6. Case study

6.1. Introduction

The following figure illustrates the structure of Chapter 6.

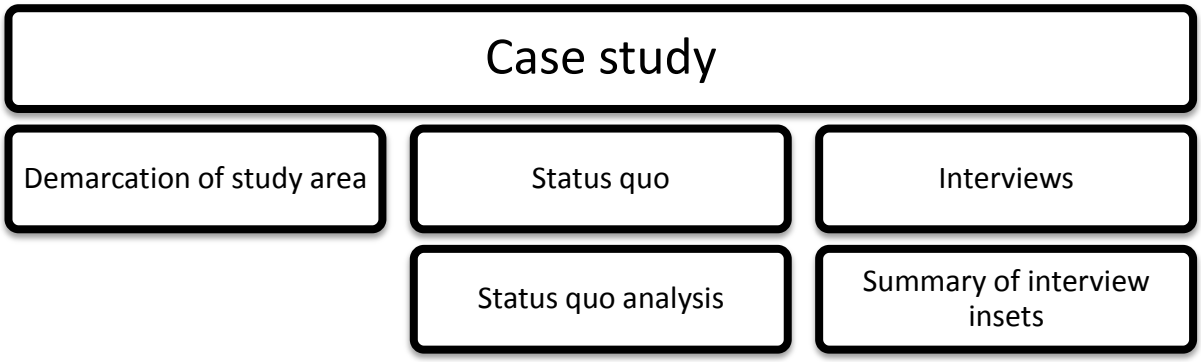


Figure 20: Chapter 6 layout

Source: Own construction (2013)

This chapter focusses on the demarcation of the specific study area, the status quo of elements relevant to the study, the analysis of the status quo's findings and finally the inputs of professionals.

As part of the research, field studies were undertaken and articles, books, guiding documentation and previous frameworks were scrutinised. However, a comprehensive socio-economic study conducted in 2008 in the town of Upington forms the primary resource (15 592 participants or 20% of Upington residents).

6.2. Upington, South Africa

A demarcated study area, situated within the town of Upington, was identified as the case study for this research document. Due to its location on the banks of the Orange River, Upington quickly transformed into an agricultural hub, especially after the construction of the irrigation canals that commenced in 1883 (Fourie, 1997:1). Today, it is the primary centre in the Gordonia region (Rademeyer & van Wyk Town and Regional Planners, 1983:4).

The town is centrally located (see Figure 21) within the Northern Cape Province and currently recognised as an educational, commercial, military, medical, transport and tourism centre. The main function of the town today is, however, to serve as a central place by providing services and products for the large hinterland which extends beyond the borders of neighbouring countries Namibia and Botswana (Fourie, 1997:2). The following two figures indicate Upington within the South African context and the different neighbourhoods within Upington, respectively.

Figure 21: Location of Upington within South Africa

Source: Own construction based on Data SIO, NOAA, U.S. Navy, NGA, GEBCO, US Dept. of State Geographer, Image Landsat, and © 2013 AfriGIS (Pty) Ltd.

Figure 22 indicate the different government spheres relevant to Upington

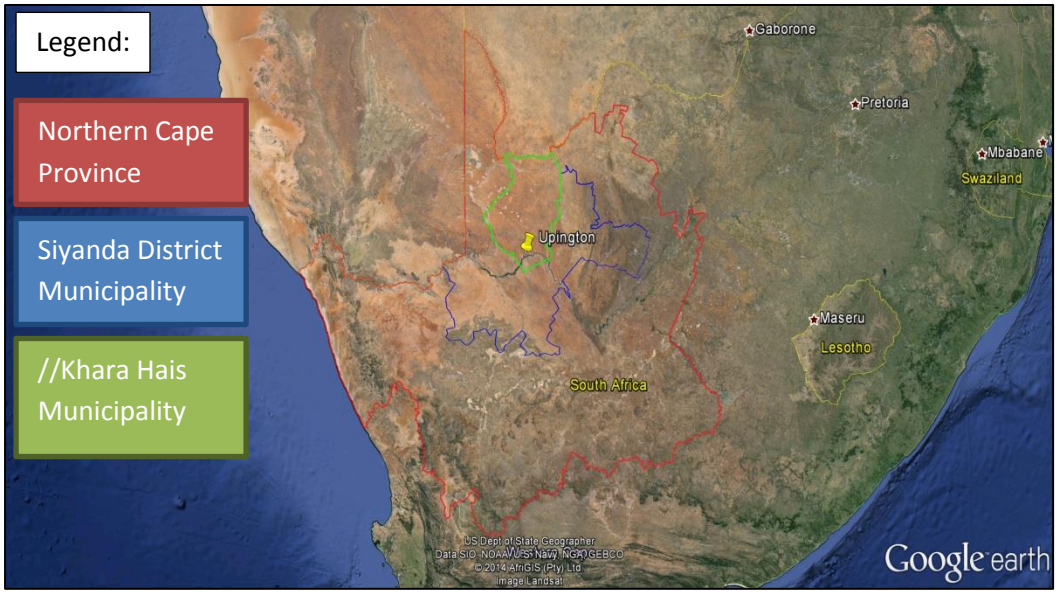


Figure 22: Government Spheres: Upington

Source: Own construction based on Data SIO, NOAA, U.S. Navy, NGA, GEBCO, US Dept. of State Geographer, Image Landsat, Demarcation Board and © 2013 AfriGIS (Pty) Ltd.

The figure below indicates the different neighbourhoods in Upington.

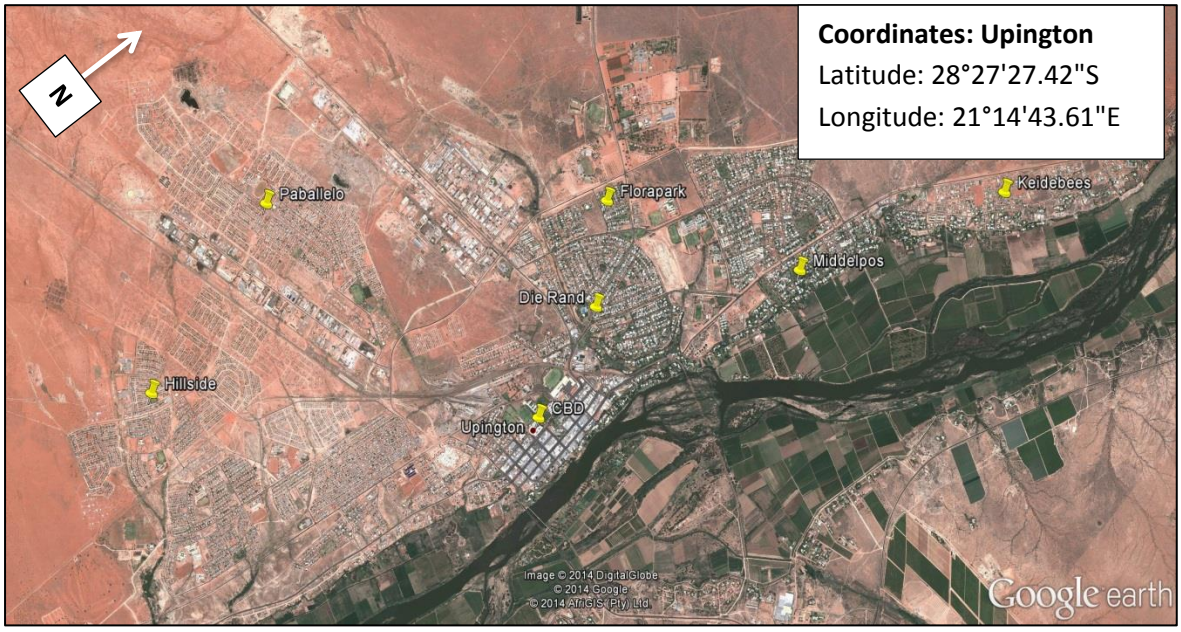


Figure 23: Map of Upington, Northern Cape Province

Sources: Own construction based on Image © 2013 DigitalGlobe © 2013 AfriGIS (Pty) Ltd.

The following table illustrates the political spheres of jurisdiction relevant to the town of Upington.

Table 17: Government spheres relevant to Upington

Government sphere	Government sphere relevant to Upington
Country	South Africa
Province	Northern Cape
District Municipality	Siyanda
Local Municipality	//Khara Hais

Source: Own construction based on the Spatial Development Framework of //Khara Hais (2012).

The town, and consequently the study area within the town, was chosen due to the following reasons:

- According to Census data (Statistics South Africa, 2011) the study area is situated within a municipality (//Khara Hais Municipality) with a total population of 93 494 residents and an annual growth percentage of 2.4% for the decade between 2001 and 2011 (The total population was 75 671 in 2001 according to Census data (Statistic South Africa, 2001)). The town is therefore large enough to experience transportation problems (parking, infrastructure and inequality) to a severe degree as Fourie (1997:4) pointed out. It is however small enough to enforce drastic, but realistic changes in the transportation network without the upset and discomfort it would cause in a city accommodating millions of

residents. Complementary to this fact is the isolation of the town and simplicity of the layout. It consists of one central business district, few secondary business areas, neighbourhoods, an industrial area and hinterland (Rademeyer & van Wyk, 1987:20).

- The CBD of Upington is laid out in a grid pattern. Three of the outer roads are national roads which create a well-defined central area. This central area was identified as the study area.

Lastly, it is was evident from the policies discussed in Chapter 4 (See 4.2 South African transport policies) that the national and provincial governments want to transform the transportation systems in South Africa and the Northern Cape respectively. More importantly is the fact that the local municipality wants to make the town of Upington more liveable and sustainable for every resident as can be derived from the local Spatial Development Framework (DMP, 2012b:21) (see Chapter 4).

6.3. The demarcated study area

The town of Upington was scrutinised in order to find a viable and practical study area which can possibly accommodate a non-motorised transport area. The CBD was identified as not only the best study area within the town, but the only area to logically accommodate this theoretical idea, as it is the primary employment, shopping and gathering area of the town. Secondly, the CBD was identified as an urban node with intense transport related urban problems (Macroplan, 2008:10-123).

To demarcate the CBD, previous demarcations of this specific area were evaluated. The Upington CBD Master Plan (Rademeyer & van Wyk, 1983:7) and Fourie (1997:9) identified the same CBD boundaries, but the demarcation in the //Khara Hais Spatial Development Framework (DMP, 2012b:21) differed. See Figure 23 for the different demarcations by the CBD Master Plan (1983), Fourie (1997) and the SDF (2012b).

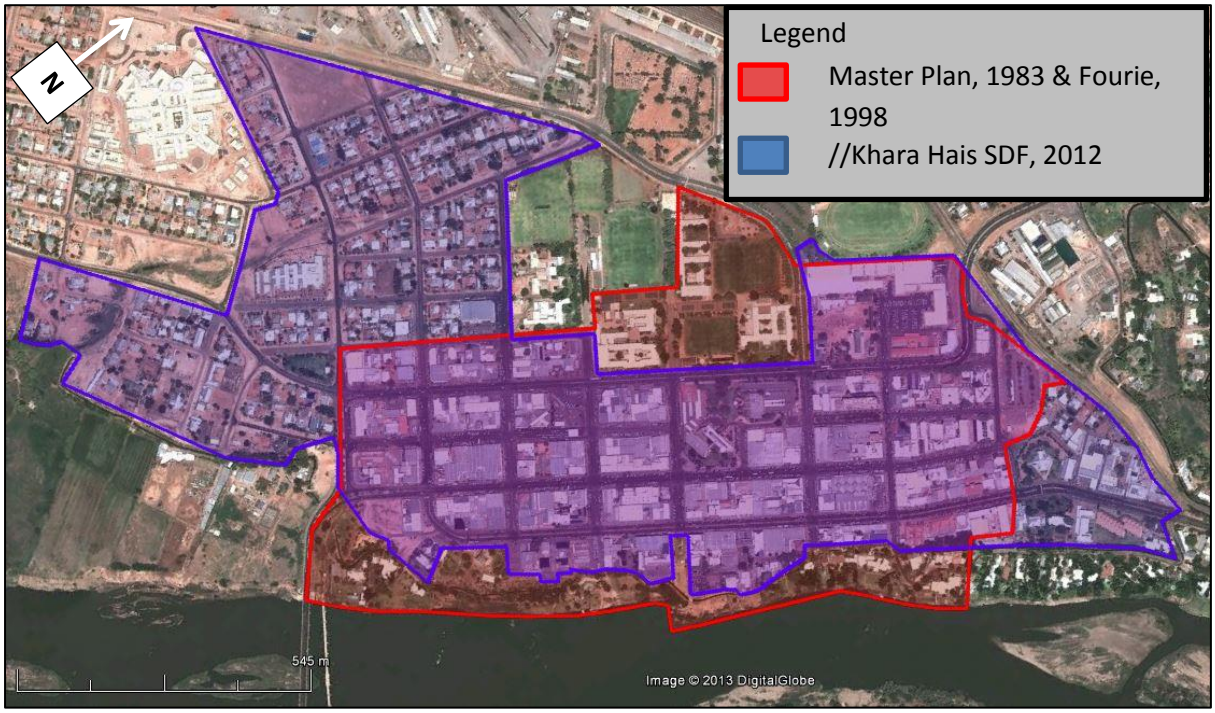


Figure 24: CBD demarcations in previous planning documentation

Source: Own construction based on Image © 2013 DigitalGlobe, Rademeyer & van Wyk (1983), Fourie (1997) & DMP (2012b).

In additional to the previously demarcated CBD areas, transport-specific elements (those elements incompatible with a NMT area) were incorporated to define the final study area for this research document. These elements that played a main role in the final demarcation were identified as:

- North: A national road (N10).
- South: A national road (N14).
- West: National roads crossing (N10 and N14 crosses in Short Street).
- East: The most eastern north-south orientated street within the previously demarcated CBD – Koöperasie Street.

Finally it was also decided to exclude 2 public parking areas and a taxi rank from the study area, as Upington and more specifically the CBD, has immense parking problems and limited public transportation modes (Fourie, 1997:69). These areas are vehicle specific and therefore incompatible with a NMT development. Figure 24 spatially identifies the national roads, Koöperasie Street, the public parking areas and the taxi-rank within the CBD of Upington.

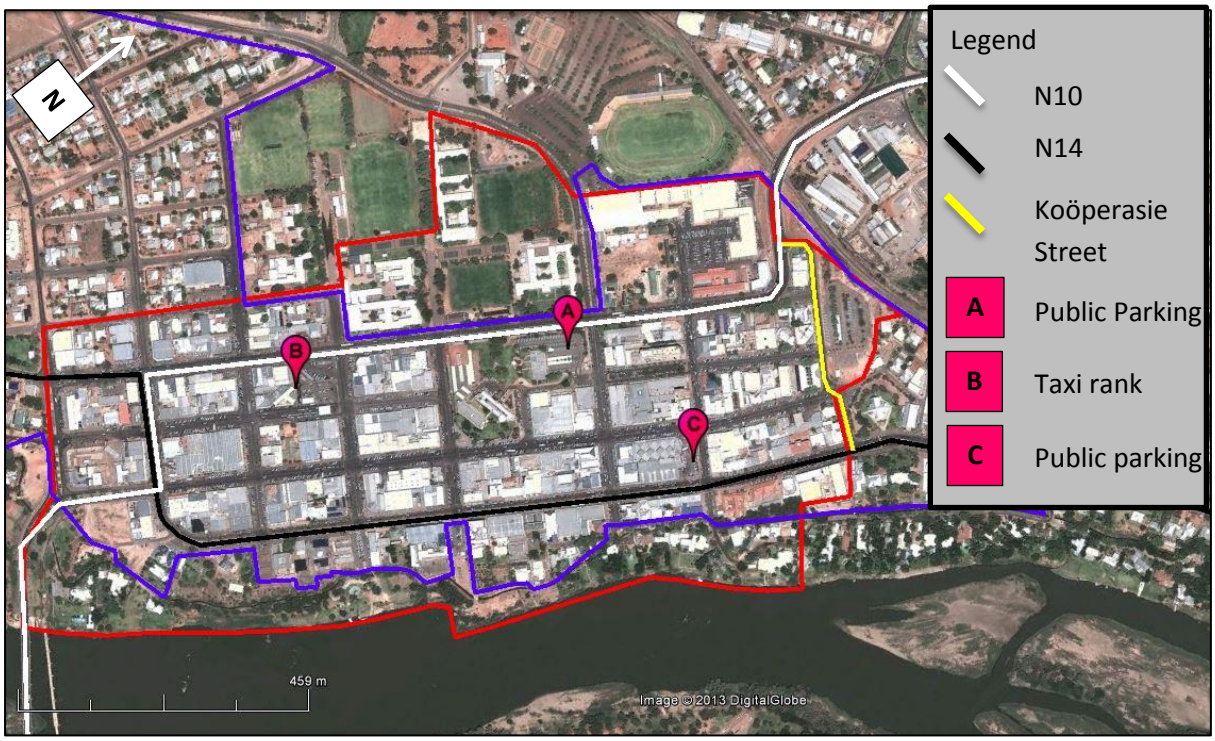


Figure 25: Transport specific elements within the demarcated CBD of Upington

Source: Own construction based on Image © 2013 DigitalGlobe.

The final study area that was identified as an area to accommodate a possible NMT development can therefore be demarcated as follows:

- Northern boundary – Le Roux Street (also the N10 road) excluding the town's taxi rank and a public parking area.
- Eastern boundary – Koöperasie Street.
- Southern boundary – Schröder Street (also the N14 road) excluding a public parking area.
- Western boundary – Short Street (Also the crossing of the N10 and N14 roads, officially it is considered the latter).

Figure 25 illustrates the final demarcated study area within the town of Upington, as scrutinised within this research document.

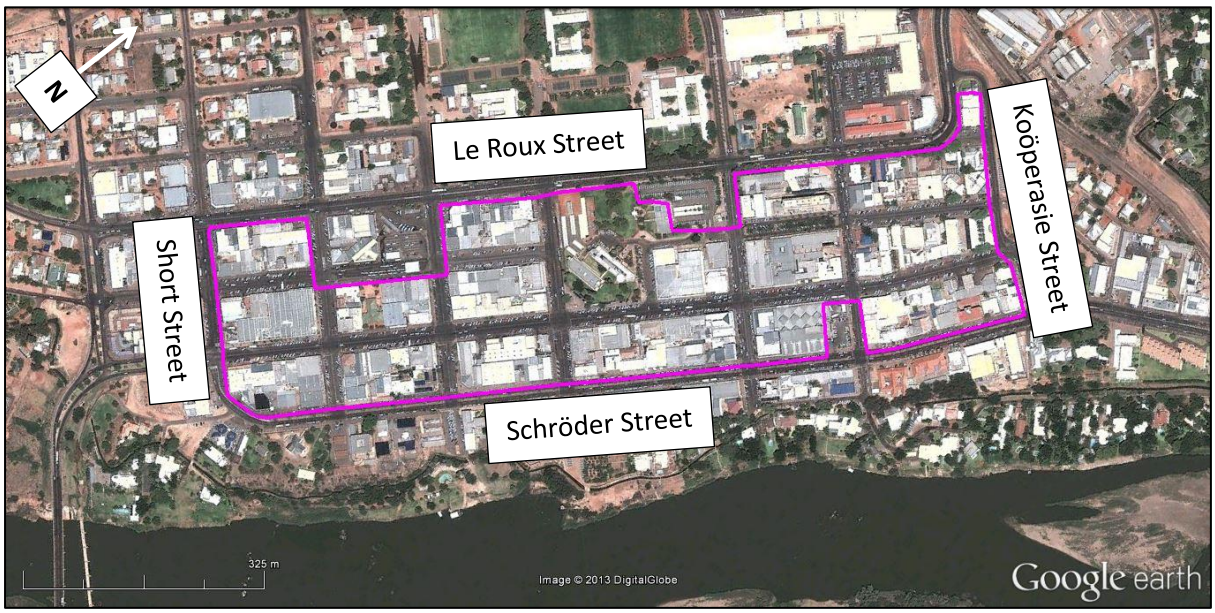


Figure 26: The demarcated study area

Source: Own construction based on Image © 2013 DigitalGlobe.

6.4. Status quo analysis

The municipality of //Khara Hais conducted thorough research and compiled very relevant and specific documentation during the past 3 decades. These documents include: the Upington CBD Master Plan (1984), the Upington City Structure Plan (1987) and the Upington Public Transportation Analysis (1993). These plans sketched a clear picture of what the ideals were for the town in the 1980s and 1990s. Many of these plans were implemented and consequently the town functions as such today. New ideas are presented in the documents compiled in the 2000s onwards, such as the Social-Economic Survey (2008) Spatial Development Framework (2012) and Integrated Development Plan (2013). These documents were also scrutinised and revealed valuable data.

From the above-mentioned documentation together with national documentation and field data obtained, a comprehensive and relevant status quo could be compiled. Some data was relevant to the entire town whereas some was only applicable to the specific study area. The status quo of aspects pertaining to the entire town was conducted first and those applicable to the demarcated study area last.

Each aspect discussed was summarised separately, thereafter the analysis was conducted and compiled simultaneously (including all aspects).

6.4.1. Climate

Upington is situated within an arid district of South Africa and has a hot desert climate with an average rainfall of 93 mm (SA explorer, 2011). Due to extreme temperatures experienced in the town it is crucial to test proposals against the maximum and minimum degrees Celsius before implementation. The maximum and minimum temperatures reached the past 12 months (1 August 2012 – 31 July 2013) were 42°C (11 November 2012) and -2°C (17 August 2012) respectively. The average daily high temperature in the warmest month (January 2013) was 37°C compared to the coldest month's (June 2013) average low temperature of 4°C (Weather spark beta, 2013).

In an area with extreme temperatures like Upington, it is crucial to evaluate all developments against the temperatures experienced. Although climate is an important aspect to take into account, mitigating measures could be implemented to ensure successful implementation.

6.4.2. Population

According to the Department of Development and Planning, Upington accommodated 2 508 residents in 1904 and grew with an average annual rate of 4.8% to reach a total population of 28 630 in 1970 (Rademeyer & van Wyk, 1983:7). Thereafter, the population grew to approximately 50 000 in 1993 (Macroplan, 1993:1), 70 000 in 1997 (Fourie, 1997:3), 75 671 in 2001 (Statistics South Africa, 2011) 78 000 in 2008 (Macroplan, 2008:10) and 93 494 residents were counted in the last census held in South Africa (Statistics South Africa, 2011).

It must be said that the exact area was amended several times over the years; consequently, to determine the exact growth for the same geographical area is not possible. However, the hinterland surrounding Upington consists of extremely low densities. Therefore it can be assumed that the implications of amending the area will be minimal.

The population growth figures and future predictions were included due to the fact that the population growth plays an integral part in urban problems experienced because of private vehicles. If the population residing within Upington increase and the private-vehicle ownership level remains the same, the pressure on transportation infrastructure will intensify as the number of vehicles in Upington will grow as proven in Chapter 2.

The following table illustrates the population growth in numbers and percentage from 1904 to 2011.

Table 18: The population of Upington

Year	Population	Growth per annum
1904	2508	
1911	2225	-1.6%
1921	2621	1.8%
1936	6370	9.5%
1946	10152	5.9%
1951	13303	6.2%
1960	20363	5.9%
1970	28630	4.1%
1993	50000	3.2%
1997	70000	10.0%
2001	75671	2.0%
2008	78000	0.4%
2011	93494	6.6%
Average annual growth		4.6%
Average annual growth between 1904 and 1960 (56 years)		4.6%
Average annual growth between 1960 and 2011 (51 years)		4.6%

Sources: Own construction based on Rademeyer & van Wyk (1983), Macroplan (1993), Fourie (1997), Macroplan (2008) and Statistics South Africa (2011).

From the table above Upington experienced annual growth as high as 10% between 1993 and 1997 and as low as 0.4% between 2001 and 2008. To lessen the volatility longer time frames with regard to the annual growth was calculated. Annual growth for the first 56 years measured (between 1904

and 1960) was 4.6%, exactly the same as for the next 51 years (between 1960 and 2011), resulting in sustainable and even annual growth of 4.6% over 107 years (1904-2011).

The figure below illustrates the annual population growth experienced, as well as an average, and therefore less volatile, annual growth percentage.

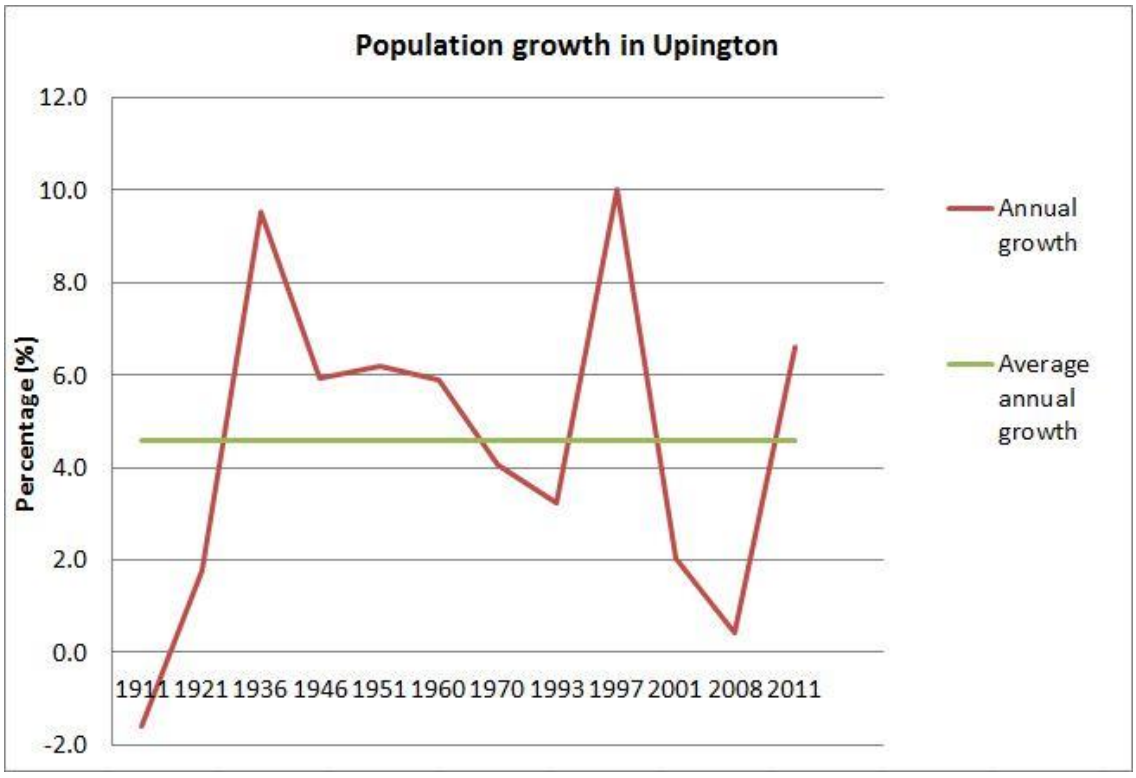


Figure 27: Population growth in Upington

Sources: Own construction based on Rademeyer & van Wyk (1983), Macroplan (1993), Fourie (1997), Macroplan (2008) and Statistics South Africa (2011).

Due to the sustainable and stable growth experienced in the town over the last 107 years, predictions can be made to determine the population for the future. Although predictions cannot be regarded as absolute, a 1% offset from the annual growth experienced of 4.6% will better the chances of correctly predicting the figure. If the steady growth continues, Upington's population will be 146 589 in 2061, taking a 1% deviation into account, it will most probably be between 131 877 and 162 749. See the table and figure below.

Table 19: Upington population predictions

Year	Annual growth rate		
	3.6%	4.6%	5.6%
2011 (Census)	93494	93494	93494
2016	96860	97795	98730
2021	100347	102294	104259
2026	103959	106999	110097
2031	107702	111921	116263
2036	111579	117069	122774
2041	115596	122455	129649
2046	119758	128088	136909
2051	124069	133980	144576
2056	128535	140143	152672
2061	131877	146589	162749

Source: Own construction (2013).

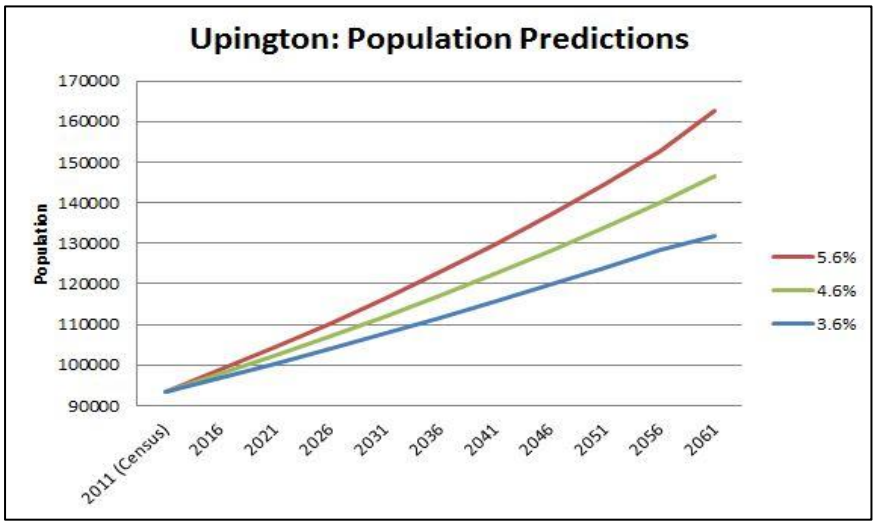


Figure 28: Upington population predictions with 1% deviation

Source: Own construction (2013).

Due to the constant population growth experienced it is evident that more pressure will be placed on the current transportation infrastructure. The urban problems currently experienced will worsen if all factors remain the same and the number of residents increase.

6.4.3. Transport modes

As part of the comprehensive social-economic study (2008), 15 592 residents responded to the following transportation questions:

With what transportation mode was the CBD most visited? The calculation was also tested with regard to the lower, middle and higher income neighbourhoods within Upington.

The figure below illustrates the location of Ward 6a (low income area), Ward 2a (middle income area) and Ward 9a (high income area) relative to the CBD of Upington.

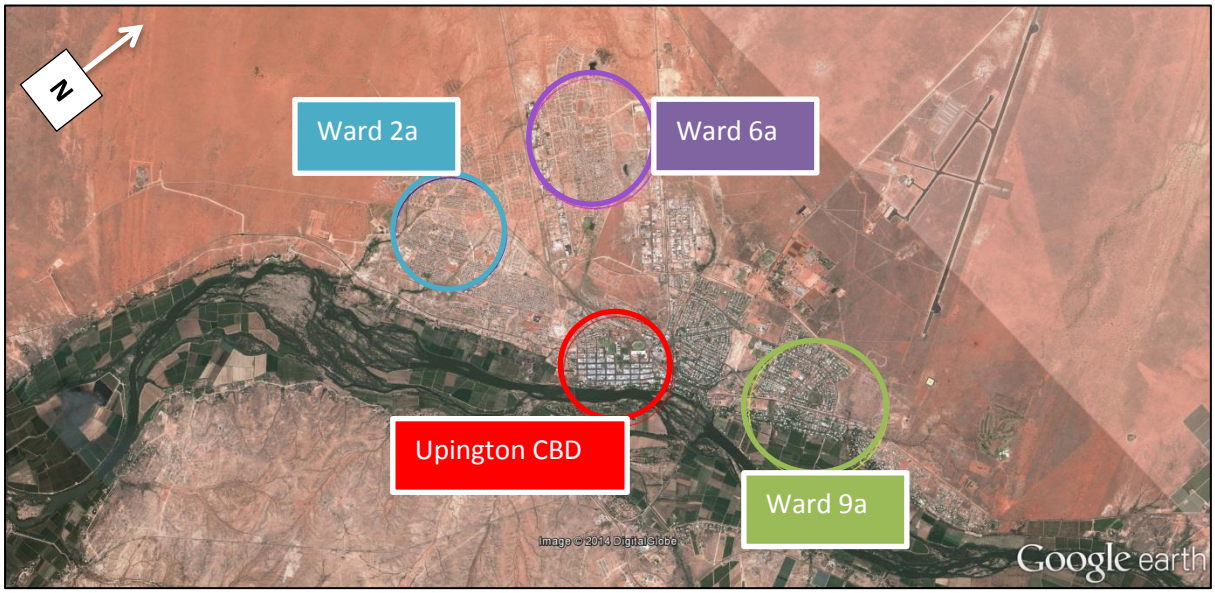


Figure 29: Upington Wards

Source: Own construction based on Macroplan (2008).

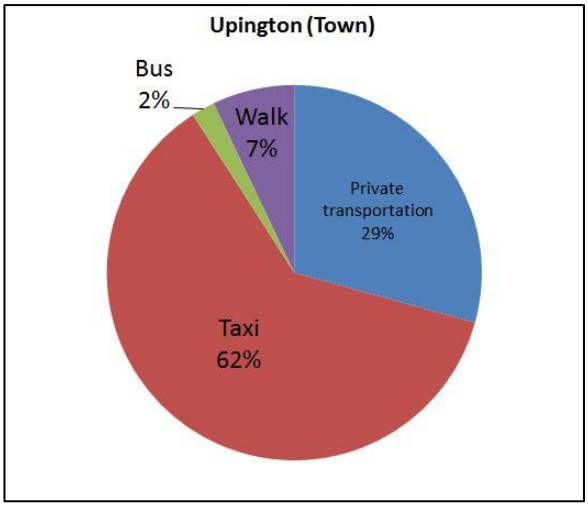
The next table indicates the transportation mode of choice between low-, middle- and high income areas situated within the town of Upington.

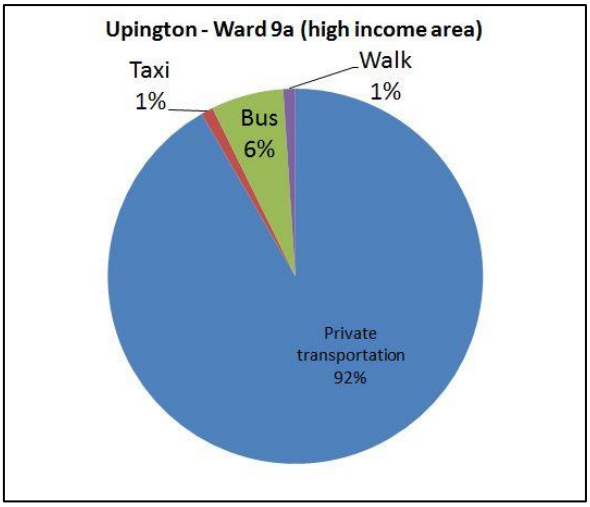
Table 20: Mode share per income area within Upington

Town	Average monthly income per household	Average distance from CBD	Private transport	Public transport		Non-motorised Transport	
				Taxi	Bus	Walk	Cycle
Upington (entire town)	R5569.67	-	29%	61%	2%	7%	1%
Ward 6a (low income area)	R2344.93	4km	7%	91%	<1%	<1%	<1%
Ward 2a (middle income area)	R4787.20	4km	19%	72%	4%	5%	<1%
Ward 9a (high income area)	R15389.21	3km	92%	1%	6%	1%	<1%

Source: Own construction based on Macroplan (2008).

The figures below provide a visual summary of the data obtained from the above table.





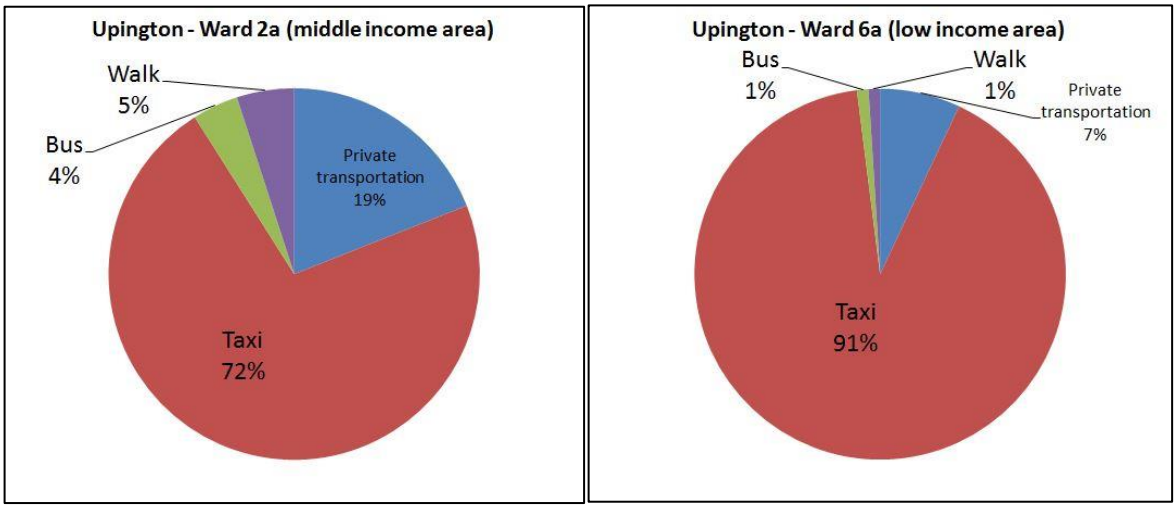


Figure 30: Mode share per income group

Source: Own construction based on Macroplan (2008).

The above table and pie diagrams indicate the following statistics:

- Cycling is the most unpopular mode of travel with regards to all income groups.
- Public transportation in Upington with regards to the middle and low income groups was highly utilised.
- Taxi transportation and the private vehicle formed a negative correlation and were the most popular modes of transportation. Taxi transportation was practically the only mode used (91%) by low income residents compared to almost no residents in the high income class making use of taxi transportation but mostly utilising the private vehicle.

It is therefore evident that a tailor-made recommendation should be formulated as different types of transportation modes exist between different income-classes.

6.4.4. Parking

As part of the CBD Master Plan (1984), an analysis of the parking demand and supply was conducted. Thereafter Fourie (1997) conducted the same study using the exact same demarcated 74 ha area and in 2012 a field study was undertaken to scrutinise the same area in order to determine the parking situation over a period of nearly three decades (28 years). Although the street and public parking figures were simple to determine; the private parking numbers proved challenging to obtain for both Fourie (1997) and for the field study conducted in 2012. In order to determine private parking figures the initial 23% of the total parking bays was maintained as it was calculated in 1984.

The next table illustrates the number of parking bays and the type of parking bays from 1984 until 2012. The number of parking bays was measured against the population in that relevant year, which resulted in a figure illustrating the number of residents in Upington per parking bay in the CBD area.

Table 21: Parking in Upington's CBD

	Parking bays	Percentage of total parking	Parking bays	Percentage of total parking	Parking bays	Percentage of total parking
	1984		1997		2012	
Street parking	1220	69%	1266	58%	1514	55%
Public parking facility	131	8%	400	19%	611	22%
Private parking facility	400	23%	506 (est.)	23% (est.)	635 (est.)	23% (est.)
Total	1751	100%	2172	100%	2860	100%
Population	50 000 (1984)		70 000 (1997)		93 494 (2011)	
Residents/ parking bay	29/bay		32/bay		33/bay	
CBD area	74ha		74ha		74ha	

Source: Own construction based on Fourie (1997) and Rademeyer & van Wyk (1983).

From the table above the following conclusions can be made:

- Street parking in the CBD reached saturation point as only 294 bays were added in 28 years.
- The public areas contributed more percentage-wise with every study. This can mainly be attributed to the retail centre parking areas developed post-1997. See Figure 29.
- In a developing and post-apartheid country such as South Africa, the private vehicle usage per person is sharply increasing; consequently more people are now dependent on one parking bay compared to three decades ago.
- In 2012 there was one parking bay in the CBD of Upington for every 33 residents living in the town.

The figure below identifies the public parking areas of both Pick n pay and Checkers.

Figure 31: Major retail developments in Upington's CBD according to the master plan

Source: Own construction based on Fourie (1997), Image © 2013 DigitalGlobe, © 2013 Google & ©2013 AfriGIS (Pty) Ltd.

In 1984 residents complained about the high demand and poor supply of parking within the CBD (Rademeyer & van Wyk, 1983:37). Fourie (1997) substantiates the problem by stating that parking in the CBD was initially only a problem on Fridays, Saturdays and month ends, but that it developed into a daily struggle for every visitor and employee that visited the CBD (Fourie, 1997:4). Fourie (1997) also requested the public to provide feedback regarding the parking situation specific to the CBD. 98% of all participants agreed that parking in the CBD was a major problem (Fourie, 1997:87).

It can therefore be derived that parking was a major problem in town in 1984 and it only intensified over time as substantiated by Fourie (1997) in 1998. As vehicle ownership and population figures grow the urban problems currently experienced will worsen in the future. The area utilised by parking bays can be used to accommodate more residents in a more sustainable way if non-motorised transportation modes are implemented. To keep providing parking to a growing population is unsustainable to maintain over time as Table 21 illustrates.

6.4.5. Road hierarchy

After the establishment of the town the first 2 streets to accommodate formal businesses were Schröder- and Scott Street (Rademeyer & van Wyk, 1983:4). Over time, businesses expanded into Mark and Le Roux Street, specifically between Brug and Koöperasie Streets (Rademeyer & van Wyk, 1983:5). As part of the Upington Central Master Plan (1984), roads were categorised according to the traffic they accommodated on a daily basis.

The evaluation of road hierarchy was included as part of the status quo analysis in order to determine which roads accommodate the most traffic. This was an important factor for two reasons:

- The planning theories and pilot studies highlighted the fact that it is important for the success of pedestrianised developments to be located in main streets.
- It is also important to avoid national roads and roads accommodating through traffic. This is done to mitigate disruption during development and to ensure that private vehicle users do not end up with a bottleneck transportation system which will worsen traffic congestion in the CBD of Upington.

The figure below identifies the roads forming part of the demarcated study area, as well as those forming the boundary (of the demarcated study area). The roads form a clearly defined grid-pattern.

Figure 32: Streets within the demarcated study area

Source: Own construction based on Image © 2013 DigitalGlobe.

In the table that follows the different hierarchy of specific roads were categorised over time. It is evident that Schröder- (now part of the N14), Le Roux- (now part of the N10) and Hill Street were

the main roads accommodating most of the traffic. Of these three roads, only Hill Street forms part of the demarcated study area; the other two forms the boundary of the study area.

Table 22: Hierarchy of roads within Upington's CBD

Hierarchy class	1984	1987	1997
Primary roads			
		Schröder	Schröder
			Le Roux
			Hill
Secondary roads			
	Le Roux	Le Roux	Rivier
	Schröder	Hill	Scott
	Hill		Park
Intern roads			
	Rivier	Rivier	Rivier
	Scott	Scott	Scott
	Park	Park	Park
Local roads			
	Basson	Basson	Basson
	Lutz	Lutz	Lutz
	Mark	Mark	Mark
	Short	Short	Short

Source: Own construction based on Upington CBD Master Plan (1983); City Structure Plan (1987) & Fourie (1997).

The figure below illustrates the findings of Table 22. It can therefore be said that the study area accommodates:

- One road accommodating heavy traffic.
- Three roads accommodating moderate traffic.
- Three roads accommodating the least amount of traffic experienced in the CBD of Upington.

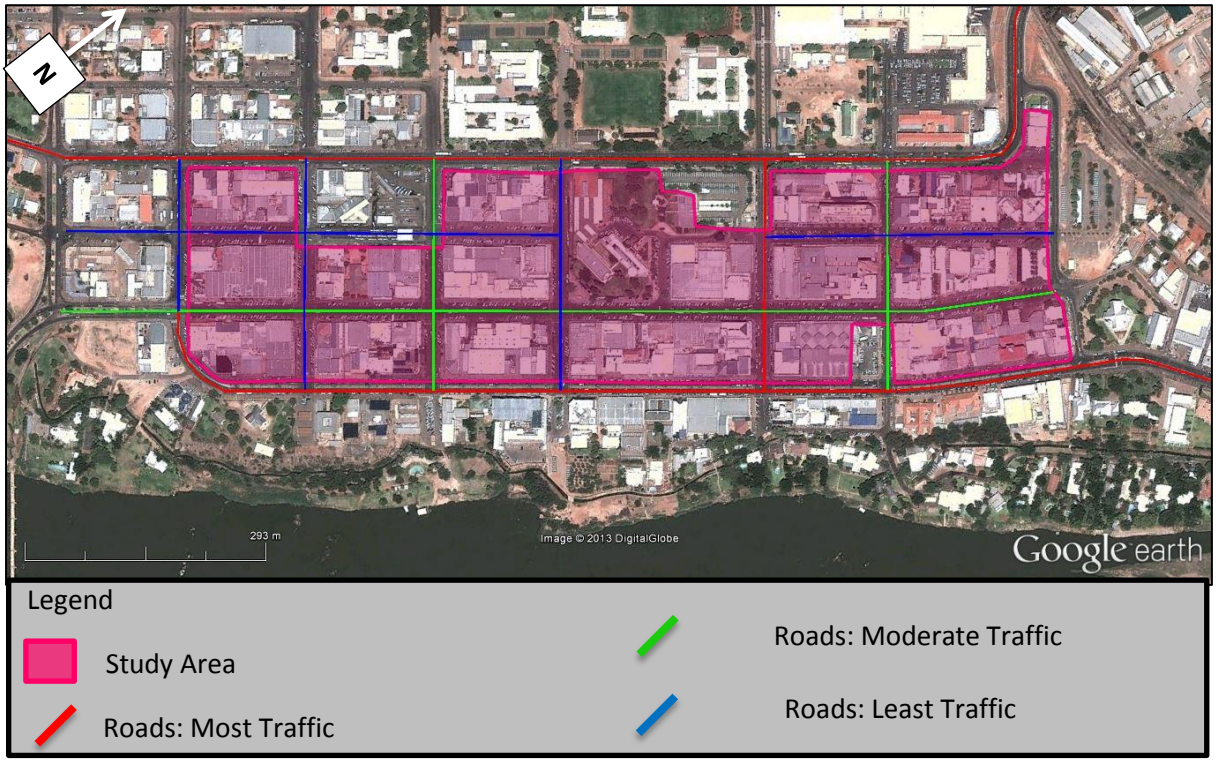


Figure 33: Road hierarchy in the Upington CBD

Source: Own construction based on Upington CBD Master Plan (1983), City Structure Plan (1987), Fourie (1997) & Image © 2013 DigitalGlobe.

It is therefore foreseen that minimal disruptions will occur (regarding traffic), even if the entire demarcated area is developed into a pedestrian-only area.

6.4.6. Labour force: CBD

According to the Integrated Development Plan (2013) of the //Khara Hais Municipality, the unemployment rate for the area was 23% of the total labour force (//Khara Hais Municipality, 2013:5). Furthermore, only 26.9% of all inhabitants were economically active (//Khara Hais Municipality, 2013:5) and approximately 40% of the labour force in Upington worked within the CBD (Macroplan, 2008:72). Lastly, 50% of the labour force drove to work with a personal vehicle and of this percentage, 55% utilised street parking. See Figure 32 for comprehensive data regarding the modes used by the labour force and the parking they utilised.

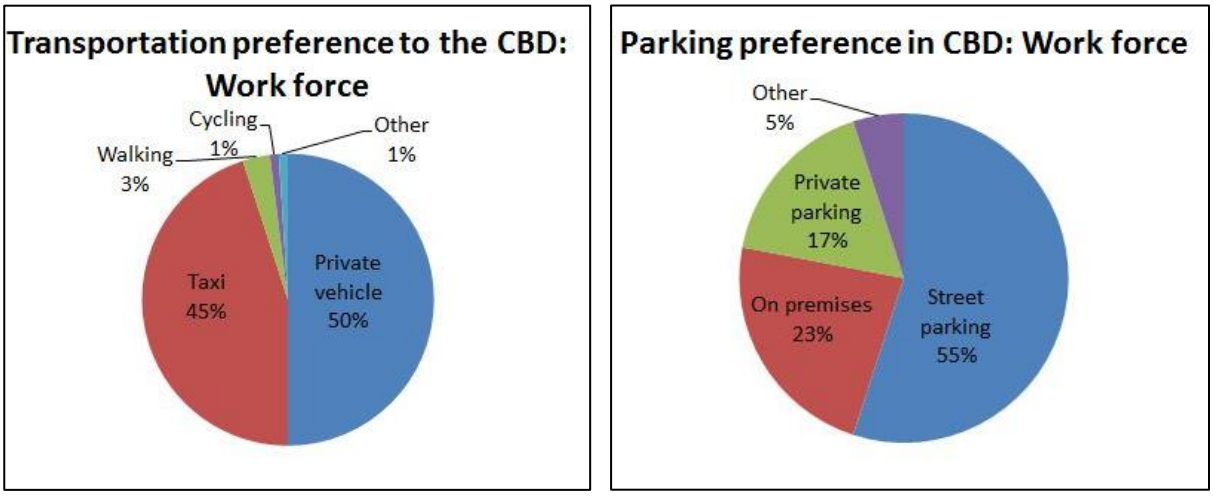


Figure 34: Transportation and parking preference to and in the CBD of Upington by the workforce

Source: Own construction (2013)

The data above coupled with other relevant data in this chapter, informed predictions regarding the number of workers in the CBD in future, the private vehicles to park at the CBD for the entire working day (as driven by the employed workers in the CBD) and consequently the parking demand.

The table below intertwined numerous data sets available and calculated the basic parking need within the CBD of Upington. In 2011 the parking bay demand already exceeded the parking bay supply by 1 252 bays. If current trends continue, the shortage in bays will grow to 2 157 bays by 2051.

Table 23: Future parking demands by the workforce in the CBD

Year	Upington population (Annual growth 3.6%)	Economically active population (26.9% of population)	Economically active population working in the CBD (40% of economically active population)	Number of people working in the CBD driving with a private vehicle (50% of people working in CBD)	Work force utilising Street parking (55% of people driving to the CBD	Available street parking
					Parking Demand	Parking Supply
2011	93494	25150	10060	5030	2766	1514

2016	96860	26055	10422	5211	2866	1514
2021	100347	26993	10797	5399	2969	1514
2026	103959	27965	11186	5593	3076	1514
2031	107702	28972	11589	5794	3187	1514
2036	111579	30015	12006	6003	3302	1514
2041	115596	31095	12438	6219	3420	1514
2046	119758	32215	12886	6443	3544	1514
2051	124069	33375	13350	6675	3671	1514
2056	128535	34576	13830	6915	3803	1514
2061	131877	35475	14190	7095	3902	1514

Source: Own construction (2013).

The fact that the demand for parking bays, required by employees, already exceeded the supply in 2011 is a clear indication that transportation infrastructure in the CBD of Upington was under immense pressure.

The CBD of Upington was therefore incapable of accommodating the private vehicle orientated system in 2011. It was also clear that urban problems, due to the transportation system, will intensify for years to come. Three principles as discussed as part of the planning theory, could tend to this problem. Mixed land uses in the CBD would ensure that less driving is needed, as workers would be able to walk or cycle to work due to the short distances. Non-motorised transport development could ensure that workers get around the CBD without the need for parking bays. Lastly, public transportation would ensure that less private vehicles are necessary to commute to the CBD.

As 92% of the high-income group (see 6.3.3) travel by means of private transportation to the CBD, it can be derived that the individuals from the high-income group are directly responsible for the pressure of transportation infrastructure in the CBD of Upington. It will therefore be viable to invest more resources into the modification of the transportation system in high-income groups than into lower-income areas that already utilise public transportation.

6.4.7. Land use types

A land use analysis of the CBD of Upington was done in 1983 as part of the Master Plan (1983). Fourie (1997) also conducted a study in 1997, and together with the current land survey a clear picture of development emerged. The three available data sets (Master Plan, Fourie's study and the 2013 survey) will present the land use for the ground floor and also for the upper floor.

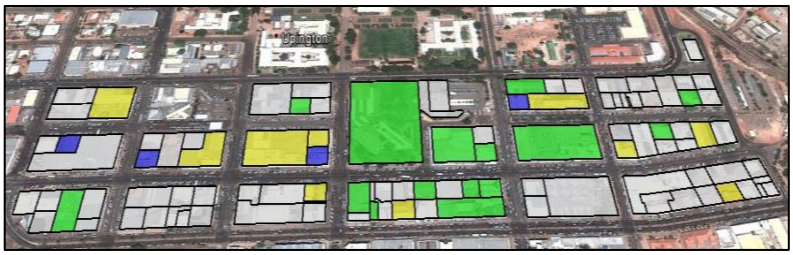
To be able to use all three data sets, and compare them with one another, the exact area was used. This area was identified as the demarcated study area. Furthermore, all land uses available were categorised into four categories. They are:

- Business: All businesses, including short-term housing (hotels, guest houses etc.) will form part of this category.
- Offices: All offices including private, governmental and municipal will be included.
- Residential: All types of permanent residential areas will be included.
- Vacant: Vacant areas (including parking areas). Single-storey buildings were also categorised as vacant in the “Upper Floors” category.

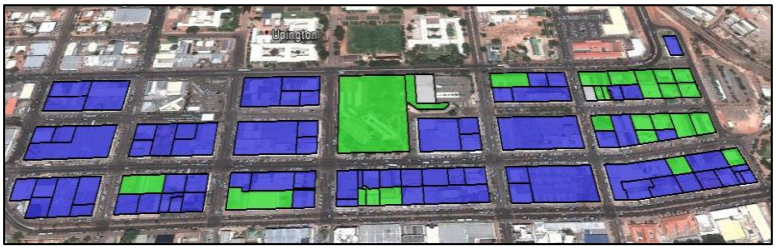
The following figure indicates and evaluates the development from 1934 to 1997 and from 1997 to 2013 from a spatial point of view. The study area as indicated below consists of 100 erven with a total coverage of 153 325 m² or 15.3 ha on ground floor excluding roads and pavements.

Ground Floor, 1983

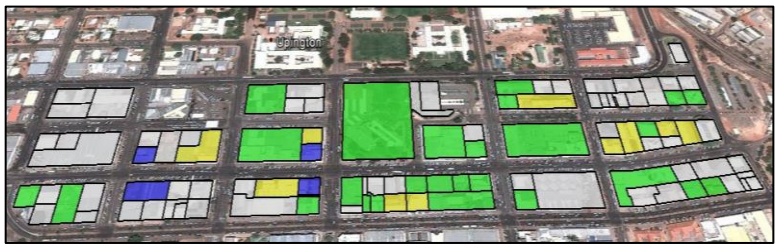
Upper Floor, 1983



Ground Floor, 1997



Upper Floor, 1997



Ground Floor, 2013

Upper Floor, 2013

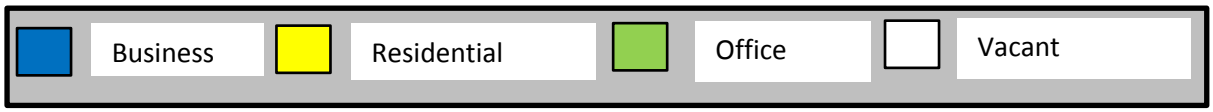


Figure 35: Land Uses within the CBD of Upington

Source: Own construction based on Chief Surveyor-General information, Upington CBD Master Plan (1983); Fourie (1997); Image © 2013 DigitalGlobe; ©2013 AfriGIS (Pty) Ltd. & ©2013 Google.

The table below indicates the different land uses on the ground and upper level and the changes over the years. It also provides a clear indication of the CBD occupation rate. On the ground floor, the business land use was dominant over the years. It currently (2013) covers 77% of the CBD and together with the office land use of 22% covers 99% of ground level erven (excluding roads). There is 1% vacant area and no residential land use is present in the CBD of Upington today compared to the 12% in 1984 on the ground floor.

The upper floor (above ground level) was poorly utilised in 1984 as 57% of the buildings in the CBD consisted of a ground floor only. This has since decreased to 41% as offices currently (2013) cover 43% of this space. The residential land use on the upper floor has remained stable with a decrease of

4% between 1984 and 1997 to stand on 10%. In the next term, however, between 1997 and 2013 an increase of 3% was measured.

The level of land uses in the CBD stood on 140% in 1984 and steadily increased to 152% in 1997 and to 158% in 2013.

Table 24: Percentage of CBD land uses ground and upper floors

Year	1984	1997	2013
Ground Floor			
Business	69%	72% (+3%)	77% (+5%)
Office	15%	26% (+11%)	22% (-4%)
Residential	13%	0 (-13%)	0
Vacant	3%	2% (-1%)	1% (-1%)
Upper Floor			
Business	2%	3% (-1%)	4% (-1%)
Office	27%	41% (+14%)	42% (+1%)
Residential	14%	10% (-4%)	13% (+3%)
Vacant	57%	46% (-11%)	41% (-5%)
CBD occupation (business, offices and residential)	140%	152%	158%

Source: Own construction based on Upington CBD Master Plan (1983) & Fourie (1997).

The figure below illustrates the findings of the table above.

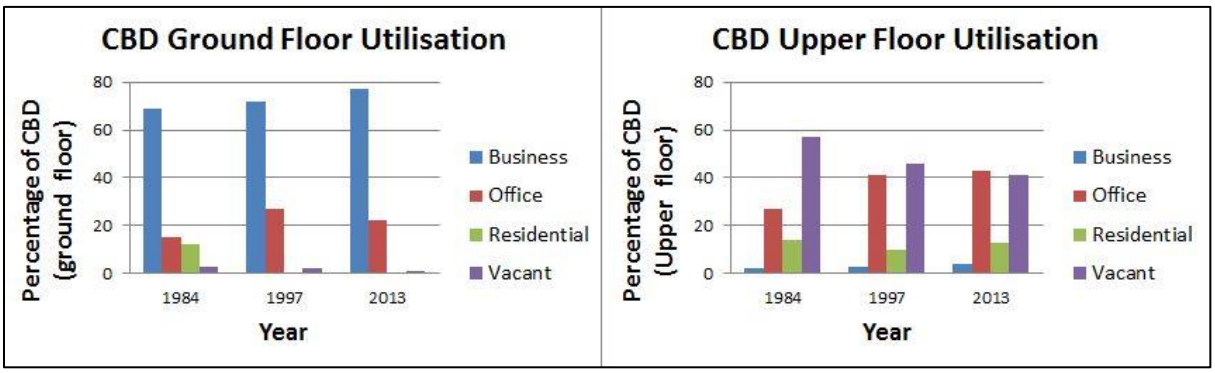


Figure 36: Land uses on the ground and upper floor

Source: Own construction based on Upington CBD Master Plan (1983); Fourie (1997)

From the data analysed the following trends were identified:

- The CBD was an exclusive area for business and office developments.
- The vacancy rate decreased, but was also accommodated by businesses and offices mostly.
- Very few people reside in the CBD of Upington.
- The CBD was under-utilised as the occupation rate was 158 % in 2013. This essentially means that the ground floor is fully occupied and slightly more than half of the buildings have one upper floor.

The CBD was therefore very exclusive towards the accommodation of business and office developments. This phenomenon could however be rectified as the CBD has the potential to become more dense. If the vacant upper floor (1 floor above ground level) and 1% vacancy on the ground level are occupied by residential units, the CBD of Upington would become more mixed, which is, according to the planning theories and pilot studies, more favourable for sustainable non-motorised development.

If 100% of the vacant ground and upper floor (just the first floor above ground level) are developed and utilised for residential units a mixed land use ratio for the CBD will result. The following table illustrates what the land uses ratio could be if the CBD is essentially 200% occupied, meaning that there is no vacant space on the ground and first floor. The future possibility row identifies the ratio if the vacant space is occupied by residential land uses.

Table 25: Land use ratio of CBD if vacant space is developed into residential units

Land use ratio in CBD (ground and upper floors)	Residential	Business	Offices
2013	1%	6.2%	5.8%
Future possibility if vacant space are used for residential developments	1%	1.5%	1.4%

Source: Own construction (2013).

From the table above the ratio was clear that for every 1% of the study area occupied by residential developments in 2013, business and offices occupied 6.2% and 5.8% respectively. If the CBD is 200% developed and all the vacancies that existed in 2013 are occupied by residential land uses, businesses and offices would only occupy 1.5% and 1.4% respectively for every 1% occupied by residential land uses.

6.4.8. Coverage

In order to establish what the coverage of roads, pavements, parking and erven is within the study area, data from the field survey will be used.

The study area is 248 233 m² in size. This area is not demarcated by erf boundaries but rather by the physical built-up area, meaning that a portion of an erf may be within the study area, whilst another portion could be outside. In this case the necessary calculations were done to consider only the portion of the erf within the study area.

Erven:

Erf boundaries were obtained (Chief Surveyor-General) and calculated. 100 erven fell within the study area with a combined extent of 153 325 m². Of these erven only one erf fell both inside and outside the study area with the area outside measuring 1 824 m². Consequently, erven occupied 151 501 m² within the earmarked study area.

Pavements:

The study area consisted of 18 blocks, each with a pavement approximately 5 meters wide (see figure 36). All the pavements surrounding the blocks were uninterrupted by private vehicle traffic except on two instances; both areas were interrupted by traffic towards parking areas.

The length (7 448 m) of the pavements multiplied by the average width (5 meters) resulted in an area of 37 240 m².

The figure on the next page provides a view of typical Upington pavements in the Central Business District.

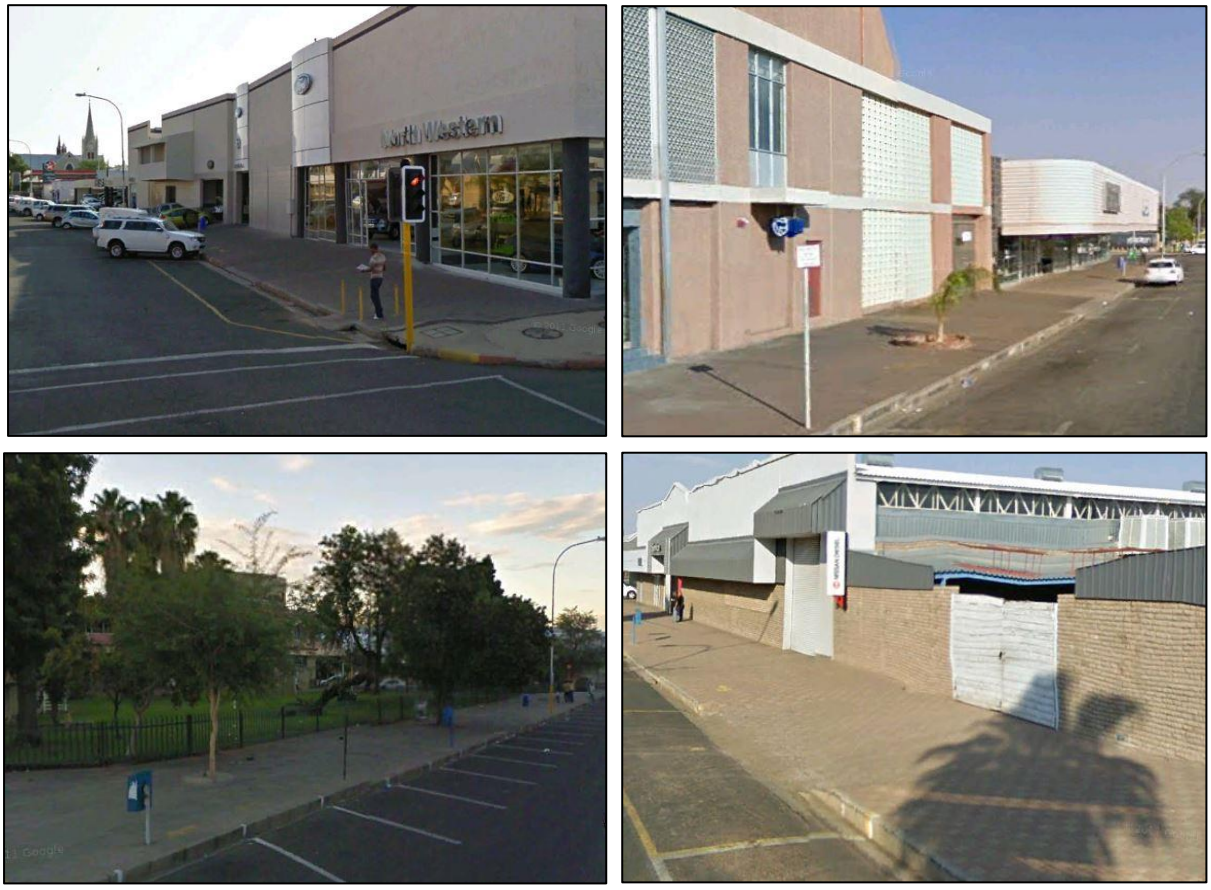


Figure 37: Sidewalk photos in the study area

Source: © AfriGIS (2013) & © Google (2013).

- Street Parking:

Results from a field survey (2013) indicate that 906 street parking bays are accommodated within the study area (these parking numbers differ from the parking section scrutinised, as the extent of the area differed). Public parking lots and private parking on site were not included as these areas were counted as part of erven. The only parking bays present in the study area are angled parking bays (approximately 13 m²) and parallel parking bays (approximately 16 m²) the average size of a parking bay in the study area can therefore be set at 15 m².

The area occupied by street parking bays in the study area accounts for 14 496 m² (15 m²*906).

- Streets:

Due to the fact that street parking and pavements are accommodated within one land use zoning – Transport zone II (//Khara Hais Municipality, 2002:55), it was challenging to determine the exact area occupied by roads (area accommodating moving cars). Therefore the total extent of the study area, minus the other areas will provide the road extent. Roads therefore occupied 44 996 m² of the

study area. The combined length of the roads was 2 692 m, resulting in an average road width of 16.71 m (44 996 m²/2 692 m).

The table below indicates the percentage of the different components. It should, however, be understood that pavements make up a larger percentage due to the fact that the boundary of the study includes pavement areas, but excludes roads and street parking. See Figure 36.

Table 26: Coverage within the study area

Uses	Extent	Percentage of study area
Erven	151 501 m²	61%
Roads	44 996 m²	18%
Pavements	37 240 m²	15%
Street parking	14 496 m²	6%
Total study area	248 233 m²	100%

Source: Own construction (2013).

The figure below spatially illustrates the components researched in the table above.

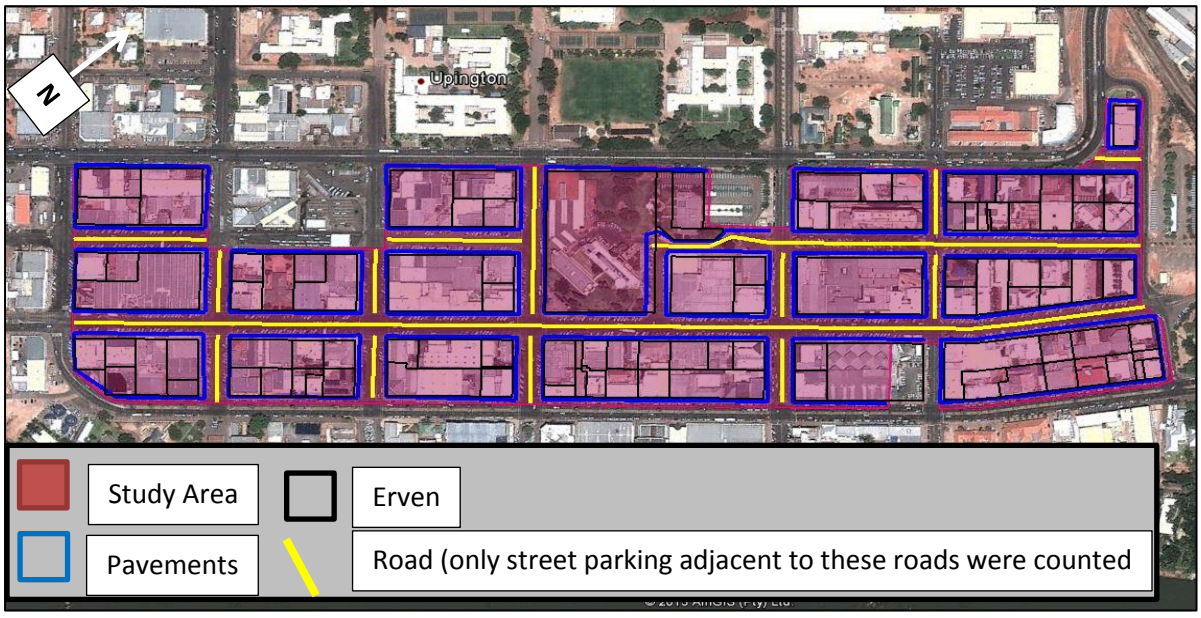


Figure 38: Uses within the study area

Source: Own construction based on ©2013 Google.

A large extent of the study area could be "freed" by the implementation of a non-motorised transportation system. Currently 24% of land (18% roads and 6% street parking) is solely used for the accommodation of private vehicles. 39% (18% roads, 6% street parking and 15% pavements) of

the study area can therefore be able to be redistributed between businesses, activities, restaurants and non-motorised transportation.

6.4.9. Summarised analysis of status quo

The table below summarises the analysis of each aspect evaluated, and indicates whether the specific aspect supports or poses a challenge for NMT development.

Aspects evaluated	Potential for NMT area	Issues to emphasise
Climate	Poses challenges	The daily temperature in summer months is extreme and special features will need to be implemented to mitigate the discomfort.
Population	Supports	The transportation infrastructure in the study area is inadequate and cannot accommodate the current population. The population is growing, therefore the pressure on the infrastructure will worsen.
Transport modes	Supports	The transport modes used by low, middle and high income groups are different. The minority high-income group is mainly responsible for transport problems in the study area. Special attention regarding transportation modes must therefore be given to high-income individuals to ensure that democracy prevails.
Parking	Supports	The demand for parking is much higher than the supply. Parking is already a problem and will worsen in the future. Therefore to develop more parking bays in the study area is unsustainable.
Road hierarchy	Supports	The two national roads are excluded from the study area. Hill Street is a

		primary road that forms part of the study area. It is however short and covers little of the road surface.
Labour force: CBD	Supports	There is insufficient street parking in the CBD for residents working there and making use of private vehicles and street parking. Therefore, too many people commute to the CBD with private vehicles, live too far from the CBD/workplace to use non-motorise transport and are not utilising public transportation.
Land uses	Poses challenges	The study area (almost exclusively) accommodates businesses and offices. This challenge can however be turned into an opportunity as there is ample vacant space to rectify the situation.
Coverage	Supports and poses challenges	Although a great extent of the study area could be "freed" from private vehicle orientated infrastructure it will be challenging to occupy this space by relevant and people-attracting uses.

Source: Own Construction (2013).

6.5. Interviews

Town and Regional Planners, with thorough experience relevant to the study area in Upington, were approached and requested to provide inputs regarding the research study (please see the question structure below). Five of the six planners responded, four of these five were Professional Planners and one was a Candidate Planner. Two represented the public sector and three the private sector.

The questions posed, along with the relevant responses, are as follows:

i. *"According to you, does the study area (as defined in this research document) currently experience traffic and/ or parking problems?"*

The Planners agree that problems exist in the study area. Fourie (2013) indicated that the problem has already existed for ten years and will continue if drastic changes are not made. Du Plessis (2013) stated that the problem is rather the control of parking areas than the volume of traffic and private vehicles.

However, it is clear that parking was a bigger problem than the traffic experienced on roads in the study area and that it is a problem that has been experienced for at least a few years. All indicated that something needs to be done to rectify the problem.

ii. *"According to you, does the private vehicle enjoy preference in the study area to other transport modes (pedestrians, cyclists etc.)?"*

Du Plessis (2013) indicated that he does not believe so. He indicated that the climate is not suited for cyclists and that the sidewalks are wide enough to comfortably accommodate pedestrians.

The other planners indicated that the study area and the CBD in totality were planned for the private vehicle and that other transport modes are secondary. It is generally agreed that the sidewalks in the area are sufficient to comfortably accommodate pedestrians, but that cyclists are not accommodated and that pedestrians' amenities are non-existent. Longland (2013) indicated that the CBD is a large area and that trees should be planted and rest areas be developed, especially in an extreme-temperature town such as Upington.

iii. *"Do you regard the current transportation situation in the study area as fair to all citizens?"*

Four of the five planners indicated that the current transport situation in the study area is not fair to the residents of the town. Longland (2013) specifically mentioned that the majority of residents do not own private vehicles. Nonetheless, the minority of private vehicle owners enjoy preference in the form of infrastructure and transport developments. Treurnich (2013) mentioned that in order to develop Upington and the CBD more sustainably, private vehicle owners must become less dependent on their vehicles and make use of different, more sustainable modes.

iv. *"Do you regard the transport situation in the study area as sustainable?"*

Generally the transport situation was regarded as unsustainable. Scheepers (2013) stated that the middleclass is growing. That in turn means that owning a private vehicle becomes a reality for more

families and that the problems already experienced will intensify making the study area and CBD a less accessible part of town. Contrary to this statement, Du Plessis (2013) commented that the CBD is not growing and that the newly developed mall (outside the study area) will relieve the CBD of some traffic currently experienced; therefore the CBD can be seen as sustainable.

Fourie (2013) stated that as long as the single erf, low density residential concept is developed it will be more difficult to shift the transportation system from private orientated (which is unsustainable) to a public and Non-Motorised system, which is more sustainable. In order to promote public transportation systems densification in land uses and residential areas should be implemented. Treurnich (2013) indicated that the current system is unsustainable and autocratic.

v. "What is your suggestion for a more sustainable future CBD in Upington?"

The development of NMT and public transportation infrastructure and modes, the development of better parking infrastructure and better utilisation of already planned infrastructure were the suggestions made.

The table below analyses the data obtained from professionals.

Table 27: Evaluation of interview questions

Questions evaluated	Potential for NMT area	Issues to emphasise
Are there traffic problems in the study area?	Supports	Derived from the interviews it is evident that transport infrastructure has been under pressure for at least a decade
Does the private vehicle enjoy preference over other modes in the study area?	Poses challenges	It was mentioned that the climate is not suitable for cyclists and that no infrastructure existed for this transport mode. The majority of planners agree that the entire CBD was planned with the private vehicle in mind, therefore they enjoy preference. It will therefore be challenging to amend the CBD to accommodate all

		transportation modes.
Is the current transport system fair to all citizens?	Supports	An inequitable transport system exists in the study area where the infrastructure of minority vehicle owners such as roads and parking facilities dominate transport infrastructure as a whole in Upington.
Is the transport system sustainable?	Supports	The majority agrees that the transport system is unsustainable and that other transport modes should be introduced and operated at the same level as private vehicles.
What are suggestions for more sustainable development in the study area?	Supports	Non-motorised transportation, better public transportation and the utilisation of current infrastructures were the overwhelming answer to the question posed.

Source: Own Construction (2013).