuttle	

5. In the event of driver/passenger, what motor vehicle were you driving? (1-6)

1	2	3	4	5	6

6. Time of departure

:

---

1. Purpose of the trip

1	Respondent 1 (Head of Household)
TRIP 8	

Work		Work related		Home	
Eat/drink		Medical		Gym/sport	
Educational/ school/university		Shopping		Accompanying children	
Social/recreational		Visiting someone		Accompanying Adults	
Other		Other Specify			

2. Time of arrival

:

3. Address of activity (destination) or nearest street corner to activity (destination) or name of destination (University of Pretoria, Unitas Hospital, Hoërskool Garsfontein etc.)

4. Mode of travel:

Car/van/bakkie driver		Car/van/bakkie passenger		Motorcycle/scooter	
Walk/wheelchair		Bicycle		Bus/school bus	
Train		Minibus Taxi		Taxi/shuttle	

5. In the event of driver/passenger, what motor vehicle were you driving? (1-6)

1	2	3	4	5	6

6. Time of departure

:

1. Purpose of the trip

1	Respondent 1 (Head of Household)
TRIP 9	

Work		Work related		Home	
Eat/drink		Medical		Gym/sport	
Educational/ school/university		Shopping		Accompanying children	
Social/recreational		Visiting someone		Accompanying Adults	
Other		Other Specify			

2. Time of arrival

:

3. Address of activity (destination) or nearest street corner to activity (destination) or name of destination (University of Pretoria, Unitas Hospital, Hoërskool Garsfontein etc.)

4. Mode of travel:

Car/van/bakkie driver		Car/van/bakkie passenger		Motorcycle/scooter	
Walk/wheelchair		Bicycle		Bus/school bus	
Train		Minibus Taxi		Taxi/shuttle	

5. In the event of driver/passenger, what motor vehicle were you driving? (1-6)

1	2	3	4	5	6

6. Time of departure

:

---

1. Purpose of the trip

1	Respondent 1 (Head of Household)
TRIP 10	

Work		Work related		Home	
Eat/drink		Medical		Gym/sport	
Educational/ school/university		Shopping		Accompanying children	
Social/recreational		Visiting someone		Accompanying Adults	
Other		Other Specify			

2. Time of arrival

:

3. Address of activity (destination) or nearest street corner to activity (destination) or name of destination (University of Pretoria, Unitas Hospital, Hoërskool Garsfontein etc.)

4. Mode of travel:

Car/van/bakkie driver		Car/van/bakkie passenger		Motorcycle/scooter	
Walk/wheelchair		Bicycle		Bus/school bus	
Train		Minibus Taxi		Taxi/shuttle	

5. In the event of driver/passenger, what motor vehicle were you driving? (1-6)

1	2	3	4	5	6

6. Time of departure

:

Indicate if more than 10 trips were made for this day by the respondent

---

Section D: Total Household Income

Please stop me when I get to the category that best describes the total combined monthly income for everyone living at this address before Tax and deductions (include all sources e.g. salaries, pensions etc.)

No income		R1-R3 000		R3 001-R6 000		R6001-R11 000	
R11 001-R15 000		R15 001-R17 000		R17 001-R20 000		R20 001-R25 000	
R25 001-R30 000		R30 001-R35 000		R35 001-R50 000		R50 001-R60 000	
R60 001-R80 000		R80 001-R100 000		R100 001-R150 000		R150 001-R200 000	
R200 001-R250 000		R250 001 or more		Don't know		Refuse	

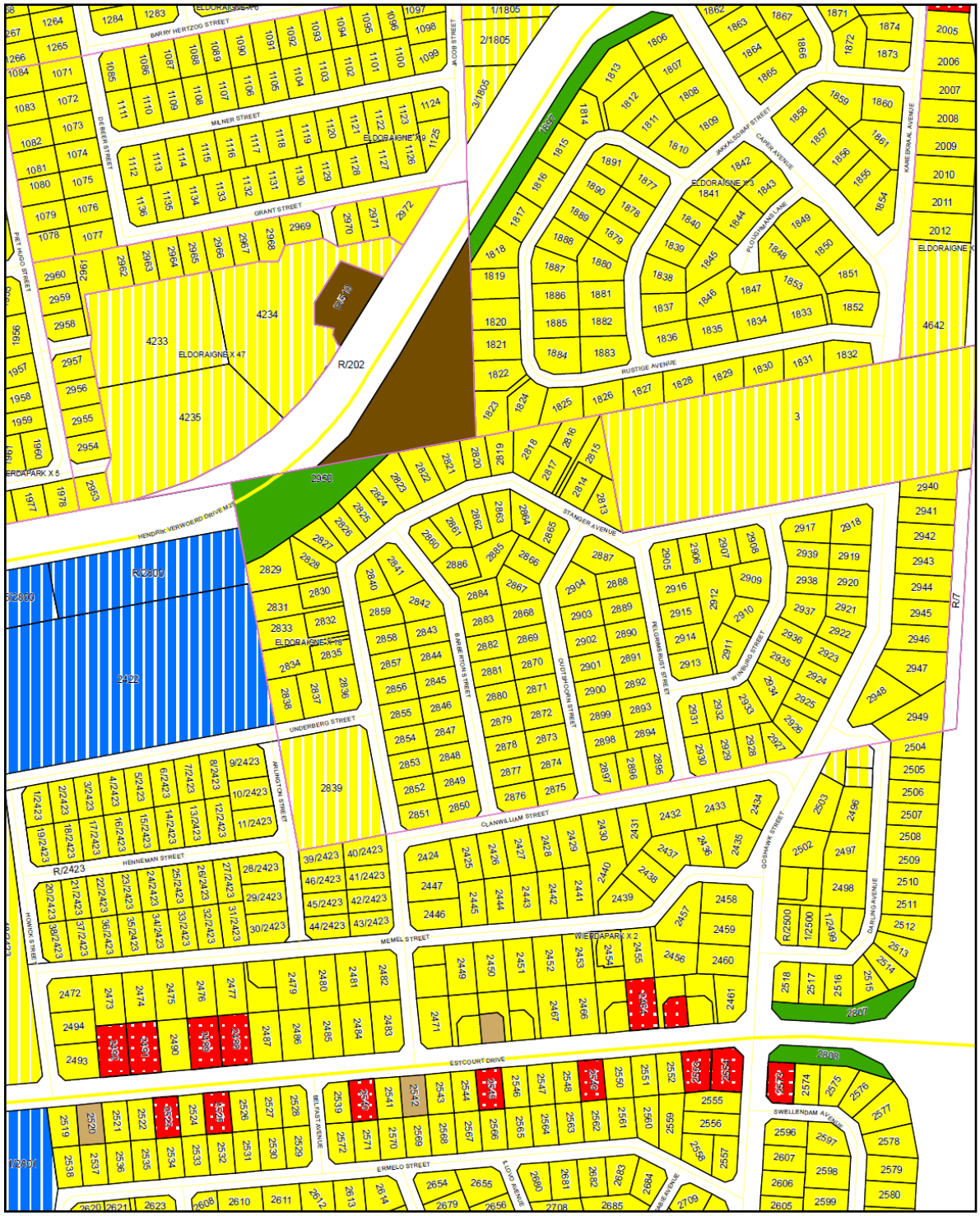
Annexure E: Breakdown of Analysis for Each Enclosed Neighbourhood

ID	NAME	NRD	Area	NSC	HCS	PTC	NPF	NCF	OPH	MG	Cul-de-sac	Total
1	Bronberrik Security Estate	239	24	3	5	478	1	0	0	1	no	30
2	Brunaly Security Area	371	55.5	3	3	147	0	8	2	0	no	39
3	Claudius Estate	221	57.3	3	5	77	1	0	0	2	no	33
4	Die Wilgers Security Village	375	48.5	5	5	337	1	1	0	1	no	34
5	Eldoraigne X18 Security Village	376	44.5	7	5	177	1	1	3	2	no	32
6	Uitsig Park	129	25.3	3	5	933	1	0	1	1	yes	11.5
7	Eldo 3 Manor	272	33.4	2	5	524	0	0	0	1	no	29
8	Caper Estate	40	17.1	1	5	60	0	0	0	1	yes	11
9	Gunib-Verdi Security Vilage	42	5.2	2	5	857	0	0	0	0	no	23
10	Verena Street	13	1.9	1	5	763	0	0	0	0	yes	9.5
11	Faerie Glen Security Village	113	16.9	2	5	1300	0	0	0	1	yes	10.5
12	Fearie Glen Village	109	11.2	1	5	290	0	0	0	1	yes	11
13	Secura Park	318	48.9	7	5	1500	3	0	1	1	no	38
14	Irene View Estate	214	18	1	5	675	0	0	0	1	no	27
15	Turnhouse Estate	47	3.1	1	5	900	1	2	0	1	yes	11
16	Willorun Bicycle Patrol	77	5	1	5	856	0	0	0	1	yes	9.5
17	Highveld Estate	29	3.9	1	5	360	0	1	0	1	yes	10.5
18	Highveld 44 Estate	65	5.1	2	5	1000	0	0	0	1	no	19
19	Highveld 43 Estate	193	9.5	2	5	1400	0	0	0	1	no	20
20	Irene Village	627	168	12	5	10	8	0	0	2	no	43
21	Irene Country Club	29	8.7	1	5	440	0	0	0	1	yes	10
22	The Ring Estate	210	19.8	3	5	720	2	3	0	1	no	34
23	Hillside Security Village	112	21.4	4	5	365	1	1	0	1	no	26
24	Strubenkop Security Village	144	36.3	3	5	383	0	1	0	1	no	26
25	Sussex North and Sussex South	19	4	4	5	252	2	1	0	0	no	26
26	Om die Berg	27	4.5	2	5	390	0	1	0	0	no	26
27	The Loop	34	10.3	2	5	915	0	0	0	0	no	23
28	Queens Crescent Estate	185	36.7	4	5	130	2	3	1	2	no	29
29	Lynnwood Glen Estate	336	85	7	5	570	2	2	0	2	no	31
30	Lynnwood Manor Village	139	33	4	5	1000	1	1	0	1	no	25
31	Manor Estate	106	27.3	5	5	420	1	0	0	1	no	26
32	Lynnwood Park	83	18.8	2	5	589	0	0	0	1	no	21

33	Lizjohn Street East	22	2.9	1	5	80	0	0	0	0	yes	11
34	Holden Crescent	7	1.1	1	5	1700	0	0	0	0	yes	8.5
35	Friesland Estate	27	6.8	3	5	554	0	1	0	1	no	22
36	Rand Estate	75	14.6	4	5	335	0	0	0	1	no	23
37	Dali Street Estate	89	11.1	1	5	450	0	1	0	1	yes	11
38	Brittany Place	17	1.5	1	5	1400	0	0	0	1	yes	8
39	Fernwick Place	13	1.7	1	5	1084	0	0	0	1	yes	8
40	Moreleta Village	278	41.7	3	5	100	1	2	0	2	no	34
41	Volt Street	4	0.8	1	5	484	0	0	0	0	yes	9.5
42	Bailey's Muckleneuk Security Village	61	13.5	3	5	20	0	0	0	3	no	23
43	Murrayfield Security Village	77	30.2	4	5	700	2	0	0	1	no	25
44	Newkloof Estate	270	42.3	3	5	532	1	1	2	1	no	30
45	Nixon Street	15	2	2	5	658	0	0	0	0	no	21
46	Jack Bennet Estate	7	0.9	1	5	2061	0	0	0	0	yes	8.5
47	Wapadrand Security Village	876	82	2	5	130	1	3	0	2	no	35
48	Milner Close	9	3.3	1	5	490	0	0	0	0	yes	10
49	Maru Close	18	3.7	2	5	500	0	0	0	1	yes	9.5
50	Lawley Estate	16	3.9	2	5	872	0	0	0	1	no	19
51	Milner Village	18	2.5	1	5	215	0	0	0	1	yes	9.5
52	Waterkloof Heights Estate	85	20	4	5	1136	0	0	0	3	no	19
53	Plough Argo	39	17.4	1	5	80	2	1	0	1	yes	12.5
54	Canopus Place	19	5.6	1	5	300	1	0	0	1	yes	10
55	Victoria Close	16	5.9	1	5	1240	0	0	0	0	yes	9.5
56	Crescendo Estate	22	6.9	2	5	30	0	1	0	0	yes	15.5
57	Silver Oak Place	31	6.5	3	5	17	0	0	0	0	no	25
58	Bootes Place	20	6.3	1	5	320	0	0	0	1	yes	9.5
59	Grus Street Estate	39	9.4	2	5	40	0	0	0	2	no	22
60	Jupiter Estate	45	10	2	5	30	0	0	0	2	no	23
61	Lyra Ridge	17	4.8	2	5	25	0	0	0	0	no	24
62	Waterkloof Ridge Estate	173	31.4	5	5	420	0	1	0	1	no	27
63	Rising Close	6	1.8	1	5	487	0	0	0	0	yes	9.5
64	Drakensberg Estate	13	3.8	1	5	407	0	0	0	0	yes	10.5
65	Silver Pine Crescent	44	5.6	1	5	692	0	0	0	1	yes	9.5
66	Zwartkop 7 North	267	35.6	2	5	73	0	0	0	2	no	30
67	Zwartkop Extension 8	104	16.7	1	5	50	1	1	0	1	yes	13
68	Zwartkop 8 Bicycle Patrol	92	16.5	1	5	50	1	0	0	1	yes	12
69	Aspen Estate	107	11.1	1	5	136	0	0	0	1	yes	11.5
70	Blackberry Estate	127	18.4	2	5	93	1	0	0	1	no	25

NRD	Number of Residential Dwellings
Area	Measured in Ha
NSC	Number of Streets Closed
HCS	Highest Class of Street Closed
PTC	Proximity to Class 1-3 Road
NPF	Number of Public Facilities
NCF	Number of Commercial Facilities
OPH	Number of Streets open during Peak Hours
MG	Main Gates/Manned Gates times
Cul-de-sac	Neighbourhoods comprising of exclusively a cul-de-sac, crescent or dead-end

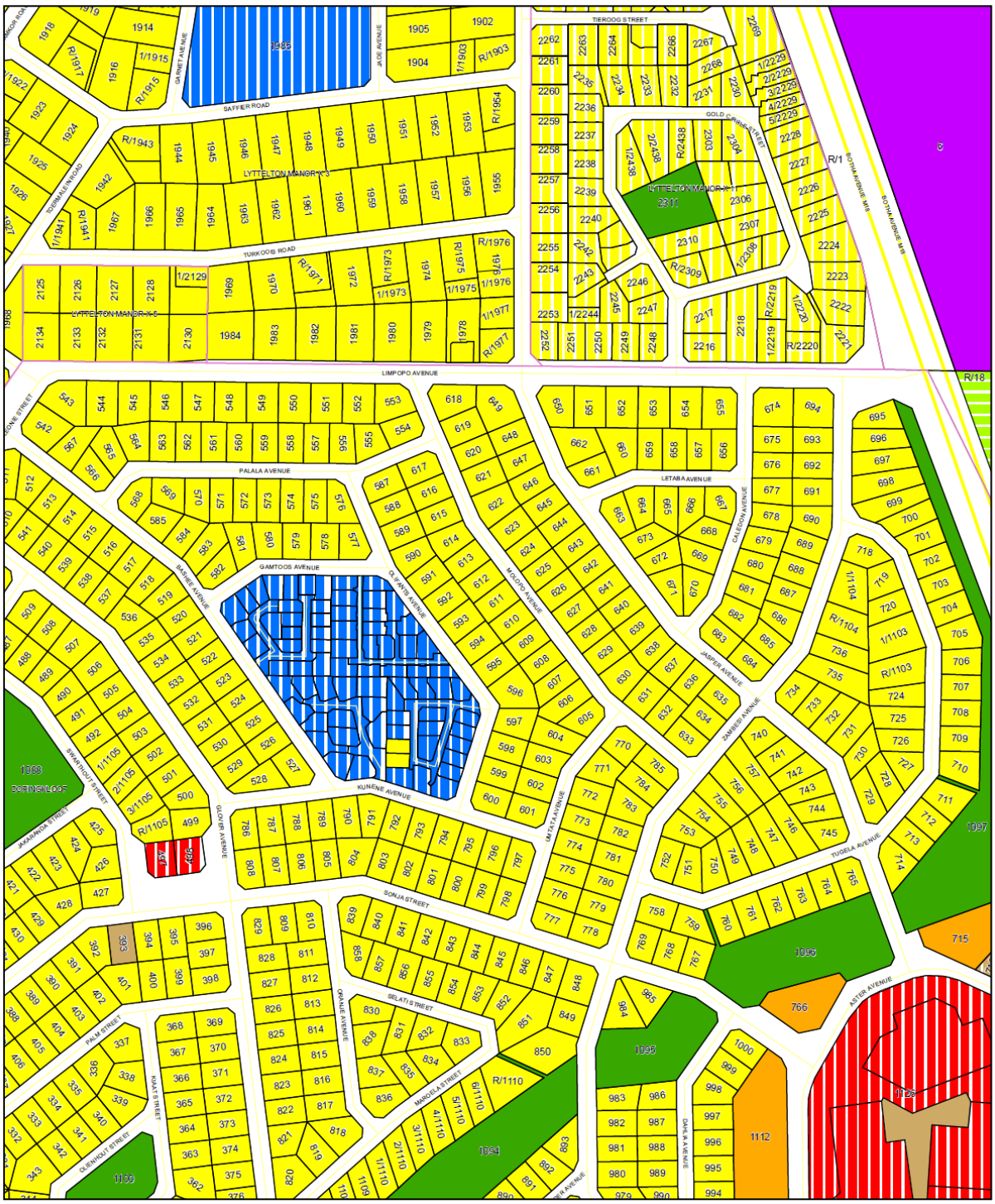
Annexure F: Zoning Plan – Eldoraigne X18 Security Village



Annexure G: Zoning Plan – Lynnwood Glen Estate

Annexure H: Zoning Plan – Lynnwood Glen

Annexure I: Zoning Plan – Doringkloof



	Residential 1		S.A.R.
	Residential 2		Cemetery
	Residential 3		Infrastructure Works
	Residential 4		Special
	Residential 5		Public Garage
	Business 1		Agricultural
	Business 2		Government
	Business 3		Public Open Space
	Business 4		Private Open Space
	Industrial 1		Undetermined
	Industrial 2		Proposed Street Widening
	Commercial		Existing Streets
	Institutional		
	Municipal		
	Educational		
	Aerodrome		