~SUSTAINABLE URBAN FORM FOR A DEMOCRATIC SOUTH AFRICA~

by

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B.L., The University of Pretoria, South Africa, 1998

A THESIS SUBMITTED IN PARTIAL FULFILMENT OF

THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF ADVANCED STUDIES IN LANDSCAPE ARCHITECTURE (MASLA)

in

THE FACULTY OF GRADUATE STUDIES

(Landscape Architecture Program)

We accept this thesis as conforming to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

October 2001

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~ABSTRACT~

"Apartheid planning...made our [South African] urban settlements extremely dysfunctional and unsustainable" and we now need to "take up the challenge of achieving sustainable cities" (Department Of Housing, 1997). However, despite the numerous new policy documents "there is no evidence of a shared vision of what planning should be trying to achieve in the 'new' South Africa" and now "urban development is occurring without a clear vision of appropriate urban form" (DPC, 1999:12; Behrens & Watson, 1996:37).

This document takes on the challenge of exploring the form of sustainable cities in the new democratic South Africa, and aims to provide guidance to the planners and designers that are at the forefront of implementing this challenge. The research focuses on initiating change towards sustainability by physically altering the physical structure of our cities.

The document describes the city as a hierarchical honeycomb that consists of dense neighbourhood cells that function in larger community cells. It investigates a number of issues that affect the ecological-, social-, and economic dimensions of sustainability and provides 101 design guidelines for the planning and design of sustainable communities. The research concludes with a conceptual illustration of the sustainable community and it provides direction for the implementation of these cells that incrementally heals the city through a process of gradual phasing.

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~ACKNOWLEDGEMENTS~

To my committee members: Patrick Mooney, Patrick Condon, and Sebastian Moffatt ~
for challenging my thoughts and your willingness to provide direction. I take with me dedication.

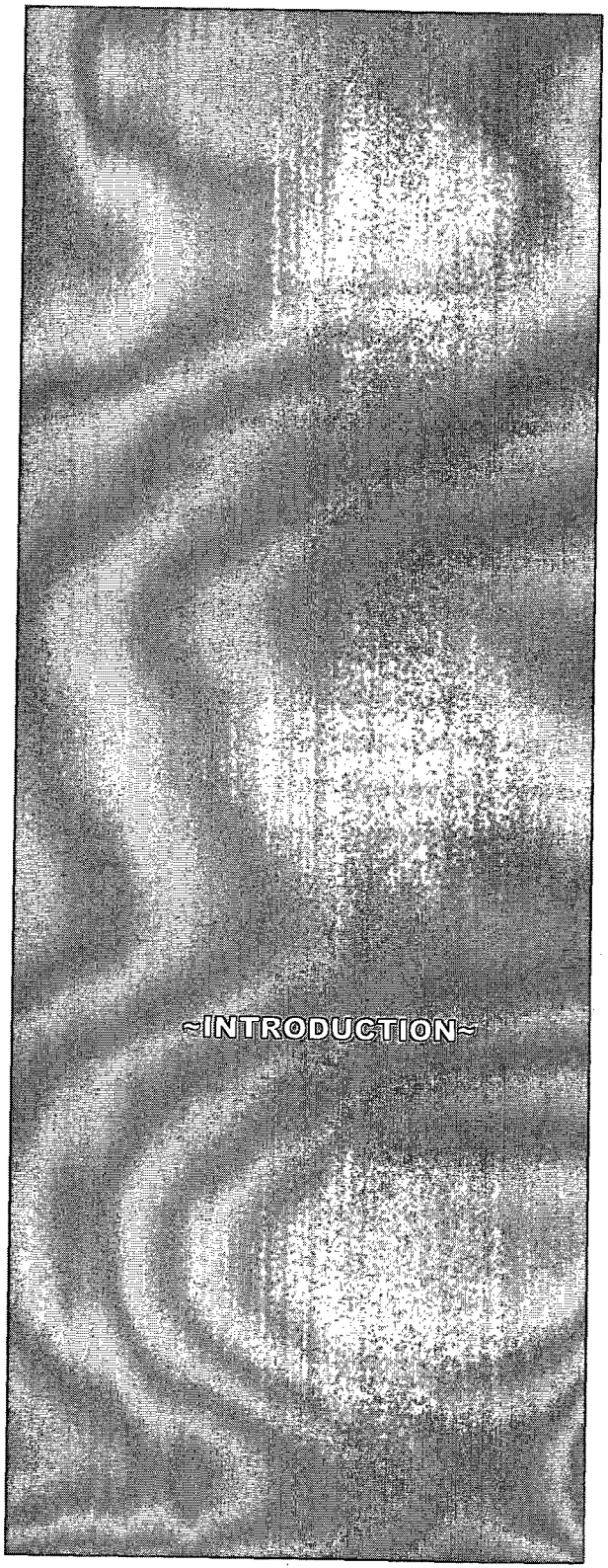
To my parents ~
for your long distance support and encouragement both in this world and beyond. I take with me gratefulness.

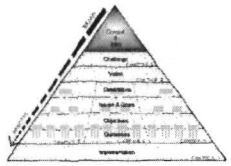
To Ryan ~
for introducing me to a greater world where I can dream without limits. I take with me inspiration.

~FOREWORD~

I grew up and studied Landscape Architecture in South Africa. It was during my studies there where I was first introduced to the concept of sustainable urban development. At the time it was a concept that placed a lot of emphasis on what I term 'stick-on sustainability' viz. solar panels, recycled materials, composting toilets etc. Although important contributions to a sustainable future, these solutions at the time seemed to have little application in my career. I did not feel comfortable promoting a solar panel on the roof while at the same time turning a blind eye to the five cars parked in the garage.

I agree with the statement of a US consulting group that sustainability is not a thing we do but it is a way of living (Five E's Unlimited, 2001). Being a strong believer that our physical environment has the potential to shape who we are and how we live our lives, I came to Canada in search of an alternative physical urban form that could initiate change towards more sustainable and democratic cities. I hope that this research will inspire others to challenge and explore alternatives to the status quo.


~INTRODUCTION~



BACKGROUND TO SUSTAINABLE DEVELOPMENT.

For most of the time that man has inhabited the earth his numbers have been small and his technical powers, apart from fire, limited. Even in 1600 AD the world's population was no more than perhaps 500 million and much of the earth was uninhabited or little affected by human activity. It took two hundred more years to reach the first billion human beings around 1800 AD. Only 130 years more were needed to add the second billion and less than 30 years for the third by about 1960. Within a mere 40 years this number was doubled to a current world population of over 6 billion people (see Figure 1).

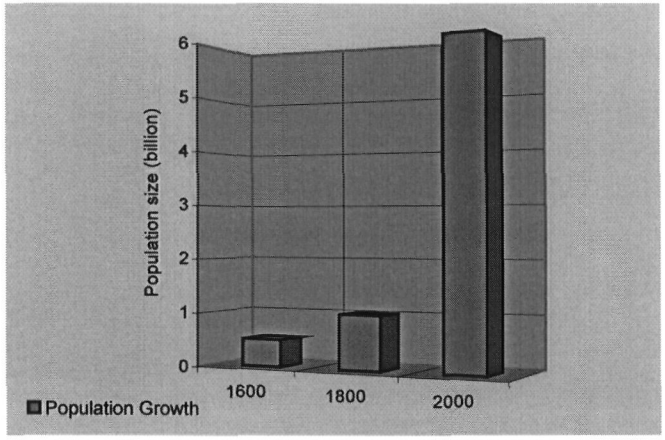


Figure 1: World population growth.

Because many of the resources on earth are finite, this exponential growth in population has the potential to cause disaster with extreme suddenness. This point can be illustrated using a French riddle. "At first there is only one lily pad in the pond, but the next day it doubles, and [every day] thereafter each of its descendants doubles. The pond completely fills with lily pads in 30 days. When is the pond exactly half full?" (Wilson, 1995:35). And of course the answer would be on the 29th day.

This concern with global population growth, led to the publication of the book 'Limits to Growth' in 1972 (Club of Rome, 1972). This study pointed out that the Earth has finite resources and that there will be a shortage of fuel, water and food necessary to satisfy the needs of the growing global population in the next century. The Brundtland Report followed in the late eighties. It emphasised that if we continue to follow current development practices, the capacity of the planet to supply resources and absorb pollution or waste was not going to support the projected world population (World Commission on Environment and Development, 1987). The Report therefore called for a new approach termed 'Sustainable Development' which was defined as "development which meets present needs without compromising the ability of future generations to achieve their needs and aspirations" (World Commission on Environment and Development, 1987:43). Robert Gillman, editor of the 'In Context' magazine, captures the essence of this definition when stating that "sustainability refers to a very old and

simple concept (The Golden Rule)...do unto future generations as you would have them do unto you" (Washington State University, 1999).

The term 'Sustainable Development' can be better understood when broken into its most basic component parts – 'Sustain' and 'Develop'. 'Sustain' means "to continue without lessening, to nourish, to allow to flourish" (Hart, 2000). However, in the context of sustainability, 'sustain' does not mean that nothing ever changes or that we strive towards perfection (Hart, 2000). Rather it is about making changes, while minimising the impact of such changes.

'Develop' means "to improve or to bring to a more advanced state" (Hart, 2000). However, there has been a common misunderstanding between the interpretations of the term 'sustainable development' as opposed to the oxymoron 'sustainable growth' (Maclaren, 1996). 'Growth' implies a continuous physical or quantitative expansion of an area and the economy supporting it, whereas 'development' is intended to imply a process by which sustainability can be attained (Maclaren, 1996). In the context of sustainability, 'develop' does not mean to grow larger indefinitely, but refers to continuous change or improvement; similar to people that start out as infants and grow until they become adults. People don't continually grow larger; they do however continue to develop (Hart, 2000).

THE DIMENSIONS OF SUSTAINABLE DEVELOPMENT.

Since the Brundtland Report, the concept of sustainable development has expanded and evolved. The next major global project linking the environment and development was the United Nations Conference on Environment and Development (UNCED) also known as the 'Earth Summit' held at Rio de Janeiro in 1992. Principal discussions were natural resource and ecological issues, and out of this followed 'Agenda 21'. The Earth Summit extended the focus

from the human and poverty related issues of the Brundtland Report, to include more specific environmental concerns.

Despite the numerous definitions of sustainability and angles of approach over recent years, a consensus has emerged that in order to move a sustainable state; progress must be made on three fronts – ecological, social, and economic. However, these three dimensions are not separate or unrelated parts. Rather they form three pillars that support sustainability, like the three legs that support a stool. Sustainability focuses on the balance of all three areas and promotes development that considers the combined effects of all three (see figure 2).

In practice however, these three areas are often managed by separate councils, agencies and professions with varying interpretations of the concept of sustainability. This leads to the three dimensions being viewed as separate, unrelated parts and consequently the problems of each are also viewed as isolated issues (Hart, 2000).

This piecemeal approach can have a number of negative impacts (Hart, 2000). Firstly, "Solutions to one problem can make another problem worse". For instance creating affordable housing areas far from workplaces might result in increased traffic and pollution. Secondly, "piecemeal solutions tend to create opposing groups." This is evident in arguments like 'if the environmentalists win, the economy will suffer' or 'if business has its way, the environment will be destroyed'. Finally, "piecemeal solutions tend to focus on short-term benefits without monitoring long-term results". Rather than a piecemeal approach, sustainable development focuses on the holistic link between the economy, the environment, and society (Hart, 2000).

"Sustainability is not a 'thing we do' or a 'program we carry-out'. Instead, it is a process, a philosophy, or an ethic, affording people the ability to consider long-term consequences of actions and to think broadly across issues, disciplines, and boundaries" (Five E's Unlimited, 2001).

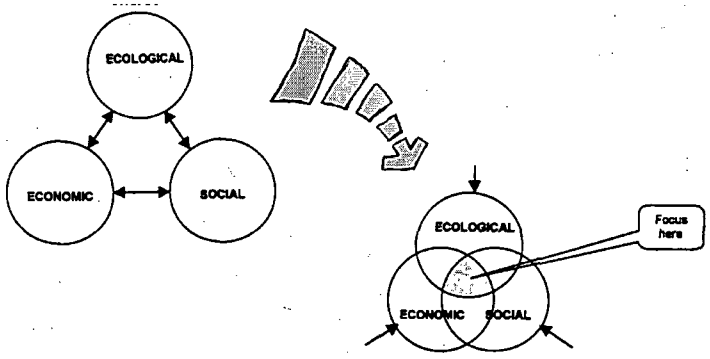


Figure 2: The three dimensions of sustainability.
(Adapted from Sheltair, 1998)

SUSTAINABLE DEVELOPMENT IN THE URBAN CONTEXT.

In this discussion, the importance of sustainable development within the urban context should be noted. Paul Downton remarked at the 'EcoCity Conference' that "the most dangerous weapon we unleash on the world is not industrialisation; it is urbanisation. Industrialisation offers the prospect of technological and environmental advances i.e. solar power vs. coal. On the other hand, urbanisation with its land clearance has been an environmental disaster since the birth of civilisation" (Canfield, 1990). In a Report to the World Bank, the GHK Group stated three reasons why cities are of importance. Firstly, "because of the sheer and increasing weight of people located in urban areas; secondly because of the economic, social and cultural activities that continue to cluster in cities and which increasingly drive national development processes; and thirdly because of the apparent intractability of urban poverty, which threatens national development" (GHK Group, 2000).

The past century has seen an alarming increase in urbanisation. In 1900, only 14% of the world population lived in cities, compared to 46.7% of the population by the year 2000. It is further estimated that by the year 2020, nearly 60% of world population will live in cities (Cities Alliance, 2000).

Despite often being a locus of poverty, cities are infused with much promise as drivers of development (GHK Group, 2000). It is often said that cities are the "engines of growth" that increasingly "drive" national economies (Cities Alliance, 2000). Urban-based economic activity accounts for between 50% and 90% of GDP in the majority of nations. The economic prosperity of many nations is often directly related to the economic prosperity of that nation's cities" (GHK Group, 2000).

Such economic realities can often lead to cities having a primarily economic focus, while neglecting the social and ecological realities that form part of our society. Douglas Paterson realised, "we [now] face two significant crises; one an environmental crisis, the other an experiential crisis...In the environment crisis we are well aware of our growing inability to

Figure 3: Urban destruction.
(Taken from Newman & Kenworthy, 1999)

sustain our future. In the experiential crisis we witness a fragmentation of self, community, and a sense of the civic" (ASLA, 1997:21). This does not mean that we should deny political or economic reality, for these remain essential components of modern society. It does however mean that we can now begin to understand how economic development can occur as a result of enhanced ecological and social environments – and what better place to attempt this than in the vibrancy of the urban environment, where these three dimensions are so independently related.

A RESEARCH FRAMEWORK.

This document is based on a framework model used by the Sheltair Group in various sustainability projects. The Sheltair Group framework creates a direct and transparent connection between broad principles and specific actions. It can be effectively combined with measurements (performance indicators) and with feedback systems in order to create an adaptive management system (Moffatt, 2001).

The framework can be represented as a pyramid that divides, from its pinnacle, into a spreading tree of elements, at increasing levels of specificity (Moffatt, 2001). This document follows a similar framework, starting off with a broad introduction to the concept and definition of sustainable urban development. From this starting point, the document then defines the problem of sustainability in the South African context, and presents a vision of change. This vision is explored, by investigating the dimension of sustainability and by identifying a number of issues that relate to these dimensions. Each issue is analysed to determine a primary goal and a number of objectives. For each objective, a number of design guidelines are then proposed, and finally, at the base of the pyramid, lays the implementation of such guidelines. This framework provides for the systematic progress from a broad scale concept to its implementation and is therefore a useful tool to try and arrange information in a logical format.

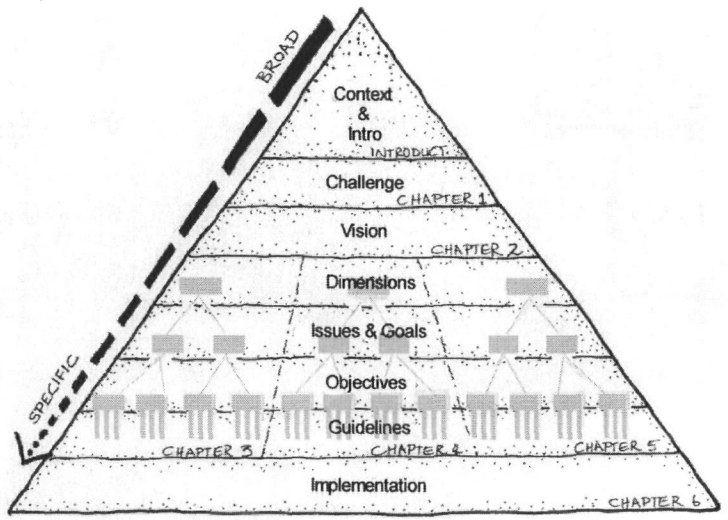


Figure 4: A pyramidal research framework that starts with a broad concept at its pinnacle, increasing in specificity towards its base.

The image of the pyramid appears throughout the document as a reference, allowing the reader to easily relate current information to the greater framework.

Chapter 1 provides an overview of the South African context. The chapter describes the inefficient sprawling urban pattern that resulted from the Apartheid planning history and it builds an argument that highlights the need for a sustainable urban form.

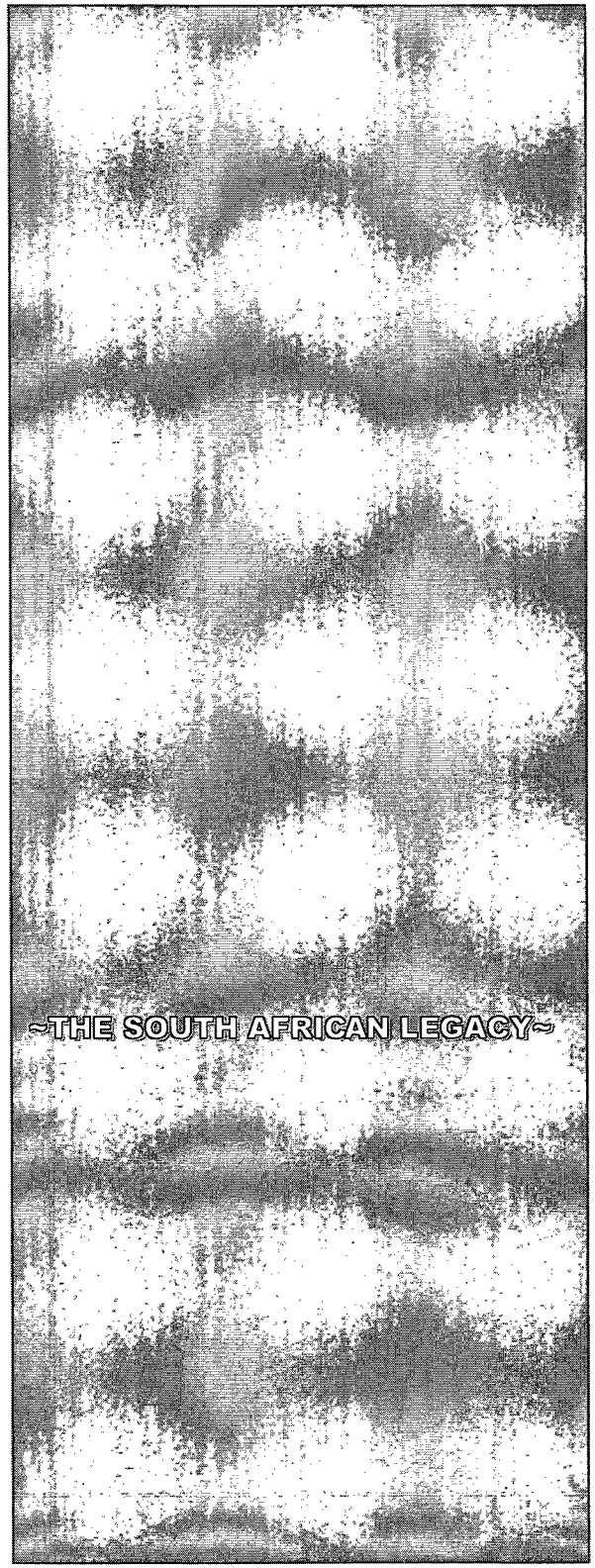
Chapter 2 explores the vision for a sustainable urban form. It describes the city as a hierarchical conglomerate of neighbourhood and community cells and envisions what the qualities of such cells might be.

Chapter 3 investigates the ecological dimension and describes a number of ecological issues that relate to urban form. It highlights some of the Apartheid implications and post-Apartheid situations and policy. Each issue concludes with a goal, objectives, and number of design guidelines for the planning and design of more sustainable neighbourhoods and communities.

Chapter 4 describes how each of the issues of the social dimension relates to urban form and the South African situation, highlighting some of the Apartheid implications and Post-apartheid situations and policy. Each issue concludes with a number of recommendations for design and planning of more sustainable neighbourhoods and communities.

Chapter 5 describes how each of the issues of the economic dimension relates to urban form and the South African situation, highlighting some of the Apartheid implications and Post-apartheid situations and policy. Each issue concludes with a number of recommendations for the design and planning of more sustainable neighbourhoods and communities.

Chapter 6 summarises the recommendations from Chapters 3-5, and illustrates, with concept diagrams, what a sustainable community-neighbourhood might look like in South Africa. It concludes with a strategy for how this might be implemented over time.



CHAPTER 1 ~THE SOUTH AFRICAN LEGACY~

THE SOUTH AFRICAN CONTEXT.

The Republic of South Africa is located on the southern-most tip of the Africa.. continent, between latitudes 22-35°S and longitudes 17-33°E. The country is 1,219,090 square kilometres in size and it is washed by the Atlantic Ocean to the west and the Indian Ocean to the east (South African Government, 2001). It is home too more than 43 million people (Education Planet, 2000). Of these, 76.7% classify themselves as African, 10.9% as White, 8.9% as Coloured, and 2.6% as Indian/Asian (Statistics South Africa, 1998), (see figure 6).

South Africa has eleven official languages and it is divided into 9 provinces: the Western Cape, the Eastern Cape, KwaZulu-Natal, the Northern Cape, Free State, North-West Province, Gauteng, Mpumalanga, and the Northern Province (see figure 5). Each province has its own distinctive landscape, vegetation, and climate and also its own Legislature, Premier and Ministers. With a per capita gross national product (GNP) of more than R8,500 South Africa is classified as an upper middle-income country (RDP, 1994:2.1.3).

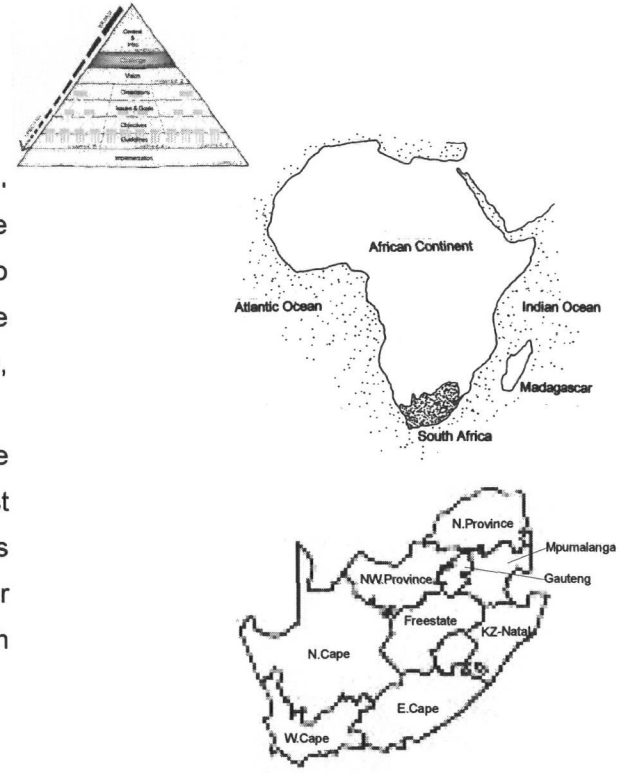


Figure 5: South Africa, with its 9 provinces, on the southern tip of the African continent.

THE PLANNING HISTORY.

South Africa has been involved in a power struggle between its European populations (primarily British and Dutch descendants) and those considered as non-European groups for more than three centuries. Prior to 1994, all South African Governments were elected by the historically white minority, which caused the planning laws, policies, institutions, and practices to reflect only minority interests. A few milestone periods can be identified in the planning history:

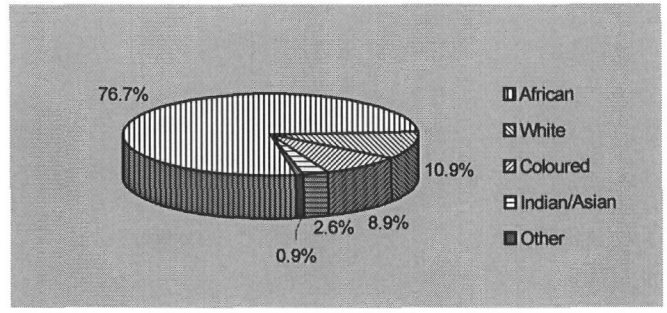


Figure 6: The South African population by ethnic group.
(Generated from Statistics South Africa, 1998)

The British planning ideology.

Political transformation during the 1910-1930's witnessed the spread of British planning ideology. This gave rise to a strong provincial influence over land and housing markets emerged, and it resulted in an increased tendency to shape human settlement patterns along racial and class lines. The exclusion of black African people from urban areas took root during this time (DPC, 1999:4).

The Great Depression, and post-war reconstruction.

As the Great Depression swept through the global economy it also brought conditions of economic hardship to South Africa; intensifying existing poverty levels. This time saw the implementation of slum clearance initiatives, mass government housing, and job reservation for poor whites. Reconstruction, after the Second World War, saw an enthusiastic acceptance of modernist concepts, such as land use separation and the dominance of the private vehicle (DPC, 1999). This period had a great influence on South African planning and laid the basis for the sprawling development pattern.

Apartheid.

The 1948 election saw the implementation of the Apartheid Policy through the Group Areas Act that called for racial separation at a variety of levels in society – between whites and nonwhites, between Africans and other nonwhites, between one African ethnic group and all other African ethnic groups, and between rural Africans and urban Africans.

Planning became a tool for racial oppression that "took political ideology as its starting point, rather than something based on people-centred and environmental ethic" (DPC, 1999:5). Urban areas were divided according to the Apartheid model (see figure 7) into racially exclusive zones. This created "a racial patchwork with white residents occupying land around

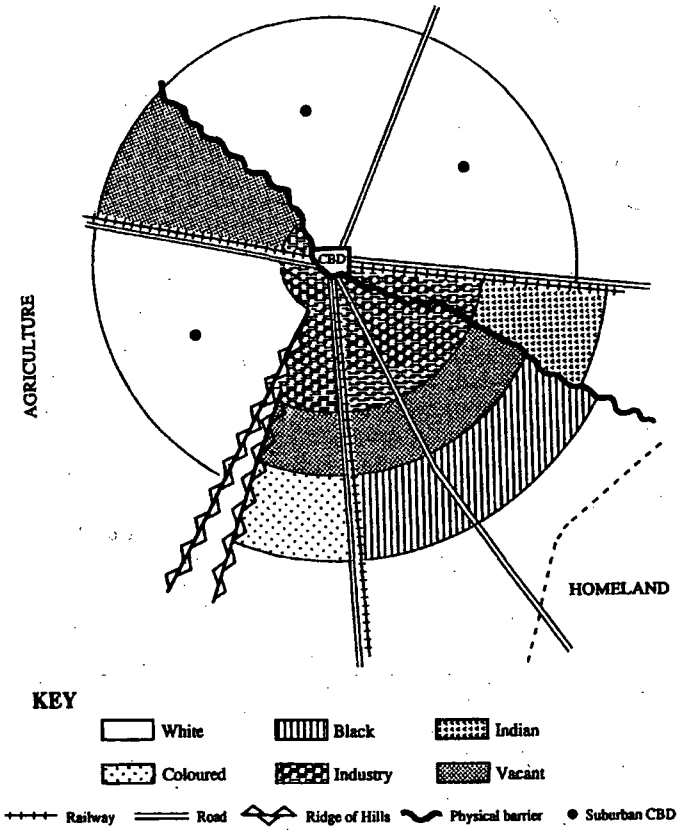


Figure 7: The Apartheid model for urban form.
(Taken from Turok, 1993)

the central business district, Indians and coloured communities living somewhat further out, and the black populations consigned to the periphery" in 'townships' (Van Ameringen, 1995:25).

The Soweto Uprising.

After almost 30 years of racial oppression under the Apartheid policy, the oppressed people pulled together in a violent protest in Soweto Township in 1976. The minority government, responded to the uprising by dismissing demands for change, and instead, increased control and oppression through the strengthening of the existing control-oriented planning system (DPC, 1999).

Leading up to democracy.

During the late eighties, the government was confronted by, an ever increasing, internal and international opposition calling for change. The Group Areas Act was relaxed, allowing the urbanisation of African ethnic groups. This period of rapid and consistent urbanisation; unmatched by sufficient housing, land, and services; brought the government to the realisation that "municipal planning was unable to tackle development needs in its existing fragmented and unrepresentative form" (DPC, 1999:5). A forum was convened in 1991 to develop an Interim Strategic Framework to help guide post-Apartheid urban development and planning (see figure 8). The vision for the new framework departed radically from the crude segregation of the Apartheid City, but ended up reproducing crude social segregation on the basis of income rather than race (Turok, 1993:31). It soon became clear that a period of transition had begun, in which new solutions would have to be sought for the inevitable, approaching democracy.

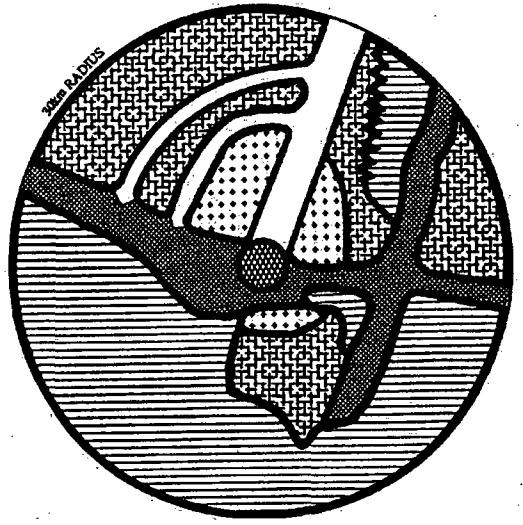


Figure 8: Proposed Interim Strategic Framework.
(Adapted from Turok, 1993)

Democracy and reform.

In 1994 Apartheid was finally set-aside and the first democratic election was held. The new democratic government set out to rewrite the country's legal documents to reflect the interests of the majority. The Reconstruction and Development Programme (RDP) was set in place in 1994 with the advent of democratic governance, as a policy instrument to direct the progress of transformation. The RDP is a strategy of reconstruction that aims to eliminate Apartheid and to address the many social and economic inequalities facing the country.

The RDP housing subsidy scheme was set in place as one of the key programs of reform. The government estimated that 338,800 units needed to be built annually to meet population growth and reduce the housing backlog. Municipalities were required to provide low-income houses within their municipal areas. The period following democracy also saw an increase in crime and the subsequent growth of 'Gated Communities' that included both 'enclosed neighbourhoods' and 'security villages'.

THE SPRAWLING SOUTH AFRICAN CITY.

The focus on cities.

With about 80% of the Gross Domestic Product of South Africa being produced in the cities, their well-being is of vital importance to the national economy, meeting the basic needs of the poor and sustaining our environment (Department of Housing, 1997).

The move from Apartheid to a democratic government saw the migration of a large percentage of previously excluded population into the cities. It is estimated that within a decade 75% of South Africa's population will live in urban areas (Jabbra & Dwivedi, 1998:83). By 1996, 97% of the total population in the Gauteng province (incorporating the cities of Johannesburg and Pretoria) were already urbanised (Statistics South Africa, 1998), (see figure

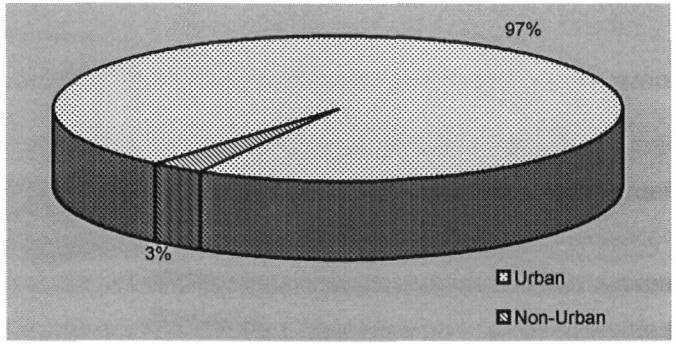


Figure 9: Urban and non-urban distribution in the province of Gauteng.
(Produced from Census 1996 information)

9). This causes increasing concern for urban development. "The former apartheid state's refusal to accept and plan for this process has left cities unprepared for the influx" (Whyte, 1995:80). "This process has been accompanied by the rapid corporate abandonment of the inner-city as businesses have relocated to the outer-lying parts" (Saff, 1998:67). Saff claims that this pattern "resulted in the inner-city exhibiting some of the characteristics of 'Black ghetto' formation in the United States".

The sprawling pattern.

"The horizontal extension of South African cities is enormous. The metropolitan area of Pretoria, for example, houses approximately 1.5 million people on an area of 130,000 hectares" (Schoonraad, 2000:2). This results in some of the lowest densities in the world, with an average population density of 14 persons per hectare and an average building density of a mere 3 units per hectare (Schoonraad, 2000).

Dewar *et al.* (1991) pointed out that the three most problematic spatial patterns of South African Apartheid cities are low-density sprawl, urban fragmentation, and urban separation. He predicts that if action is not taken soon, South African cities will increasingly resemble other Third World cities as a result of these patterns. Of these three problems, sprawl is the major challenge for South African cities, as the problems of fragmentation and separation can be seen as consequences of the sprawling development patterns of the past.

Traditional planning promoted suburban settlement – a world in which lots and private gardens are large, dwellings are detached, population densities are low, and levels of mobility are high (Behrens & Watson, 1996:37). People moved from the inner city and dispersed over low densities in suburban areas. At the same time, black populations were restricted to peripheral areas, where the densities sharply increased to about 160 units per hectare within the confines of the township (Van Ameringen, 1995; Whyte, 1995). This pattern resulted in what Schoonraad (2000) refers to as the 'doughnut city' where densities sharply decline

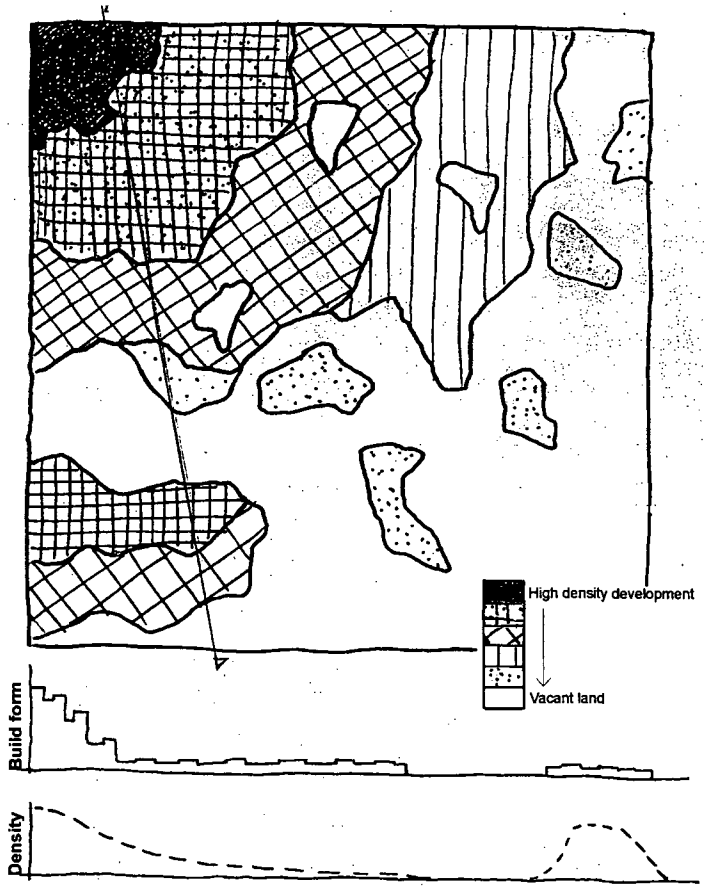


Figure 10: The typical South African urban form where density increases towards the periphery.

outwards from the inner city, but then peak again towards the urban periphery (see figure 10). This pattern results in the majority of the population living far away from amenities and employment opportunities. In addition, the low densities in suburban areas impact greatly on the provision of services, and public transportation, with the majority of public transit dependent people living on the periphery of the city (Department of Transport, 1998). This heightens their existing struggle against the inefficient Apartheid urban form (see figure 11).

Though the low-density sprawling pattern is common to the historic white suburb, it is no longer a problem associated only with these regions. The 'wealthy western suburb' is portrayed as the ultimate luxury and ideal, and the 'poorer third world township' cultures understandably mimic this type of development. The ideal prototype of a sprawling suburb with its large detached house, a car or two, a garage, lawn and the dog in the front yard, has become the dream of the common man. South Africa can consider itself fortunate that only a small minority have traditionally possessed the means to develop in such a destructive way. With the constraints of Apartheid now something of the past, a large segment of the population is actively striving towards this warped ideal. This can commonly be seen in recent private developments found within the township areas (see figure 12).

If this continues to happen, the country will be facing enormous problems in dealing with the consequences of this development pattern. As Ruckelshaus stated: "...if the poor nations attempt to improve their lot by the methods we rich have pioneered, the result will eventually be world ecological damage" (Ruckelshaus, 1995:427). This is further emphasised by Heal, who wrote: "undeveloped countries [the poor] cannot advance by retracing the steps of the developed countries [the wealthy]. It would imply repeating those errors that have lead to deterioration of the environment" (Heal, 1998:6).

The 'Urban Development Framework' makes a strong case against this sprawling pattern (Department of Housing, 1997). Yet, in spite of this, land use decisions still act to reinforce the tendency towards low-density dispersion. Current planning and development initiatives exacerbate the spatial legacy by locating new housing on the urban periphery, far

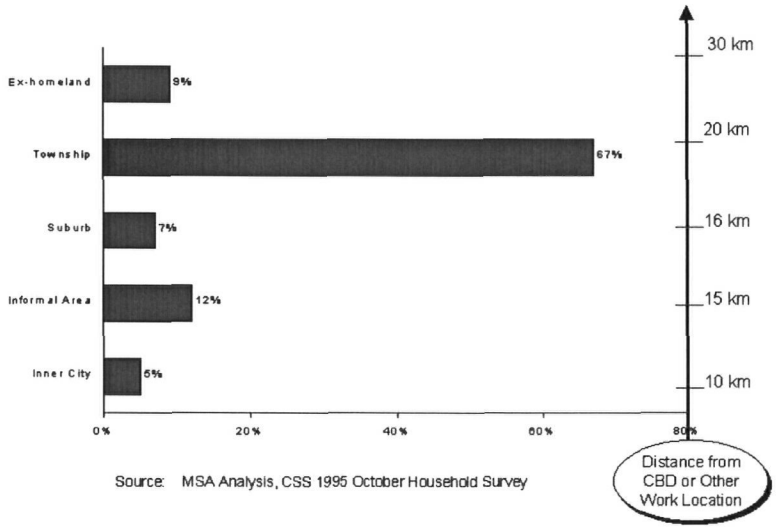


Figure 11: Geographic distribution of public transportation users from work locations.
(Taken from Department of Transport, 1998)

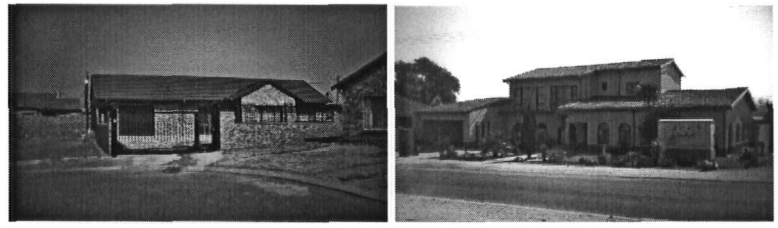


Figure 12: Suburban homes found in Atteridgeville Townships as the portrayed ideal.

away from amenities, services and employment (Department of Transport, 1998). The Department of Housing frequently awards housing subsidies in outlying areas, where the land is cheaper and lot sizes large, rather than infilling denser areas closer to the CBD or other employment nodes (DPC, 1999:12). Even the government Reconstruction and Development (RDP) housing subsidy scheme promotes single detached units on the periphery of the city (see figure 13).

Such developments that promote low-densities and peripheral locations continue to exacerbate the inefficiencies of the historical urban form. This pattern has a far-reaching effect on the country's ecology, social fabric, and economy (elaborated in Chapters 3-5). It is one of the biggest challenges to planners and designers that shape the future of the South African city. It is evident that the current patterns of development attempt to deal with pressing issues of the Apartheid City. However, Huntley warns that during this time of socio-political change, the most popular route is one that offers immediate rewards and satisfies immediate needs. He writes, "a strong economy in the long run requires the existence of a strong social- and environmental ethic" (Huntley *et al*, 1989:92).

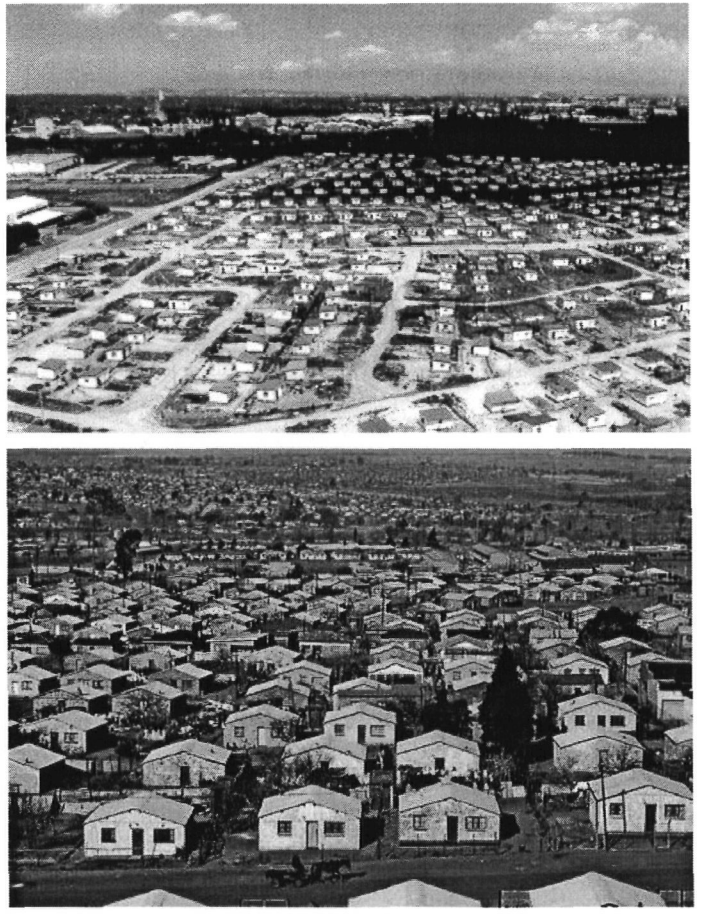


Figure 13: Typical examples of RPD housing projects, sprawling across the landscape on the urban periphery.
(Taken from Department of Housing, 1999; Gauteng Tourism Agency, 2001)

SUSTAINABLE DEVELOPMENT IN SOUTH AFRICA.

A first world city in the third world.

Marc Levine titled his article in Polese and Stren (2000) 'A third-world city in the first world' when referring to development in Baltimore in the United States. The reverse of this concept might be considered when referring to the South African city. Western cultures came to South Africa and were segregated into mainly urban areas due to the Apartheid policies. These culture brought with them, contact with the First World that resulted First World South African cities that were separated from the surrounding Third World context and its problems.

This poses a complex, yet challenging problem for sustainable development in South Africa "the meaning and implications of the concept 'sustainable development'...has different connotations for developed and developing countries...While the primary concern in developed cities is on overcoming environmental constraints [and] attempting to maintain present standards of living, the emphasis in...the Third World is about the lack of development and minimal living standards in its cities" (Chowdhury & Furedy, 1994:3). The approach of many developing countries form part of what is referred to as the 'brown agenda' meaning that "in poor countries, environmental considerations cannot be approached solely through such 'green' concerns as biodiversity, the protection of the ozone layer, and the creation of wildlife and forest preserves, but must be channelled through far reaching programs to reduce poverty –in particular, urban poverty. This means providing urban infrastructure, education, and improved health programs for the urban poor as a bare minimum" (Stren & Polese, 2000:15).

As is evident in the words of Coch: "South Africa with its mix of First World...and Third World environmental problems...is a microcosm of the environmental challenges facing the planet" (Cock & Koch, 1991:1). This quote initially focuses on environmental sustainability, but it was soon realised that "arguments underlying our environmental discussions are as much about the structures of our society as they are about the environment" (Jabbra & Dwivedi, 1998:92). Huntley linked these arguments when he stated that "South Africa's future rests on the ability...to interrelate decisions on the economy, the environment and society" (Huntley *et al*, 1989:89).

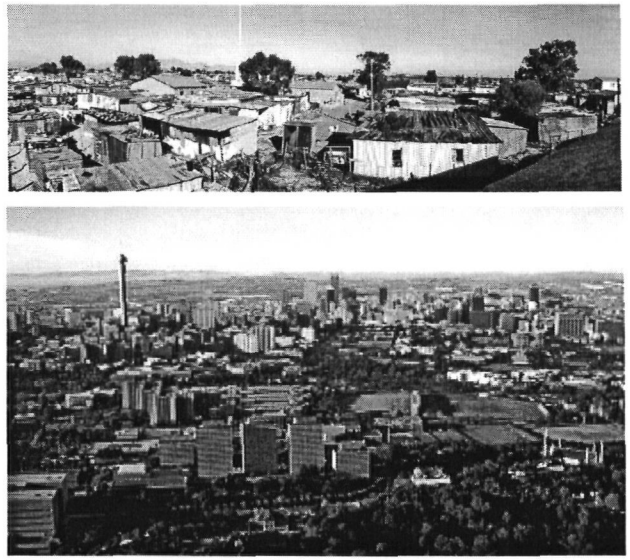


Figure 14: South Africa with its mixture of Third World and First World realities.
(Taken from Liffiton, 2000; Communications Department, 2000)

A time for change.

In recent decades, it has become increasingly clear that the Apartheid City is neither sustainable nor democratic. Muller realises that "the present political, socio-economic and structural transformation of South African society...could have an unfreezing impact to initiate the change towards sustainability" (Jabbra & Dwivedi, 1998:92). "The advent of democratic

government in South Africa provides a unique opportunity to assess environmental issues at the same time that other economic and social circumstances are undergoing sweeping change" (Jabbra & Dwivedi, 1998:79).

The South African democratic struggle occurred at about the same time as the global struggle for sustainable development and is therefore closely interwoven with the new vision for a changing South Africa. With the advent of democratic government in 1994, the task of rewriting the South African legal documentation was begun. Recent documentation like the 'Development Facilitation Act' (DFA, 1995) and the 'Urban Development Framework' (Department of Housing, 1997) emphasise the need for change. However, these documents provide at most "a broad, general vision for South Africa's urban areas [and it] offers little in the way of how intentions should be achieved, and therefore, what their implications are for planning" (DPC, 1999:12). The Development and Planning Commission (DPC, 1999:12) recently stated that "there is no evidence of a shared vision of what planning should be trying to achieve in the 'new' South Africa" and now "urban development is occurring without a clear vision of appropriate urban form" (Behrens & Watson, 1996:37). The next chapter aims to construct a vision of what the sustainable South African city might be.

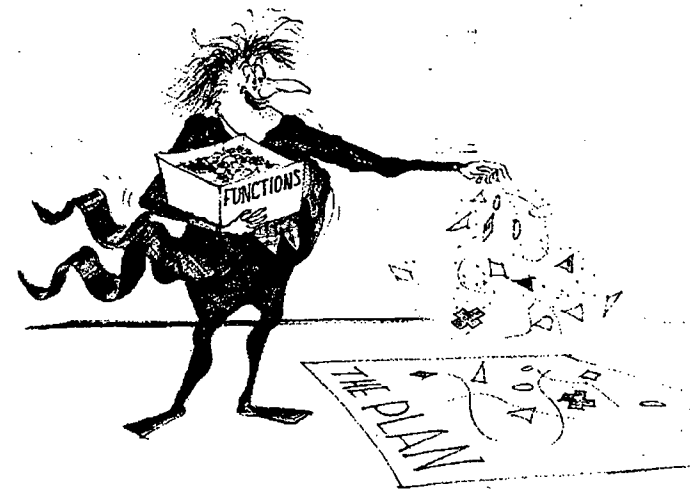
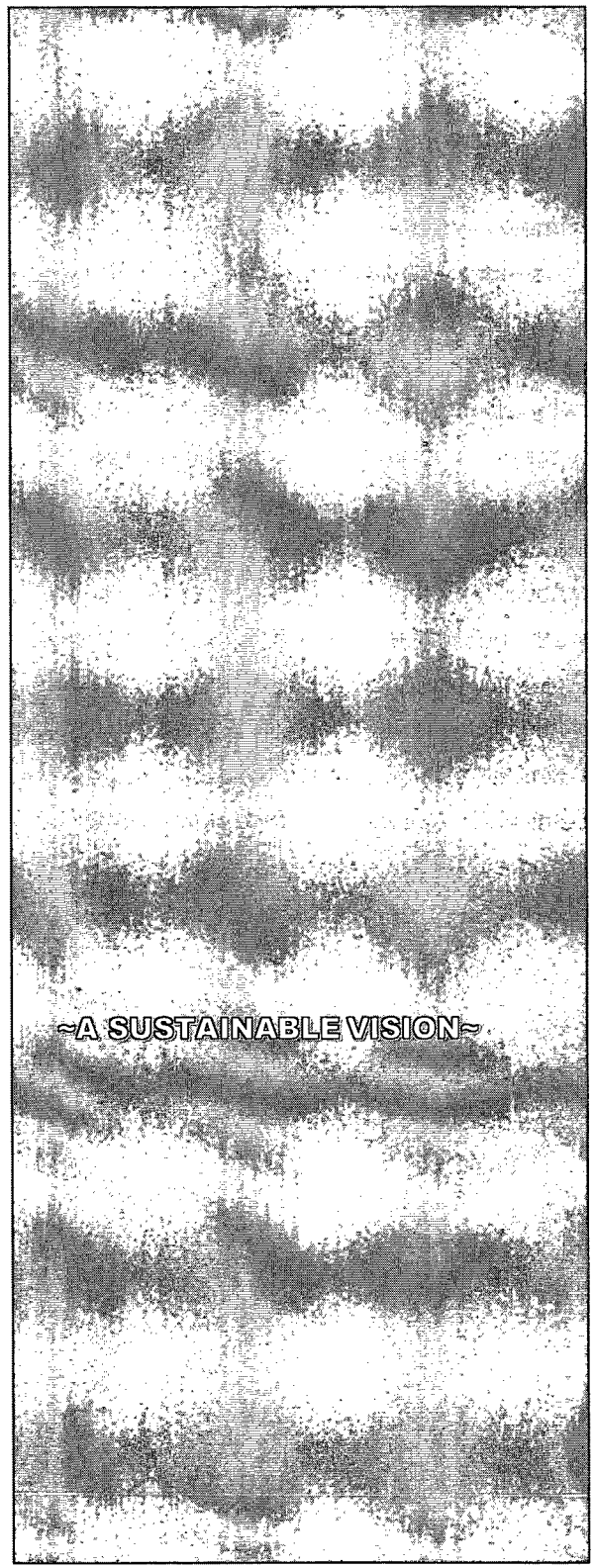
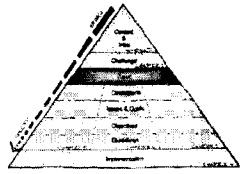


Figure 15: A comic representation of the 'scatter' process involved in designing and planning cities.
(Taken from Hedman & Bair, 1967)


CHAPTER 2
~A SUSTAINABLE VISION~



ESTABLISHING A SUSTAINABLE VISION.

South Africa is indeed facing multiple challenges in its future, including the challenge of moulding a vision for a sustainable, democratic urban form. In the words of Minister Mthembi-Mahanyele: "Apartheid planning...made our urban settlements extremely dysfunctional and unsustainable" and we now need to "take up the challenge of achieving sustainable cities" (Department Of Housing, 1997). Realising that the South African city is in need of a clearer vision for sustainable urban form and that the current sprawling pattern is not the solution, we are left to ask: What form and structure would make the city more sustainable?

The urban hierarchy.

"Every landscape is joined with all other landscapes in a network of interdependence that extends over the entire earth. Everything...is indeed related at some level, to everything else. So when we shape a landscape of any size, we need to place it in a larger perspective, to see the web of relationships and avoid breaking critical strands..." (Lyle, 1985:24). For landscape design purposes, an operational set of scales has emerged from practice rather than theory. It is therefore a flexible and adaptable system but might be broadly represented as follows: earth, country, region, city, district, community, neighbourhood, site (see figure 16). In such an urban hierarchy the city is made up of a number of district 'cells', while each district is made up of a number of community 'cells'. Each community in turn then consists of a number of neighbourhood 'cells', which is formed through the individual lots in the city.

James Feiblemann described some fundamentals of the relationships among such a hierarchically integrative system. Firstly, he recognised that each level organises the level below it. Secondly, the higher level depends on the lower level and thirdly, the higher level directs the lower levels. For any scale, its implementation or mechanism lies at the level below

and its purpose or goal at the level above, as diagrammatically illustrated in figure 16 (Feiblemann, 1954:63-64). From this we can conclude that achieving sustainable cities depends on the achievement of sustainable regions, communities, neighbourhoods and sites, but to achieve meaningful, sustainable sites there must be sufficient direction from the higher community and neighbourhood levels.

However, there seems to be a void in the continuum as the foci of sustainable research tends to be on the larger scales, or on the individual site scale, avoiding the transition between the two at the community-neighbourhood level (Condon, 1996; Groh, 1972). This is understandable when we examine the historic low-density sprawling patterns, in which the community-neighbourhood concept seems to have become a mere management jurisdiction boundary rather than a distinguishable unit that is used in the planning and design of our cities. Community- and neighbourhood cells play an important role in the urban environment and their survival is necessary for a sustainable future.

The concept of community and neighbourhood cells is not new to urban planning. Early in the 20th century the relevance of the community-neighbourhood structure became evident. Arthur Morgan highlighted the need for a community structure in 1942 when he describes how man is a community animal in search of social units. He argued that there is a need to reflect this structure in planning and he investigated the ideal size of such a community structure.

The neighbourhood is the most basic unit for planning and it appeared as the building block of urban planning in the work of Clarence Perry's as early as 1929. He proposed creating neighbourhood unit plans as a means of correcting the disregard for social living in city growth. Perry had a vision of creating optimum size neighbourhoods, each with its own shops, schools, and community facilities, where people could find friendliness, relaxation, convenience, and safety, as well as opportunity for citizenship activities on a manageable scale (Perry, 1929).

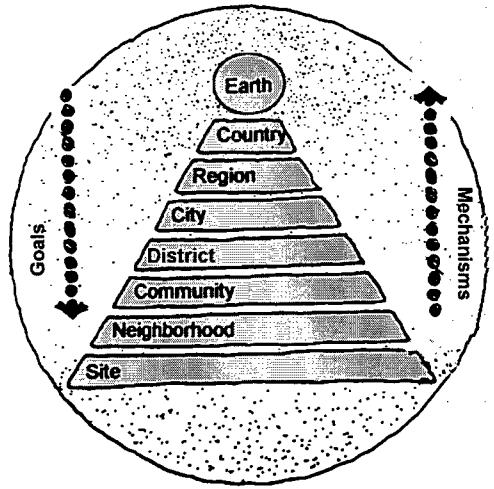


Figure 16: A hierarchy of scales.
(Adapted from Lyle, 1985)

In later years these cells were re-featured in planning as a tool to create more democratic, environments – a very relevant issue in the new democratic South Africa. Yates (1973) claimed that direct democracy depends on proximity and community participation and so the urban structure should provide an arrangement that fosters community involvement in small, manageable cells. He argued that such an urban structure would increase pluralism in urban democracy, and permits the articulation of more diverse preferences and interests (Yates, 1973). Frey (1999) also emphasises the need to design and plan with neighbourhood cells that enable effective participation and local autonomy due to its small size and population.

The absence of community- and neighbourhood cells in the urban fabric creates a gap between broad-scale policy and local implementation. As illustrated in figure 17, the activity of 'Design' gives form to physical phenomena at the lower levels of scale, while 'Planning' represents the administrative, legal, or policy-making activity at the higher levels (Lyle, 1985). Planning thus becomes the guidance for Design and Design becomes the physical manifestation or implementation of the Planning policy. Planning and Design "are closely linked and work in tandem, sometimes to the point of being indistinguishable" (Lyle, 1985:17). The two interact most at the community and neighbourhood levels where the void in the continuum occurs. This void might explain the frustration with achieving urban sustainability in South Africa as when Schoonraad (2000) writes that "strategic plans and policy documents [in South Africa] are vague and unprescriptive...None of the plans have been elaborated into detail plans that clearly indicate the minimum density and intensity of development. This has resulted in a gap between policy and implementation. Given this fact, it is almost impossible to judge the merit of an application to develop an individual lot."

Communities with their clustered neighbourhood cells therefore seem to have the potential of becoming the hinge-point between higher levels and lower levels in the scale continuum, between planning and design, and between theoretical guidance and physical manifestation. It is therefore essential that the sustainable South African city addresses the

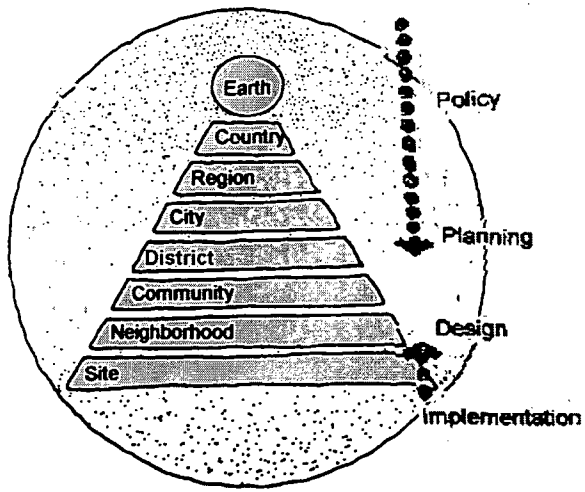


Figure 17: The void in the continuum of the hierarchy.

uniform sprawling mass and establishes an urban hierarchy, by 'tightening' its lose mass into a series of community and neighbourhood 'knots'.

The urban honeycomb.

Urban density has been the topic of many discussions and debates held between the 'centralists' and 'decentrists'. The decentrists "favour urban decentralisation, largely as a reaction to the problems of the industrial cities" while the centrists favour the compact city and "believe in the virtues of high density cities and decry urban sprawl" (Jenks *et al*, 1996:14).

Realising the consequences of the sprawling Apartheid form in South Africa, the post-Apartheid documentation and policies direct development towards more compact configurations. One such document, the Development Facilitation Act (1995), clause 3(1)(c)(vi), states that development should "discourage the phenomenon of urban sprawl in urban areas and contribute to the development of more compact towns and cities."

However, there seems to be a lack of clarity as to what 'compact' implies. Frey (1999:29) found that the arguments around the 'centrist-decentrist debate' are "unnecessarily complicated by the lack of definition of what kinds of concepts people have in their mind when discussing city form." When talking about compact urban form, the picture that springs to mind is perhaps the most extreme concept of a compact city – the core (or medieval) city. However, when Jenks *et al* (1996) suggest other proponents of a sustainable city, one may conclude that the compact city is not necessarily as compact and abruptly edged as the medieval city. Compact descriptions range from large concentrated centres; to decentralised, but concentrated and compact, settlements linked by public transport; to dispersed self-sufficient communities (see figure 18).

The argument can more clearly be presented when the city is seen as a honeycomb. The honeycomb consists of a cellular framework structure. Bees collect nectar and tightly pack the honey into these individual cells. When stepping back, to view the honeycomb, one can

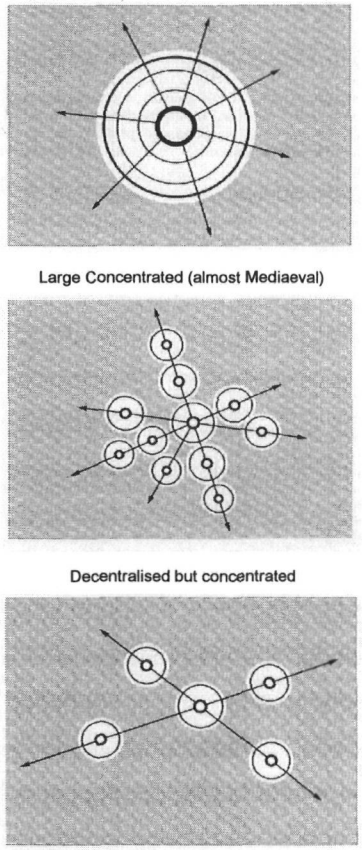


Figure 18: Ranging descriptions of what compact implies.
(Taken from Frey, 1999)

see a varying intensity, ranging from concentrated areas where neighbouring cells are all filled, to dispersed areas where there are only a few cells filled with honey (see figure). The same applies to the city that consists of a framework of cells. Some cells might be densely developed while others are left undeveloped. This gives rise to the hierarchical structure of the city where neighbouring cells form areas of greater scale, intensity and overall urban compactness.

Frey suggests that the opposing groups seem to have much more in common than one would think. "The difference seems to lie in the degree of compaction and the degree of centralisation or decentralisation, rather than the principle" (Frey, 1999:31). If we view the compact city debate from a sustainability point of view, the centralists and decentrists share a common vision in which the city is a conglomerate of mixed use, and densified neighbourhood cells that enhance and protect the ecological, social, and economic vibrancy of the city (Frey, 1999). At the same time there seems to be a consensus that the neighbourhood cell cannot function in isolation and that it should form part of a larger conglomerate of cells (thus form part of a community structure). Frey (1999) argues that access beyond the neighbourhood cell is essential for today's urban society which relies on even more specific uses and specialized provisions which do not necessarily depend on central locations and services provided exclusively within the neighbourhood boundary.

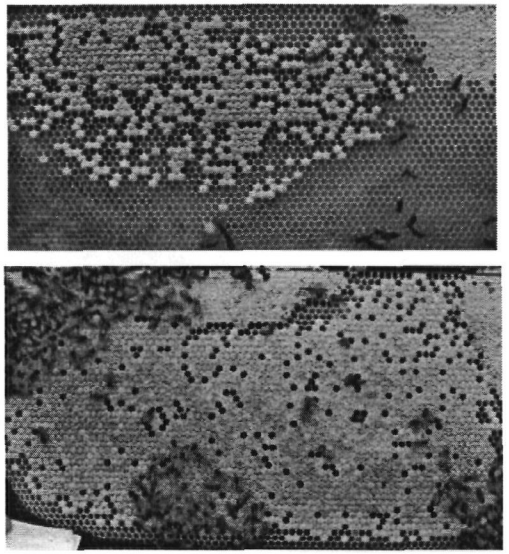


Figure 19: Varying overall density in a honeycomb.
(Taken from Dick, 2000)

Envisioning the qualities.

It is evident that the community, with its conglomerate of neigbourhood cells, is an important component of a more sustainable urban form. But how do we envision the qualities of these cells, or what should life be like in the sustainable community-neighbourhood cell?

The following is a fictitious letter that envisions the typical lifestyle and qualities of the sustainable, democratic community in urban South Africa.

Dear Ryan

It has been a while since I last wrote, but with the recent move there has been little time to write. Our new home is in a redeveloped part of town, close to the city downtown core. Our house is a beautiful multi-story two-bedroom unit with an additional detached rental unit on top of the garage in the back yard where Josh is currently living. He is now all grown up and can you believe he is even earning his own steady income. After school, he helps out a Chinese guy, who lives just up the street and runs a jewellery craft shop from his house.

Josh is graduating from high school this year and then my mother might be moving into the unit. It would be ideal for her, as she can be close to the family but still maintain her own independence to come and go as she pleases. She is not happy in the seniors home at the moment and says that the institutionalized routine makes her feel even older, so I think she will he very pleased to 'rejoin society'. Our neighbours rented their basement suite last month to an old lady that used to work with my mom when she was younger so I think the two of them will enjoy each others company. I really look forward to having my mom around again and it will be ideal to have someone around in the afternoons when Sonja comes home from school.

Despite her fear of the new school, Sonja is fitting in well. Initially Josh would walk her to the local primary school just a few blocks from home on his way to school, but she quickly made a few friends in the neighbourhood and now they all walk or cycle to school in the mornings. She is hardly home in the afternoons and is always out and about, exploring the neighbourhood with her friends, playing in the park, or visiting Ms. Mgobe next door. Just across the road is a 'gated block'

Figure 20: A photograph of our new house.
(Taken from BSCLA, 1999)

development (a block-sized gated community) where one of Sonja's friends live and the complex has a common central swimming pool facility where she is often to be found!

The past few months were spent unpacking and making adjustments around the house. Just after moving in I started planting new flowers in our small front garden that leads up to the porch. Initially I thought that I would not be able to do much gardening here, but I have to say that the small front yard gives me just enough opportunity to live out my gardening passion without having to feel as if I am maintaining the 'White House' gardens! The neighbourhood is just a wonderful colour canvas with all the porches, gardens and trees lining the streets and I often go for walks in the early evenings to view all the interesting houses and gardens in the area. I am still amazed at how busy these streets can get, not with cars rushing by, but with children playing ball in the streets, or people going for a run, a bicycle ride, or to walk the dog. I sometimes just sit on the porch to watch all the street activity and people passing by.

We just sold one of our cars last week, as we don't have much use for two cars anymore. Peter still works at the company downtown, but with the area so well serviced by public transport, it is faster and more convenient to get there by bus than driving through the maze of morning rush hour traffic. Even though there is a mini-bus taxi service to the central community core that runs past just in front of our house, we usually prefer walking together to the community centre in the mornings where Peter then catches his bus into town.

I still work at the same lawyers office, but they recently relocated to an office development build above the shops in the central community core. This is so much better than the offices they had last year in the suburb,

not only for me but also for the business. Things are so much more vibrant and during lunch times I usually stroll down to the community park, and watch all the people as they pass by. Often, I meet one of our neighbours or parents from Sonja's school there and talk the lunch hour away. Some days I even dash home quickly or go pay a bill. It is very convenient and it saves me so much time not having to drive all the way across town to get to work, to drop off the children, or to do my shopping and administration tasks. On my way home in the afternoons I usually walk past the supermarket to pick up a few things for supper and then take the mini-bus taxi home, or I send one of the children to the local neighbourhood centre to pickup bread and milk. We have bought each of the children a proper bicycle and with everything in close proximity they can get were they need to be on their own.

Saturdays are fast becoming traditional family cycling day. We usually cycle down to the river for a picnic. At first I was a bit concerned to have Sonja come along because of traffic, but it turned out to be a wonderful ride along a series of connected parks in the area. Even along major roads there are demarcated zones for cyclists. Josh of course is not too interested in hanging around the family all the time and he usually sprints ahead with his friends and then they cycle to some of the surrounding communities before joining us later. On our way back we often stop at the community market where many of the locals sell their goods. The produce at the market is an absolute must, not only for its freshness but also for its price! I usually buy from a guy that lives about three blocks from me where he grows a variety of veggies in his back yard. I can spend hours at the market just looking at all the wonderful talented arts and crafts or listening to the local musicians.

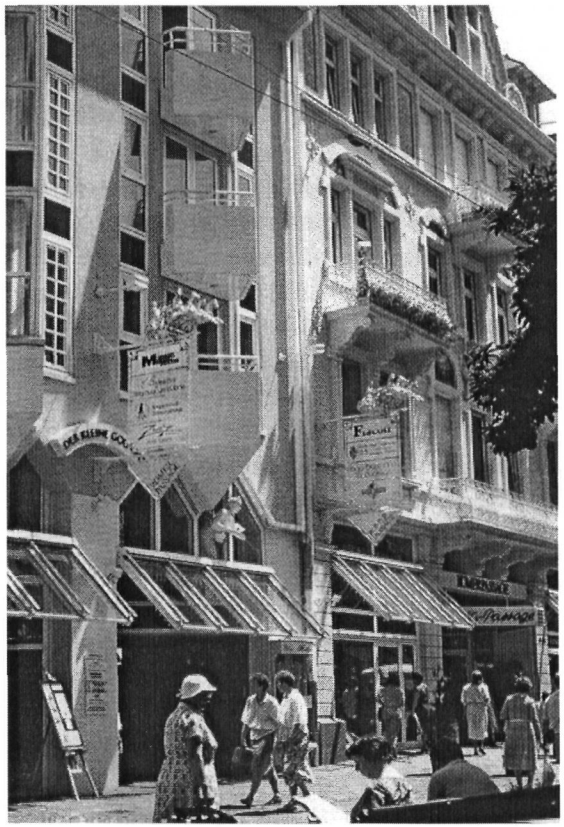
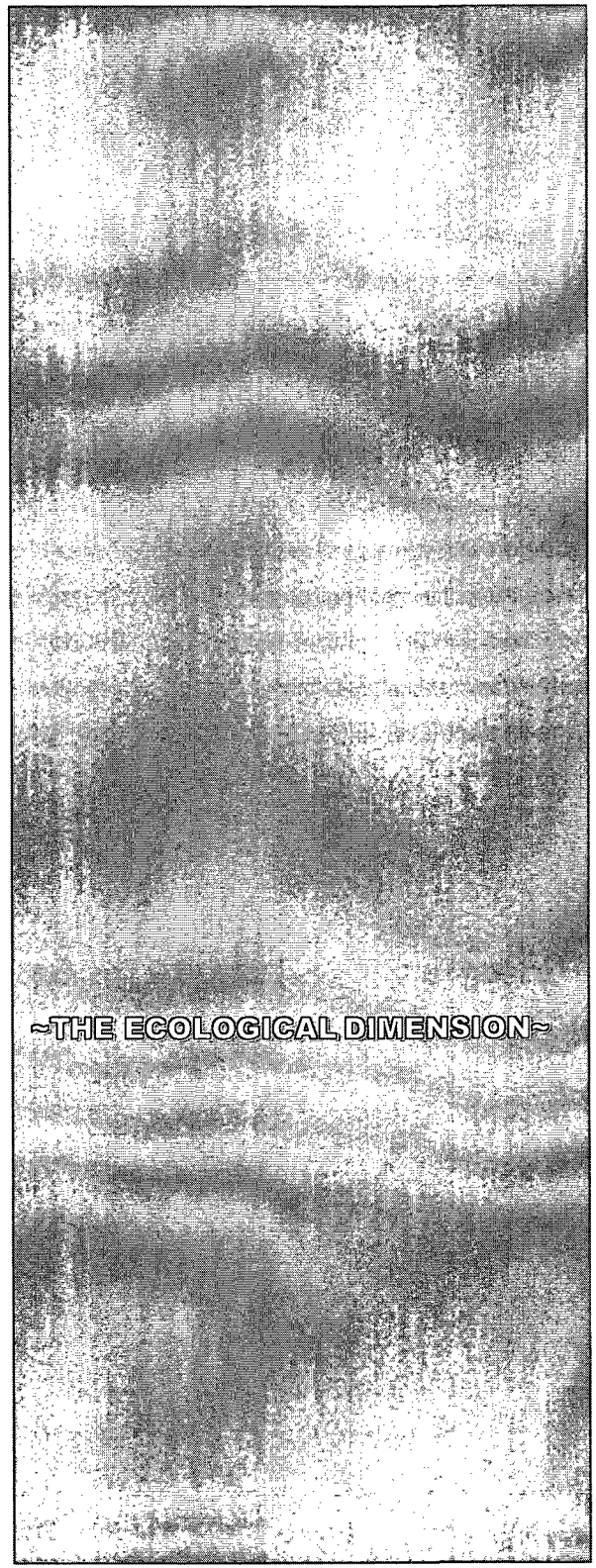


Figure 21: A photograph of my office.
(Taken from Crowhurst Lennard & Lennard, 1995)

Next Friday Sonja's school is hosting a play in the community hall and I thought it would be a great opportunity for you to come visit us for the weekend. We all look forward to seeing you again.

Love Lourette

This chapter envisioned the sustainable city as a conglomerate of compact neighbourhood cells that cluster together to form communities and greater urban hierarchies. It established a broad vision of the qualities and characteristics of the community-neighbourhood unit, but the vision is still vague and unprescriptive. Chapters 3-5 provide a deeper investigation into the qualities and characteristics of the sustainable community-neighbourhood cell and establish design guidelines that might assist planners and designers that have to bring about change.



CHAPTER 3 ~THE ECOLOGICAL DIMENSION~

AN OVERVIEW OF THE ECOLOGICAL DIMENSION.

"Ecological sustainability involves the maintenance of clean air, soil and water and variety of species and habitats through practices that minimise damage to the carrying capacity of the natural environment and that ensure the long-term integrity of a healthy ecosystem" (Sheltair, 1998:22).

"Ecological sustainability basically implies the preservation of biodiversity at a sustainable level" (Munasinghe & McNeely, 1995:27). However, "sustainability does not necessarily imply maintaining some static natural state, but rather maintaining the resilience and capacity of the ecosystem to adapt to change" (Munasinghe & McNeely, 1995:29). Adaptability and change are inevitable and important elements of sustainable development (Forman, 1990).

"Sustainability from a [ecological] perspective is linked to the idea that the dynamic processes of the natural environment can become unstable as a result of stresses imposed by human activity. Sustainability in this scenario refers to maintaining a system's stability, which implies limiting the stress to sustainable levels on ecosystems that are central to the stability of the global system" (Munasinghe & McNeely, 1995:27). Forman (1990) raised the question of what the nature of stability is, when referring to sustainable development. He concludes, "mosaic stability, which includes changes, even radical changes, within specific spatial units, is a key element of sustainable development" (Forman 1990:263).

Munasinghe and McNeely (1995) state that limits on the sustainable use of the environment are related to both additions of materials, such as carbon dioxide emissions, and subtractions of materials, for example deforestation. They continue to say that "the spatial nature of additions and subtractions leading to the overreach of a system's limits depend on the general type of environment" (Munasinghe & McNeely, 1995:29). Compare for example, the addition of harmful materials to the atmosphere, where the problem is not contained, to the addition of harmful materials to the terrestrial level, where impacts are felt mainly locally.

In a production function (such as the Cobb-Douglas production function: $Q=K^{1-\alpha}R^{\alpha}$, there is a relationship between an output (Q) and input. If either capital stocks (K) or resources (R) are run down to zero, then output is zero (Munasinghe & McNeely, 1995; Creighton University, 2000). Sustainability calls for the preservation of 'output' for future generation and that implies that the 'input' needs to be managed to ensure that current consumption does not exceed the natural increment. The challenge for environmental sustainability might be found in the words of Robert Goodland from the World Bank Group: "Natural capital must be maintained, both as a provider of inputs, and as a sink for wastes." As a 'provider of inputs' harvest rates of renewable resources must be kept within regeneration rates, while as a 'sink of wastes' it should hold waste emissions within the assimilative capacity of the environment without impairing it (Goodland, 1999).

We need to find more room for wild nature within the process of development. " The processes of wild nature renew the oxygen in the air, maintain the cycles of essential elements, sustain the fertility of the land, and regulate the flow of rivers. We turn to wild nature for new crops and new drugs as well as for the beauty that enriches life. Environmental protection and development are not opponents but are inseparably one" (Munasinghe & McNeely, 1995:32).

This chapter describes four ecological issues in greater detail. These include the Atmosphere, Water, Land, and Fauna and Flora. These issues are discussed with relevance to urban form and the South African situation. Each issue concludes with a set of recommendations for the planning and design of more sustainable communities and neighbourhoods.

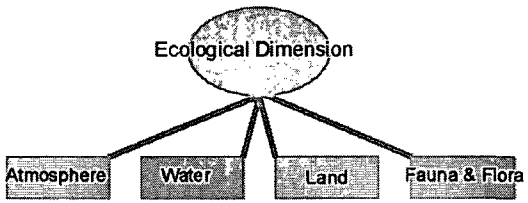


Figure 22: Issues related to the ecological dimension.

ATMOSPHERE.

Gas emissions.

Natural concentrations of so-called greenhouse gases in the atmosphere keep the temperature near the earth's surface about 30°C higher than it would be without these gases. The global temperature depends upon the balance between these gases and the chemical composition of the atmosphere.

In recent decades this balance has been affected by man-made emissions of greenhouse gases. Greenhouse gasses act as a one-way filter in the atmosphere. Most of the radiation from the sun penetrates the filter, warming up the Earth's surface. The warm, infrared radiation from the Earth's surface does not penetrate the filter to the same extent, thus 'trapping' energy. This causes a gradual heating of the lower part of the atmosphere and a consequent increase in average global temperature, rising sea levels, shifting climatic zones, and extreme weather events (UNEP, 2001; Sheltair & Ramsay, 1999).

Carbon dioxide (CO_2) is one of the greenhouse gases that are increased by human activity. CO_2 emissions are occurring at a rate 60% higher than can be neutralised by the biosphere and these emissions contribute to more than 50% of the increased greenhouse effect (Sheltair & Ramsay, 1999; UNEP, 2001). "Air emissions from transportation are one of the most significant contributors of carbon dioxide emissions. The seriousness of the potential effects of increased global warming ranks this issue as one of the most pressing threats to long-term life on the planet" (Sheltair & Ramsay, 1999:79).

Though CO_2 might be one of the pressing concerns, transportation also contributes to the accumulation of a variety of other gasses in the atmosphere, each with a variety of impacts (EPA, 2001; UNEP, 2001). Car dependence is a major challenge for a healthy atmosphere and "the most effective and viable way to preserve clean air is to reduce the quantity of cars on the road and to reduce the distances they travel" (Sheltair & Ramsay, 1999:79).

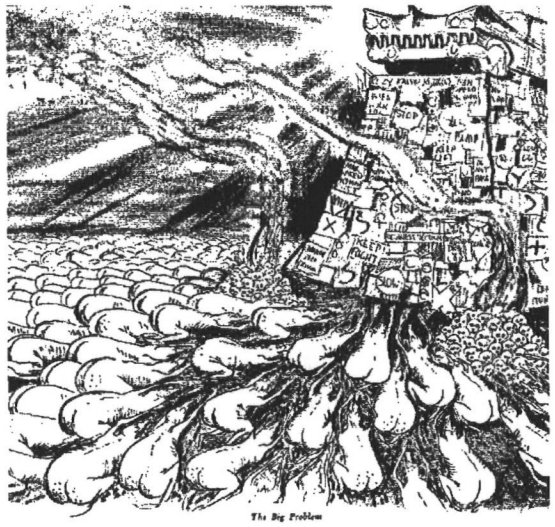


Figure 23: The problem of car dependency in society depicted in a comic. (Taken from Hedman & Bair, 1967)

However, between 1972 and 1996, the number of cars in South Africa increased by 72%, and forecasts suggest that numbers will increase again by 64% between 1996 and 2020 (Department of Transport, 1998). Apartheid era spatial planning created long distances and decentralised nodes within urban areas. This, combined with good road networks, has encouraged car dependency (Department of Transport, 1998). Factors such as low car operating costs, land use patterns, poor public transport alternatives, and infrastructure investment in roads are fuelling this trend (Department of Transport, 1998).

Figure 24 illustrates the relatively low-income levels at which South Africans begin to use cars as their primary mode of transport. Research indicates that "once household income rises above R30,000 per annum, car use begins to dominate. The result is a situation with a much higher than average vehicle population per capita among middle-income groups, compared to other developing countries" (Department of Transport, 1998). This results in an increased reduction in the quality of public transport and increased car-related problems such as congestion and pollution. Since many of the vehicles are old and poorly maintained, the resulting emission levels are much higher that average (Whyte, 1995:90),

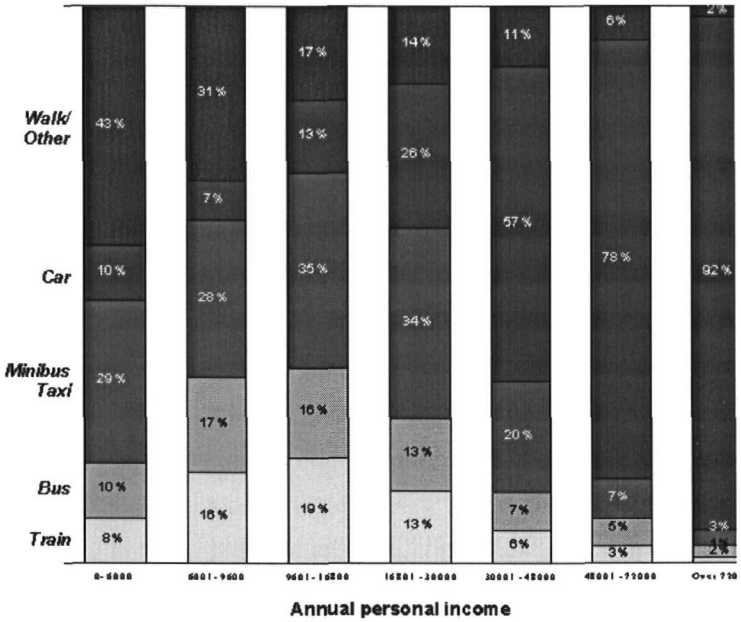


Figure 24: South African transportation modes used per income group
(Taken from Department of Transport, 1998)

Particulate matter.

In addition to harmful gasses, motorised transport also contributes to increased particulate matter. Particulate matter is the term for particles suspended in the air, and include dust, dirt, soot, smoke, and liquid droplets. Particles can be suspended in the air for long periods of time. Some particles are large or dark enough to be seen as soot or smoke. Others are so small that individually they can only be detected with an electron microscope.

Another major source is barren soil, which is often a problem on construction sites, tilled fields, and unpaved roads where wind can easily pick up dust and dirt and suspend it in the air (EPA, 2001). Dust particles are of particular concern in an arid country such as South Africa, where vegetation cover diminishes during the dry winter months. Prevailing winds pick

Figure 25: The barren dusty landscape that accompanies typical low-cost housing construction.
(Taken from Department of Housing, 1999)

up dust particles and carry them over long distances. Poor construction practices aggravate this situation further as sites are typically cleared of all vegetation prior to construction (see Figure).

Particulate matter reduces visibility, and this in turn reduces the urban aesthetic value. Particles settle on, or even stain and damage objects (EPA, 2001). Many scientific studies have linked inhaling particulate matter to a series of significant health problems in humans (EPA, 2001). The effects of particulate matter are not only local. Particles can be carried over long distances by wind and then settle on ground or water. This impacts of the health of the ecosystem as diversity is reduced, lakes and streams becomes more acidic, nutrient balances change in coastal waters and large river basins, and soil nutrients are depleted (EPA, 2001).

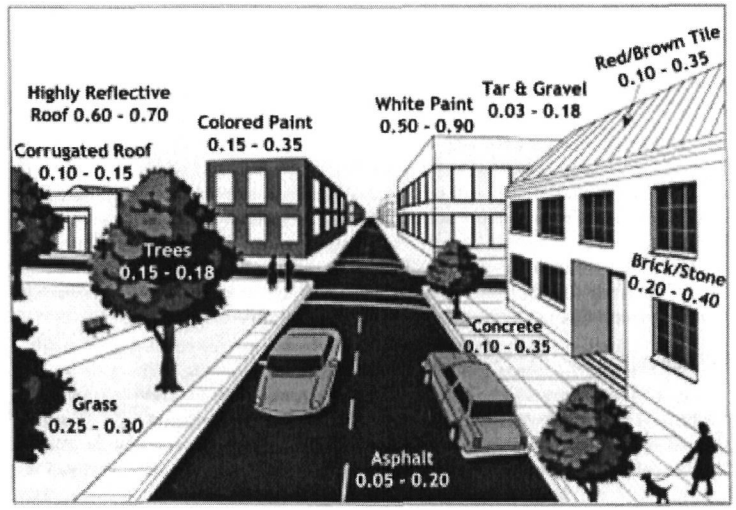


Figure 26: Various albedo-levels in the urban environment.
(Taken from GHCC, 1999)

Climate.

Much of the solar energy that strikes vegetation is used for metabolic processes. Plants use moisture for controlling their own temperature and then release any excess moisture, thus cooling the surrounding air (EREN, 2001). In a city however, plants are replaced with surfaces such as asphalt, brick, and concrete that have far lower albedo-values (see figure 26). The albedo is a measure of the amount of solar energy reflected by a surface (GHCC, 1999). A low albedo implies higher surface temperatures since larger amounts of energy are absorbed. These surfaces have a low reflective capacity, so they absorb and store solar energy instead of reflecting it. Typical urban surfaces, such as concrete and asphalt, get much hotter than vegetated surfaces during the day. The increase of such surfaces in the urban environment increases the amount of heat retained in the city and so creates a dome of warmer air over the city, known as the Urban Heat Island effect (see figure 27).

South Africa falls squarely within the subtropical belt of high pressure, making it dry, with an abundance of sunshine. Temperatures above 32°C are fairly common in summer, and frequently exceed 38°C in some locations (South African Embassy, 2001). These high

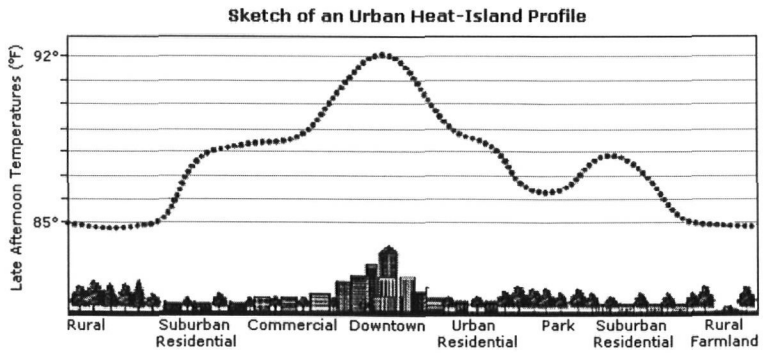
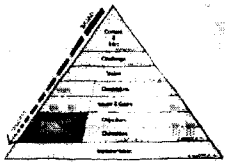


Figure 27: An urban island profile.
(Taken from GHCC, 1999)

temperatures, combined with the heat island effect, raise concern in urban areas. Not only does it impact on human comfort, it also contributes to more serious consequences such as heat exhaustion. The excessive heat found in urban areas causes a greater need for air-conditioning and a concomitant increase in energy and air pollutants from increased electricity demands.

Recommendations.

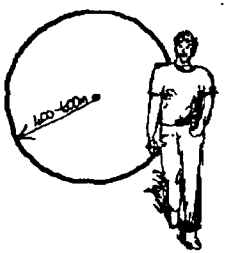
Goal: Facilitate design that responds to the local climate and that maintains good air quality.



Objective: Reduce the contribution of particulate matter and gas emissions in the air.

Design Guidelines:

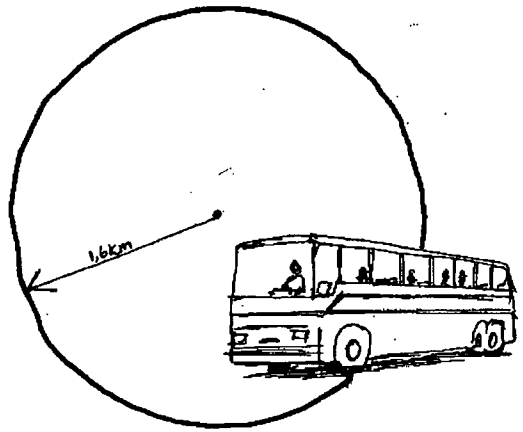
1. Walking & Cycling ~ Promote walking and cycling, by designing walkable neighbourhoods with access to basic amenities and needs within 400-600m from homes, and by establishing small pedestrian scaled blocks (100-150m), and local and regional circulation paths.



If we are to reduce car use, there will have to be other commuting alternatives in order to maintain mobility. Such alternatives should, however, have less impact on the environment (Sheltair & Ramsay, 1999). Probably the most effective solution is to move away from motorised transportation to incorporate non-motorised options like walking and cycling that cause no obvious increase in air pollutants. Research shown that at distances less than 400-600m (10min walk) the vast majority of people will walk, but at distances of 1km most car-users will rely on their cars instead (Barton *et al*, 1995; Frey, 1999; Calthorpe, 1993). Therefore it is necessary that basic amenities are provided closer to the home within 400-

600m walking distances and circulation networks should incorporate pedestrians and cyclists. Pedestrians need a fine grain of pathways that allow them to get to their destination via the most direct route (Cervero, 1996). Street blocks of 100-150m are recommended for pedestrian permeability and mid-block pathways should be used where larger block occur (JTC, 1998). Generally the local road network will provide sufficient permeability for cyclists, but accommodating these users along major roads can become a concern. Roadways should accommodate cyclists in cycling lanes on the shoulder of the road where possible or where space allows for it. These users can be provided with dedicated pathways next to sidewalks, or in combination with wider sidewalks. Continuous pathway connections should also be encouraged along open space systems (greenways) that link bicycle and pedestrian paths, to public facilities and regional centres along these open space spines (Calthorpe, 1993).

2. Public transport ~ Promote the use of public transportation, as a more environmentally friendly transportation alternative, by providing access to the local transportation network within 400-600m from the home, and access to the regional transit network within 1.6km.



Over longer distances the incentive to drive increases and yet, such longer distances seem unavoidable in modern society (Sheltair & Ramsay, 1999). Beyond the walkable neighbourhood, motorised transportation is a given, but through the use of public transportation, instead of cars, the amount of pollution per capita can be reduced. To increase the incentive to use public transit, a transit stop will have to be provided within a 400-600m walk from the home (refer to guideline 1). This transit network should connect people to the community core and regional transportation network so that their travel does not exceed 5min or 1.6km (Calthorpe, 1993).

3. Proximity & mix ~ Reduce car travel by locating houses, amenities, and employment closer to one another and mixing them within the same community.

The sprawling Apartheid pattern created a coarse grain of fragmented, isolated land uses. This caused a large segment of the population to be located far away from amenities. As the distance to amenities increases, so does the incentive to drive (Sheltair & Ramsay, 1999). This causes people to commute long distances between different land uses as they drive back and forth between their home, jobs, shops, and other uses located outside their residential 'cells' (PlannersWeb, 2000). To reduce the amount and length of commutes, a finer grain of uses is necessary. This would facilitate the move away from current single-use zoning practices, and recognise that some uses can live harmoniously side-by-side. Mixing uses in a finer grain and thus locating them closer to one another and to the home could reduce the number of trips, their lengths, and consequently pollution.

4. Mixed-use center ~ Create a mixed-use commercial center around major transportation stops, where a fine grain of uses occurs within a street, block or even vertically within a building.

Research has found that mixed-use commercial development around a transportation node is the most effective way, to reduce car use and increase public transit use (VTPI, 2001). This strengthens the concept of a fine grain of mixed uses within a community even further by encouraging mixed uses on a micro-scale where it can vary within a street, block or even a single building.

5. High-income housing ~ Locate high-income housing closer to amenities and public transit stops, to reduce the incentive to drive.

Individuals with higher incomes seem to have a greater incentive to use the car (see figure 24). Unlike medium- or low-income families, this segment of the population is less likely to walk, cycle, or use transit if they live on the periphery of the walkable neighbourhood. Higher market values can also be expected around viable economic centres, which make these locations more viable for the high-income buyer.

6. Ground cover ~ Drought tolerant ground cover should be established on areas that are not covered by development.

Ground cover can prevent soil particles from becoming airborne, but if the plants deteriorate in the dry winter months they are of little use. Therefore, the use of drought tolerant species is almost a necessity in the arid South African climate. Although not restricted to indigenous plant species, these plants might provide a more suitable palette to use, due to their natural adaptability to such conditions (see guideline 34).

Objective: Maximize the remediation of pollutants in the air.

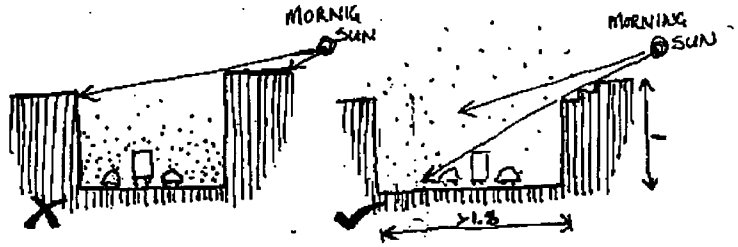
Design Guidelines:

7. Roadside vegetation ~ Establish street trees, and where possible, mixed vegetation along roads to filter particles from the air.

Plants "cleanse the air through the process of photosynthesis, which controls air pollution through oxygenation and dilution. The ability of plants to introduce excess oxygen into oxygen-deficient air serves to readjust the balance. Plants also absorb pollutants directly into their leaves and assimilate them" (University of Georgia, 1999). In addition to the choice of plant

specie, certain plant arrangements can also be more effective in reducing pollution than others. For instance, plant groupings of mixed species, that include a layered structure and ground cover, are more effective than trees alone (Spirn, 1984).

8. Street canyons ~ For buildings located on the northern side of the street, maintain a building-height:right-of-way ratio greater than 1:1.8 and where taller buildings are required, they should be terraced, in order to increase solar access onto roads and to avoid trapped pollutants.



High buildings can prevent the ventilation of street canyons and often create an inversion that traps pollutants at ground level for most of the day. As the sun rises it heats up the air, but the cooler, more dense air at the bottom of the street canyon stays stagnant until noon when the sun is at an angle where it can heat up the polluted air and cause it to rise into the atmosphere (Spirn, 1984). To allow solar access onto streets, buildings that are located on northern side of the street should be limited in height and designed as terraces where heights are exceeded. Assuming an average 30° sun angle in South Africa, a building-height:right-of-way ratio greater than 1:1.8 is recommended to allow morning sun onto roads and minimise trapped pollutants.

Objective: Maximize design that responds to the hot South African temperature and reduces the heat island effect.

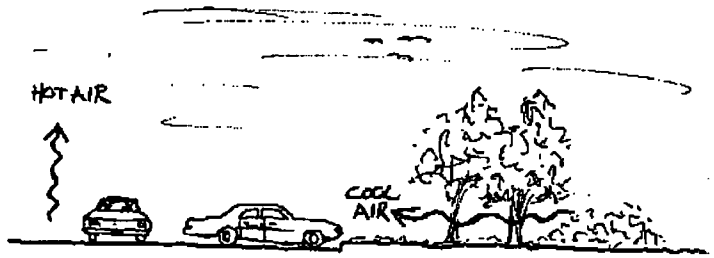
Design Guidelines:

9. Shade ~ Plant trees in parking lots and between the road and sidewalk.

Cool urban environments, through the use of trees in parking lots and right-of-ways, to create a shaded environment during hot summer temperatures. Trees between the sidewalk and

road, rather than between sidewalk and house, provide more shade on the road, street parking, and pedestrian- and cyclist paths.

10. Thermal breezes ~ Where large hard surfaces are unavoidable or existing, establish adjacent shaded parks that can stimulate light thermal breezes.

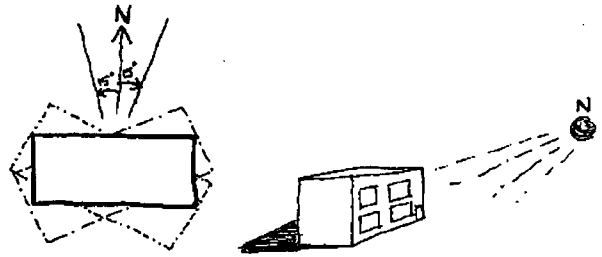


Where large heat absorbing surfaces like parking lots are unavoidable, they should be used in conjunction with adjoining shaded park areas. As the sun heats the hard surfaces, the hot air rises upward and is replaced by cooler air from shaded adjacent areas (Spirn, 1984). This can cause a light thermal breeze that helps cool the area.

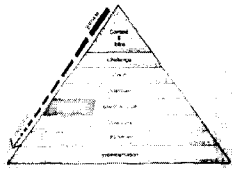
11. Albedo surfaces ~ Reduce the amount and scale of low-albedo surfaces, especially asphalt roads and parking lots, and maximize urban vegetation cover.

Low albedo-surfaces, such as asphalt roads and parking lots, should be avoided or reduced as much as possible. These surfaces absorb and retain heat from the sun and aggravate the already hot summer temperatures in urban areas. High-albedo surfaces should also be used recognition that they often reflect a lot of light causing glare. Vegetation is ideal as it has a high-albedo value but lacks the visual glare typical of a light coloured surface. It cools directly by shading and indirectly through evapotranspiration.

12. Building orientation ~ Orientate houses with the longest side and most windows facing North.



In the southern hemisphere houses should face north with ideally no more than a 15° variation while windows on west facing walls should be limited or avoided due to problems of overheating during the afternoon (USN, 2001).



WATER.

Surface water quality.

Water quality is important for the health of an aquatic system and can also affect human health when people are in contact with or drinking polluted water. Non-point source pollution is a major threat to water quality (Arnold & Gibbons, 1996). It is derived from contaminants washed off land surfaces through stormwater runoff, and then carried directly or indirectly into water bodies or groundwater (Arnold & Gibbons, 1996). Automobile dependence is one of the significant challenges to water quality as it results in the pollution of water bodies through the emission of pollutants onto road surfaces that drain into the water system (Sheltair & Ramsay, 1999). Pollutants from vehicles include crankcase oil, anti-freeze, tire rubber, brake dust, and petrol (Welsh, 1994). Roads have the highest pollutant loads for most land-use categories. Runoff from these surfaces is therefore one of the biggest threats to water quality and should be treated before being released into the aquatic system (Arnold & Gibbons, 1996).

Water quantity and speed.

"The stormwater flows and drainage form a key part of the earth's hydrological cycle, helping to maintain the ground water reserves and sustain plants and animals in both aquatic and terrestrial ecosystems" (Sheltair & Ramsay, 1999:7). As development increases, so does the amount of impervious surface that prevents infiltration of water into the soil. This sets off a chain of events that alters the hydrological cycle. "While roads and rooftops are the most prevalent...types of impervious surfaces, others include sidewalks, patios, bedrock outcrops, and compacted soil" (Arnold & Gibbons, 1996:244). As impervious coverage increases, the velocity and volume of surface runoff consequently increases, and there is a corresponding

decrease in infiltration as shown in figure 28 (Arnold & Gibbons, 1996). Studies show that "sprawl development, with its wide streets and large parking lots, can lead to storm runoff at a rate over 50% higher than the more compact development found in cities" (PlannersWeb, 2000).

The traditional engineering response to dealing with this increase in runoff is to dispose of it through the use of curbs, pipes, gutters, and channels (Arnold & Gibbons, 1996). Such a system of conveying water through pipes has three main drawbacks (Welsh, 1994). Firstly, pipes cause an increase in water speeds that result in increased peak flows and subsequent flooding. Secondly, pipes limit or eliminate any significant aquatic life and stop groundwater recharge, and finally pipes hide the water and all it's associated aesthetic, psychological, and functional attributes from the people. Pipes do however play an important part in the safety of the people (located upstream anyway) and are therefore an integral part of the urban system. They should, however, be used in combination with more natural approaches that allow maximum infiltration and retention.

South Africa is a semi-arid country where freshwater is the most limited natural resource. Evaporation exceeds precipitation in all cases and prolonged droughts are often terminated by severe floods. For this reason the Reconstruction and Development Programme (RDP) recognises drought management and water reserves as one of the country's priorities in the country (RDP, 1994:2.6.4). South Africa receives only around half the average rainfall of other countries (Department of Environmental Affairs and Tourism, 1999). The country has a mean annual precipitation (MAP) to mean annual runoff (MAR) ratio of 8.6%, meaning that, only 8.6% of the rainfall is available as surface water, which is due to the abundant sunshine and high evaporation rate. This is one of the lowest conversion ratios in the world, compared for instance to Canada and Australia, which have similar MAP figures but with ratios of 65.7% and 9.8% respectively (Department of Environmental Affairs and Tourism, 1999). Like surface water, South Africa's groundwater resources are relatively limited compared to world averages.

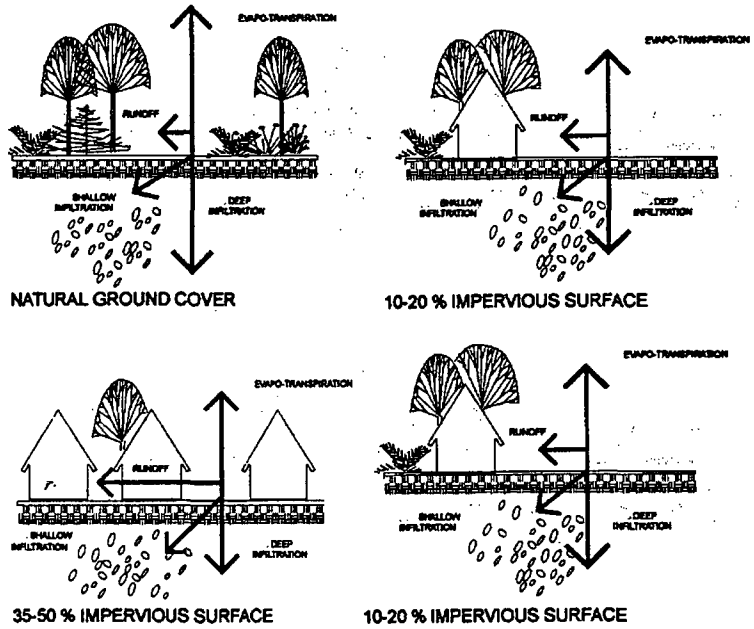


Figure 28: Alterations in hydrology associated with urbanization.
(Adapted from Arnold & Gibbons, 1996)

Groundwater is of significant importance as a main source for irrigation water in South Africa (South African Government, 2001).

The reduced amount of infiltration, that accompanies development, limits groundwater recharge that is essential for plants and streams as a source of water in dryer months (Arnold & Gibbons, 1996; Sheltair & Ramsay, 1999). The available runoff water is collected as fast as possible in engineering water disposal systems that deflect water away from aquatic water bodies that would normally depend on this source for recharge. The availability of water in South African aquatic habitats has been so severely changed, that little remains of the country's natural systems (Department of Environmental Affairs and Tourism, 1999). When water resources are not scarce, they are in excess. The large expanses of impervious surfaces in the urban environment combined with the rapid South African rainstorm, causes devastating floods. The increased volumes of water and sediment, combined with the rapidness of such discharges, lead to higher levels of soil erosion that destroy streamside habitat and cover in-stream habitat with a uniform blanket of sediment (Arnold & Gibbons, 1996). This high velocity stormwater also poses a great concern to public safety, especially those people living in floodplains and on river embankments.

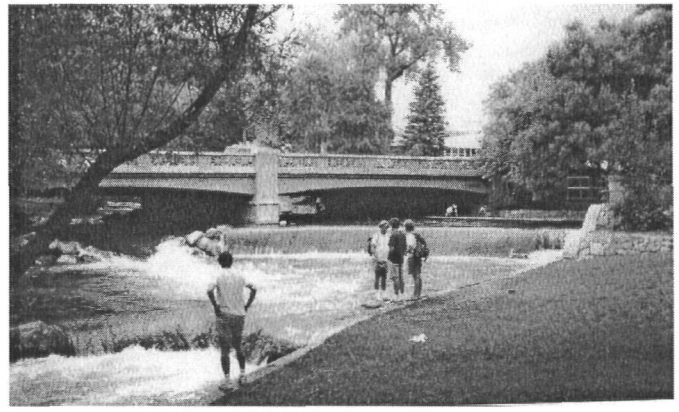


Figure 29: Rivers- a sight not common in urban areas.
(Taken from Smith, 1993)

At the present rate of population growth and economic development, it is unlikely that the projected use of water resources in South Africa will be sustainable. Water supply will become a major restriction to the future economic development of the country, in terms of both the amount available and the water quality (Department of Environmental Affairs and Tourism, 1999). The longer water stays on the surface, the more it is exposed to pollutants, sunshine, and the resulting evaporation. To combat this water should be filtered and directed into the ground as fast as possible. This will also assist in the reduction of urban runoff quantities that pose a flood hazard to many South African people.

Recommendations.

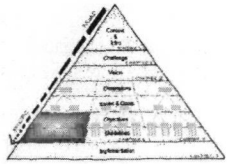
Goal: Manage the quality and quantity of urban runoff.

Objective: Reduce non-point source pollution.

Design Guidelines:

13. Vehicular pollutants ~ Reduce the amount and distances of motorised transportation trips per capita, and encourage walking, cycling, and public transit.

As with pollutants in the atmosphere, motorised transport is a major challenge for water quality, as it contributes pollutants that get washed into water bodies during rainstorms. As travel times and distances increase, more pollutants are released into the environment. Non-motorised alternatives, like walking and cycling, and public transportation options, that contribute fewer pollutants per capita, are important means of reducing vehicular pollutants (Refer to guideline 1-4).

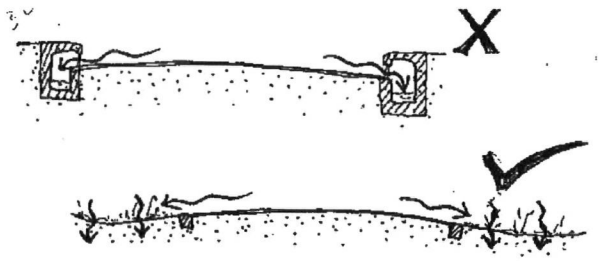


Objective: Maximize the filtration, retention, and infiltration of runoff water.

Design Guidelines:

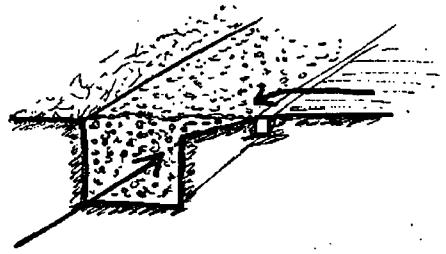
14. Curbs ~ Eliminate barrier curbs so that runoff from roads can be captured for roadside infiltration.

Barrier curbs collect runoff from the street and direct it into an underground stormwater system. In order to maximize roadside infiltration, it is necessary to eliminate curbs so that water can freely move into the ground rather than into a pipe.



15. Infiltration trenches ~ Incorporate infiltration trenches along roadsides to direct water away from the development while maximizing water infiltration below grade where it is sheltered from evaporation.

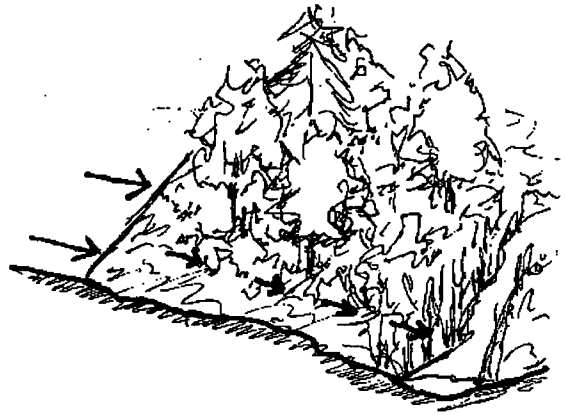
"An infiltration trench is an excavated strip of land that is then filled with porous material such as sand, stone, or another coarse aggregate" (Welsh, 1999:83). These trenches have considerable worth in reducing peak flows. "It temporarily stores water which can be infiltrated into the ground or directed to another outflow" (Welsh, 1999:30). It also helps replenish the ground water, and it can remove pollutants very effectively through adsorption into soil particles, and biological and chemical conversion in the soil (Welsh, 1999; BCLSS, 2000). Infiltration trenches collect water just below grade, reducing the vulnerability of the runoff to be lost to evaporation. Because they take up little land area and are not highly visible, they can be located close to residential and commercial areas. Where necessary, these trenches can be combined with pipes that carry excess water during major storms.



16. Temporary basins ~ Design parking lots, parks, and sport fields as temporary basins, that retain water during peak rainstorms.

To reduce flooding, dry detention basins temporarily detain a portion of the runoff for a specified length of time (BCLSS, 2000). Water is then slowly released back into circulation and the basins are allowed to dry out between major rainstorms. These basins also remove a limited amount of pollutants, by allowing particulates and solids to settle out of the water, but their use for this function is limited (BCLSS, 2000). Dry detention basins are mainly used to reduce peak stormwater discharges, control floods and to prevent downstream channel scouring (BCLSS, 2000). Parking lots, parks, and sport fields, that have limited use during bad weather, can be designed as temporary storage areas for runoff.

17. Filter strips ~ Direct surface runoff through wooded filter strips before releasing it into aquatic systems.

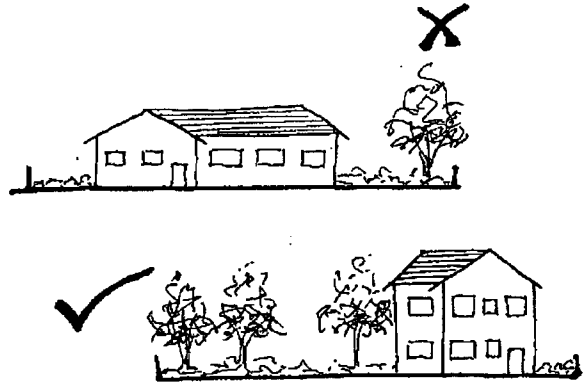


Filter strips are bands of close-growing vegetation, planted between pollutant source areas and water receiving areas (Welsh, 1999). They reduce pollutants such as sediment, organic matter, and many trace metals through the filtering action of the vegetation, infiltration of pollutant-carrying water, and sediment deposition (BCLSS, 2000). Trees in strips can be more effective than grass strips alone because of the trees' greater uptake and long-term retention of plant nutrients. Properly constructed forested and grassed filter strips can be expected to remove more than 60% of the particulates and perhaps as much as 40% of the plant nutrients in urban runoff (BCLSS, 2000).

Objective: Reduce the amount of impermeable surfaces.

Design Guidelines:

18. Roof coverage ~ Reduce the size of buildings and use multi-story development in order to reduce the amount of roof coverage and building footprint on the site.



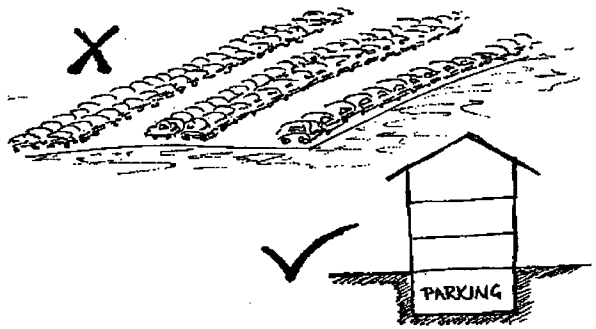
Together with road surfaces, roofs are one of the largest contributors of impervious surfaces in the urban environment (Arnold & Gibbons, 1996). It is therefore essential to reduce the roof coverage, by reducing the footprint of buildings. This necessitates smaller, multi-story buildings. Refer also to guideline 26.

19. Road coverage ~ Reduce road widths, by limiting lanes to about 3m, and reduce the amount of road coverage by incorporating 100-150m street blocks.

Road surfaces are one of the main contributors to site impermeability. Arnold & Gibbons (1996:251) state that "for virtually all land uses, one of the best design-related opportunities for

reducing imperviousness is through the reduction in road widths". 3m lane widths should be used, where appropriate, to reduce overall road widths (see guideline 62). Reducing a typical 10m wide road to a width of about 6m can result in a 40% reduction in road coverage. This equals approximately an 8% reduction in total site coverage when assuming the standard where 20% of a development is covered by roads (USN, 2001). The finer the grain of street blocks the greater the increase in site coverage and therefore in runoff. This conflicts with the needs of pedestrians that require a fine grain (see guideline 1). Although mid-block access is one solution to this conflict, the separation of vehicular and pedestrian paths should be minimised (see guideline 62). An optimum block size of 100-150m is recommended that can cater for the needs of the pedestrian, while minimising the amount of roads.

20. Parking coverage ~ Reduce the amount and size of impermeable parking lots and incorporate parking underneath buildings where possible.



The spatial dimensions required to accommodate the car, fill the urban landscape with large expanses of parking. Usually constructed from impervious asphalt, these surfaces produce large quantities of runoff that might be avoided if the parking were located underneath the already impervious buildings (see also guideline 27). Where surface parking lots are unavoidable, these areas should be broken into smaller lots, where the runoff can be managed more effectively in small quantities.

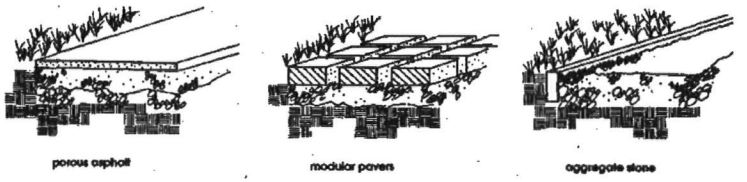
21. Density & Proximity ~ Increase residential densities and locate employment, education, amenities closer to the home.

The low-density sprawl contributes to excessive amounts of road coverage, as more roads are extended into outlying areas where they serve fewer people. By locating destinations closer to

the home, less traveling on extensive roadways is required, and higher densities ensure a more efficient use of roads per capita.

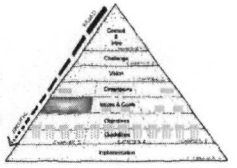
22. Porous surfaces ~ Substitute impervious surfaces with porous alternatives where possible.

Porous surfaces are intended to reduce imperviousness and surface runoff. These surfaces may be asphalt or concrete that lacks the finer sediment found in conventional concrete, or it can be modular, interlocking open-cell cement blocks, or even gravel (BCLSS, 2000). Such surfaces allow water into the soil and improve soil aeration (see guideline 30).



(Taken from Flink & Searns, 1993)

LAND.



Land consumption.

In the twentieth century the introduction of vehicles permitted and encouraged the dispersal of urban populations over the landscape at lower densities, consuming large expanses of land. A global comparison of 32 cities shows that automobile use is firmly imbedded in the structure of low-density cities, with the resultant wasteful use of land (Newman & Kenworthy, 1989). The car has an enormous spatial demand that is about 25 times higher than the spatial requirements of a human being. This is exacerbated even further when the car is in motion (Warren, 1998). As a result, today's urban landscape is an expansive mosaic of development that spreads into the landscape in order to accommodate the car with impermeable parking lots and multi-lane roadways. From the air one can see that as sprawl increases, open land within and between urban areas decreases.

"Sprawl does not make efficient use of the available land. Instead it spreads over expansive areas at low densities and in doing so, destroys valuable farmland, scenic landscapes and wildlife habitat" (PlannersWeb, 2000). According to Warren (1998) it is often the choicest farmland, forests, and scenic lands that are built upon, since those very qualities made them desirable for human inhabitation and development in the first place. New development in South Africa frequently occurs on the urban periphery, where it spreads into 18,000ha of agriculturally- and economically important land annually (Van Ameringen, 1995; South African Government, 2001).

Figure 30: Vast areas of land being consumed by development.
(Taken from Newman & Kenworthy, 1999)

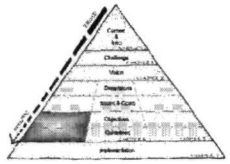
Soil quality.

Impermeable surfaces not only restrict water penetration, but also remove vegetation. Vegetation is an important contributor to both soil stability and soil fertility. The increased runoff in urban areas combines with poor soil stability, and washes away tons of valuable topsoil. In South Africa alone, an estimated 500 million tons of topsoil is lost annually through erosion caused by water and wind (South African Government, 2001). The average soil loss is 2.5 ton per hectare per year, with a maximum of 60 ton per hectare per year. This is more than eight times the rate of soil formation, and is clearly unsustainable (Department of Environmental Affairs and Tourism, 1999).

Whyte expressed the view that the "construction methods used by developers in low-cost housing projects have added to land degradation. Often an area of land zoned for low-cost housing is cleared of all vegetation and graded flat before construction begins (see figure 25). This results in the loss of topsoil and vegetation, and an increase in erosion" (Whyte, 1995:85). In addition, the loss of vegetation reduces soil aeration and increases vulnerability to compaction. These barren, compacted surfaces further contribute to particulate matter in the air and exacerbate urban runoff problems.

Recommendations.

Goal: Protect the land against the impact of urban development.



Objective: Reduce the amount of land being consumed by new development.

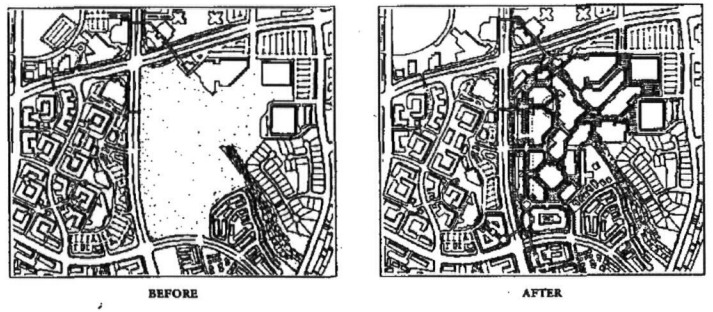
Design Guidelines:

23. Urban boundary ~ Restrict the low-rise horizontal spread of urban development into undeveloped peripheral land and locate new developments within the existing urban boundary.

New development should occur within the existing urban growth boundary, to avoid development into undeveloped land on the urban periphery. Strategies such as infill development and redevelopment should be used to utilise already disturbed land. Refer to guideline 0-25.

24. Infill ~ Infill new development in undeveloped, or underdeveloped parcels.

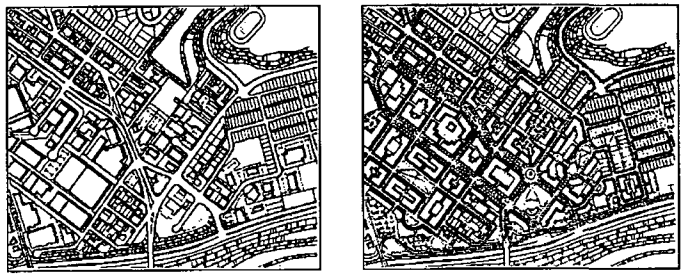
Infill sites are undeveloped parcels of land that are usually surrounded by existing development, but that have been 'skipped over' by development in the process of growth (Calthorpe, 1993). This does not imply that all available open spaces within urban areas should be developed, but it aims to develop those sites that were designated for development but were left undeveloped or underdeveloped as circumstances directed development elsewhere. The scale of infill can vary and may be as small as infilling a single unit on an individual lot.



(Adapted from Calthorpe, 1993)

25. Redevelopment ~ Redevelop underutilised or abandoned urban areas with uses that can revive the area.

The urban environment is a mosaic of development that varies in age, use, and popularity. Current development might not be useful to future generations or even current generations. Such sites can be redeveloped over time in order to revive an under-utilised area or to give old abandoned areas a new life. "Buildings must always be built on the parts of the land which are in worst condition, not the best" (Alexander *et al*, 1977:509).



(Taken from Calthorpe, 1993)

26. Building footprint ~Reduce building size and use multi-story buildings to make more effective use of land.

The typical single story low-rise development, found in South Africa, causes buildings to spread horizontally over large expanses of land. Smaller buildings and/or multi-story buildings should be used, to reduce land consumption. Refer also to guideline 18.

27. Basements ~ Make more effective use of land through the use of basement construction, especially for parking.

Basement construction can be used to provide additional building space without consuming extra land. Parking lots that usually consume large expanses of land can be located in these basements (see guideline 20).

28. Density ~ Increase residential densities, to reduce land consumption per capita.

Low densities, cause development to spread over large expanses of land. To reduce the amount of land that is being consumed, residential densities should be increased. The South African government promotes "higher density in respect of housing" (USN, 2000).

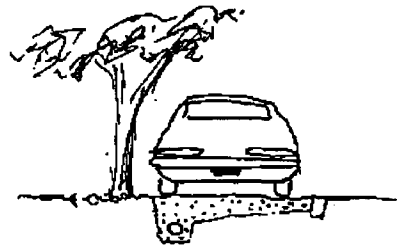
29. Vehicle dimensions ~ Reduce car dependency and limit road- and parking coverage.

Car dependency causes an increased consumption of land and large areas are being covered by roads and parking. To reduce the amount of land that is being consumed, car dependency, and road- and parking coverage, will have to be reduced. See guideline 1-4,19-20.

Objective: Minimise the impact of new developments on soil quality, fertility, and stability.

Design Guidelines:

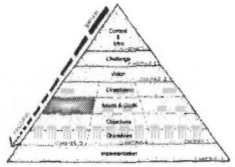
30. Breathable, permeable surfaces ~ Reduce site impermeability and use vegetation or porous surfaces that allow air and water into the soil.



Water and air are the most basic elements needed by living things, including plants. With soil as the growth medium for plants, it is important that soil provides water and air to the roots. Hard surfaces in the urban environment cover soil like a plastic layer, restricting soil aeration and the flow of water into the soil. To maintain good soil quality it is therefore important to maximize vegetative cover and permeable surfaces to allow aeration and infiltration. Refer also to guidelines 18-22.

31. Vegetation cover ~ Maximize the use of vegetation to contribute organic matter to the soil as compost and to cover to protect the topsoil from erosion.

Decomposing plant material contributes fertile compost to the soil that reduces its vulnerability to compaction, and improves the water retention capabilities of the soil. The fine root system and leaves from vegetation cover, also establish a fabric-like cover in the top layer of the soil. This keeps topsoil from being blown away by wind or washed away by runoff.



FAUNA AND FLORA.

Biological diversity and productivity.

Within an ecosystem there are many parts, or layers of biological activity. To disrupt the life cycle of one layer is to potentially disrupt the lifecycle of associated layers. This threatens the functional integrity of the overall system (Sheltair & Ramsay, 1999).

In a conversation with Richard Forman, Thorne (1993) discovered that ecological integrity (health) is characterised by natural levels of plant primary productivity, and a high level of native biological diversity. The Net Primary Productivity (NPP) of an area is a measure of the total biomass weight of that area for the year. The NPP is directly linked to the amount of vegetation (and animals to a smaller extend) present in that area (Mooney, 2001). As discussed earlier, the benefits of vegetation include reducing the impact of the heat island effect and energy consumption, reducing the amount of carbon dioxide and free pollutant particles in the air, and increasing soil fertility and stability.

Biological diversity or biodiversity is an expression used to describe the richness or variety of living organisms found in an area or type of environment. Biodiversity includes genetic diversity (the genetic variation within each species), species diversity (the different species in a given area), and the habitat diversity of ecosystems (UNEP, 2001). As development consumes open land, habitats and diversity of all sorts of life, including birds, mammals, reptiles, insects, fish, and plants are reduced. The elimination or change of habitats is the leading cause of loss of biodiversity (UNEP, 2001). Edward Wilson (1984:121) conveyed the urgency of this process when he stated that "the one process now going on, that will take millions of years to correct, is the loss of genetic and species diversity by the destruction of natural habitats. This is the folly our descendants are least likely to forgive us". The introduction of non-native or alien species to habitats also causes severe problems, including diseases and increased competition (UNEP, 2001). To improve biodiversity we need to

improve the habitat quality and the range of habitat types and conditions in an area so as to attract a greater and wider variety of animals and plants (Sheltair & Ramsay, 1999).

"South Africa has among the world's greatest diversity of plant and animal species contained within one country and is home to many species found nowhere else in the world...According to the White Paper on the Conservation and Sustainable Use of South Africa's Biological Diversity, published in 1997, South Africa ranks as the third most biologically diverse country in the world and is of major global importance for biodiversity conservation" (South African Government, 2001).

The urban landscape however, preserves little of this splendour. Historically, the overpopulation and low-income construction methods used in the township has resulted in barren fields of dust, threatening the health of the people and the environment (see figure). According to Whyte (1995:89) "there is a severe lack of green space in black townships, resulting in a lack of recreation areas and a shortage of vegetation to perform environmental services such as filtering air and water, and providing habitats". In the historically white suburbs on the other hand "streets, parks, and suburban gardens are planted with predominantly exotic plants that often require large quantities of water during dry months and contribute little to the preservation of South African flora or the provision of habitat for indigenous fauna." Invasion by alien species of plants and animals is a major problem in South Africa. Alien organisms can replace large numbers (even whole populations) of native animals and plants, and use greater quantities of scarce water resources (Department of Environmental Affairs and Tourism, 1999).

Open spaces within urban areas are under a lot of pressure to be developed. The Reconstruction and Development Programme (RDP, 1994) housing subsidy scheme requires municipalities to provide a fair share of low-income formal houses within their municipal areas. This has caused sudden financial stress on local authorities that are now selling public open space in an attempt to boost their finances (Whyte, 1995). Such financial pressure makes it difficult to preserve the open spaces within urban areas.

Figure 31: The rich diversity of South African fauna and flora. (Taken from Calendar, 2001)

Fragmentation.

Human encroachments, such as urban settlements, roads, clear-cutting of forests, dams and mass tourism, not only reduce the size and number of the remaining natural areas but also cause habitat fragmentation (see figure 32). This results in open space configurations or arrangements that are poorly suited to maintaining ecological function (Smith, 1993). Fragmentation is destructive in that it increases edge habitat and causes greater isolation between patches (Labaree, 1992). Edge habitat is an area of transition between two types of land cover. The edge habitat that results from human activity can be disruptive to the ecosystem. While some species are adapted to edge habitat, there are many species which require interior spaces, shielded from the influence of surrounding lands (Flink & Searns, 1993). Fragmented landscapes may be so small and narrow that they have no interior habitat at all (see figure 33).

In addition, human development cuts the connections between green spaces causing the formation of isolated green patches and the species that are trapped within them. This limits the migration and movement patterns of species, making them more vulnerable to genetic interbreeding and localised extinction (UNEP, 2001; Smith, 1993). Fragmentation not only cuts individuals off from other habitats but it also makes it harder for them to sustain their populations by creating barriers between potential mates. Thus, development causes a reduction in biodiversity, productivity, and ecological integrity (NWF, 2001).

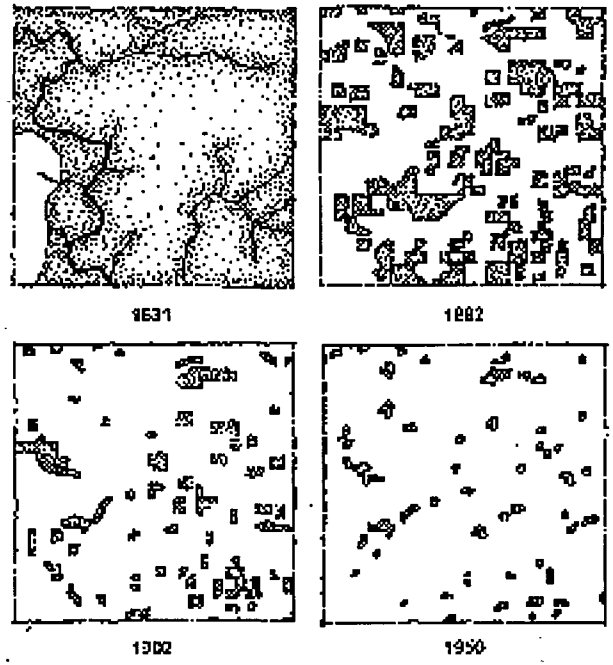


Figure 32: Fragmentation of habitat in urban areas over time.
(Taken from Smith, 1993)

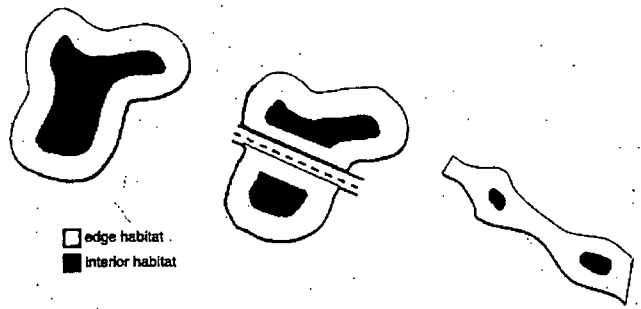
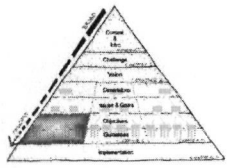


Figure 33: A decline in interior habitat and -species.
(Taken from Flink & Searns, 1993)

Recommendations.

Goal: Maintain ecological integrity in urban areas.

Objectives: Maximize biological diversity and biological productivity in urban areas.

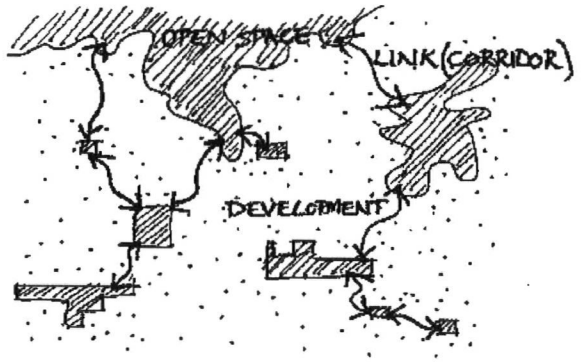


Design Guidelines:

32. Habitat sizes & types ~ Incorporate a wide range of habitat types and sizes to maximize the biodiversity and productivity.

Various plant and animal species prefer various habitat conditions. By maximizing the variety of habitat sizes and types, a wider diversity of species can be encouraged to reside in the area. The availability of larger habitats also ensures a greater presence of interior species that are typically scarce in urban areas.

33. Movement corridors ~ Link green spaces with one another into a continuous network, that can serve as wildlife movement corridors.



Corridors have been evoked as tools for the conservation of biological diversity since the advent of the Island Biogeography Theory in the late 1960's. The theory predicted that small, isolated patches of habitat, that resemble islands, would experience high extinction rates and low immigration rates (Noss, 1993). Corridors that link these islands with one another, provide habitat for plants and animals, and serve as a conduits for movement. These corridors permit daily and seasonal movements of animals, facilitate dispersal, and allow the long-distance range shifts of species (Noss, 1993). They maintain biodiversity by facilitating the recolinization of local extinction sites.

Objective: Reduce the impact and pressure of urbanisation on fauna and flora.

Design Guidelines:

34. Sensitive areas ~ Avoid development on ecologically sensitive areas.

Some areas in the city could be important ecological areas that for instance contain threatened plant- or animal species. Such areas have significant ecological value and are sensitive to human activity. They should be identified, and development on these areas should be avoided.

35. Native species ~ Use indigenous plant species wherever appropriate.

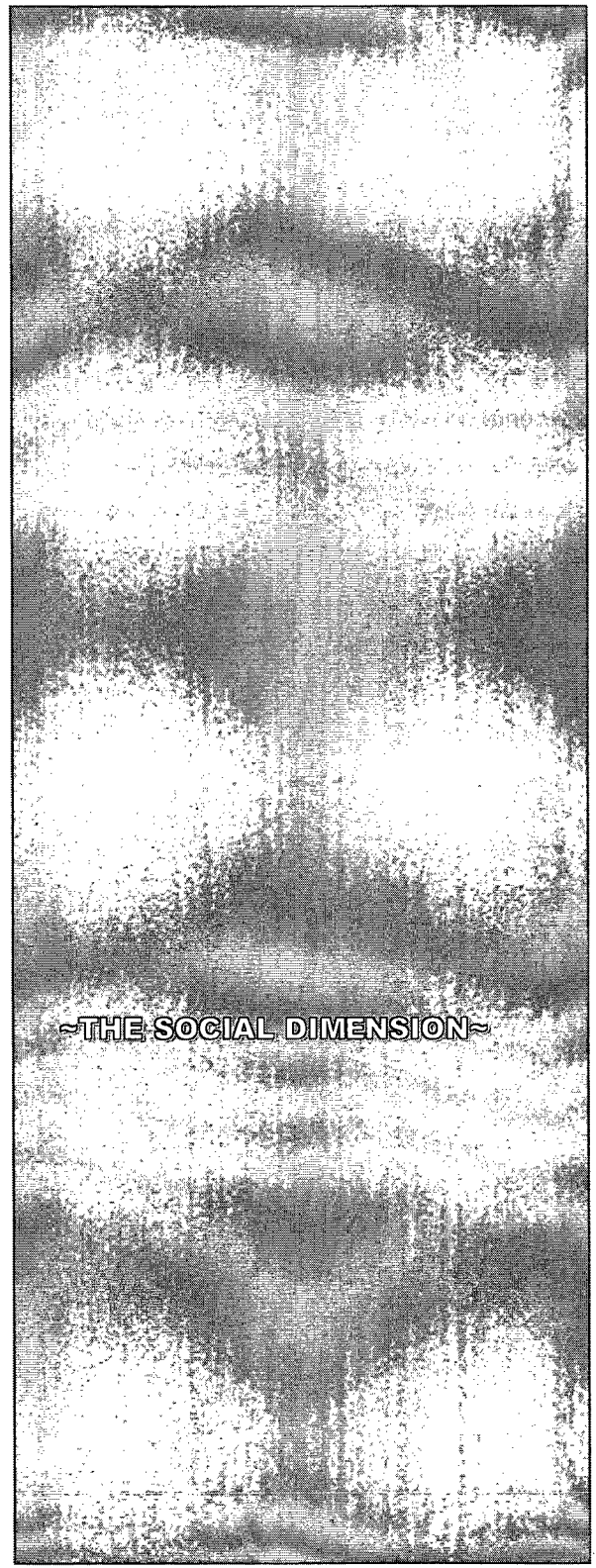
This does not deny the use of exotics as part of the ecosystem, but it recognises the presence of exotic species as an integral part of private urban gardens. It promotes the use of indigenous species in the public realm wherever they might be appropriate to the circumstances in order to reduce the impact that exotic plant species have on the integrity of native species and on the water resources in South Africa.

36. Valuable nature ~ Encourage intimately scaled open space to ensure ownership over spaces, and incorporate interest groups (such as schools) or income-generating uses (such as restaurants) that are associated with these spaces.

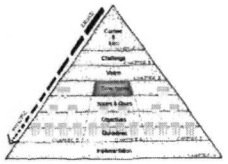
Open spaces in urbanised areas are under a lot of pressure to be developed, especially where these spaces are located on prime land in popular development areas. The cost to municipalities, that need to maintain these open spaces, is another factor that makes it tempting to sell these spaces to developers. However, such urban open spaces in the city are necessary for animals and plants to survive, and as an asset to people (see guideline 50). Encouraging more intimately scaled open spaces will cause people to take a sense of ownership over these spaces and to resist proposed redevelopment (CSIR, 2000). The association of other uses, such as restaurants, schools, and even office parks, can help subsidise the costs to municipalities that have to maintain these parks.

37. Land consumption ~ Promote nature as an integral part of the community and reduce the amount of habitat that is being consumed through development.

In urban areas, there is an ongoing competition for land between 'development' and 'nature'. As development consumes more and more land, the open spaces within the city are reduced and nature is pushed to the edges of the city. Land consumption is directly linked to the loss of vegetation and consequently animals that rely on the plants for shelter and food. To ensure the survival of open spaces within urban areas, the horizontal spread of development should be restricted (see guidelines 23-27). "Natural habitats [should be] protected and natural features [should] become an integral part of the community. These resources should be treated as key amenities rather than as edges to developments" (Calthorpe, 1993:72).



CHAPTER 4 ~THE SOCIAL DIMENSION~



AN OVERVIEW OF THE SOCIAL DIMENSION.

"Social sustainability refers to the on-going ability of a community to function as a safe, healthy, and viable setting for human interaction, education, employment, recreation, and cultural development" (Sheltair, 1998:22).

A fundamental characteristic of The Brundtland Report's definition of sustainable development is the concept of inter- and intra-generational equity (Maclaren, 1996; Munasinghe & McNeely, 1995). Inter-generational equity embraces the notion that the current generation has a social (or moral) responsibility to protect resources so as to provide for future generations' needs. Intra-generational equity on the other hand refers to the relationship among people of the current generation. Society is a composite of diversities – different people, classes, races, religions, genders, social groups and so on. These social diversities form the basis for social sustainability, which aims to preserve social diversity through the recognition of human rights and equal opportunities for all.

"Social sustainability is strongly reflected in the degree to which inequalities and social discontinuity are reduced" (Stren & Polese, 2000:14). The opposite of social sustainability might be seen as 'exclusion' where certain groups are physically, politically, and socially isolated and 'excluded'.

Robert Goodland from the World Bank Group has stated that social sustainability refers to maintaining, "shared values and equal rights, and [to] community, religious and cultural interactions" (Goodland, 1999). It aims towards the integration, as opposed to exclusion, of diverse groups and cultural practices in a just and equitable fashion (Stren & Polese, 2000:3).

"To achieve social sustainability, [we] must reduce both the level of exclusion of marginal and/or disadvantaged groups, and the degree of social and special fragmentation that both encourages and reflects this exclusion pattern...Policies conducive to social sustainability must, among other things, seek to bring people together, to weave the various

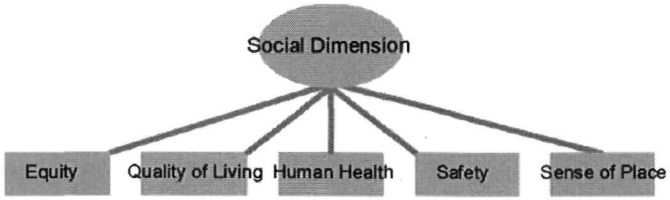
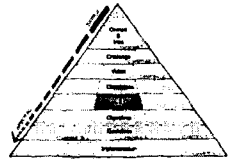


Figure 34: Issues related to the social dimension.

parts of ...into a cohesive whole, and to increase accessibility (spatial and otherwise) to public services and employment, within the framework...which is democratic, efficient, and equitable" (Stren & Polese, 2000:15).

This chapter describes five social issues in greater detail. These include Equity, Quality of Living, Human Health, Safety, and a Sense of Place. These issues are discussed with relevance to urban form and the South African situation. Each issue concludes with a set of recommendations for the planning and design of more sustainable communities and neighbourhoods.

EQUITY.



Social equity.

The dictionary defines equity as the "ideal of being just, impartial, and fair " (Lexico, 2001). This definition is parallel to the meaning of democracy and equity is therefore an integral part of the new South African vision. A socially equitable society can be described as a democratic society in which discrimination in terms of age, gender, class, race, religion, and ability is minimised (Maclaren, 1996). Social equality aims at achieving equal rights for all people, no matter who they are. This achievement is central to the new democratic Constitution (1996), however the long-term effects of the inequitable urban form persist.

The sprawling South African Apartheid pattern and accompanying car dependence have isolated people by age, class, and race – the young from the old, the rich from the poor, whites from blacks. This pattern heightens racial disparities and intensifies economic polarisation. The Environmental Justice Resource Centre (2001) found that "sprawl-fuelled growth is widening the gap between...the 'haves' and 'have nots' and is pushing people further and further apart geographically, politically, economically, and racially".

To achieve a democratic society, the inequitable development patterns will have to be addressed. In Powell's words: "fragmentation and sprawl may be the most important impediments to racial justice as we approach the millennium...I am not suggesting that by simply addressing fragmentation and sprawl we will achieve racial justice. However, without addressing these issues, it is highly unlikely that we will make much progress towards that goal" (Powell, 1999).

Development in urban areas currently aggravates segregation. Schoonraad (2000) states that the mono-functional character of neighbourhood developments and the lack of diversity in lot sizes and housing types aggravate socio-economic segregation. The residential developments undertaken in Mamelodi township since 1990 consisted entirely of detached houses and in Centurion suburb only 9% of its neighbourhoods had more than two residential typologies while only 2% contained a mixture of uses (Schoonraad, 2000). This limited range, allows little opportunity for people of various income and age to integrate. The bulk provision of low-cost housing by the government is also contributing to class segregation, resulting in areas with concentrations of poverty and poor geographic access to urban opportunities and provision.

Figure 35: Social integration in a more equitable society.
(Taken from Newman & Kenworthy, 1999)

Geographic equality.

A geographically equitable society might be described as one where all people have access to benefits and services such as employment opportunities, basic amenities, and transport. The geographic segregation of different groups made it possible to impose geographic inequalities where certain areas were extensively provided with amenities and services while others had none. Geographic inequalities are closely linked to social inequalities in South Africa where geographic exclusion of certain racial groups has been used as a tool to enforce racial discrimination under the Apartheid policy.

During the Apartheid era, government policy was aimed at denying the majority of South Africans access to urban opportunities and amenities (Department Of Housing, 1997). "Current urban development patterns [in South African cities] are often unsustainable, exacerbating the level of inequality and poverty and generating a range of economic, social and environmental costs which are largely borne by the lower income groups, and more specifically women and children" (Department of Housing, 1997:4). The RDP (1994) states that "in all aspects of our society there is great inequality – in schooling, health, welfare, transport, housing, and employment. Some people have all they need while many have nothing at all".

When viewed as a whole, the South African urban transport system is performing relatively poorly against the needs of key groups of customers. As shown in figure 36 the largest segment of the urban population (29%) depends on public transit while 25% depends on walking or cycling to reach their destination (Department of Transport, 1998). Nevertheless, the current South African urban form promotes a car dependant society that ignores the commuting needs of the majority. To prevent these people from being stranded, these needs should be the common denominator for planning and design, thus achieving a more equitable society.

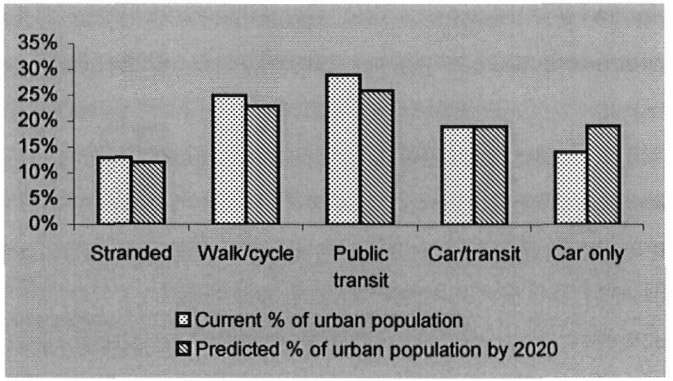
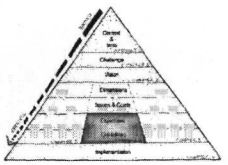


Figure 36: Transportation modes used by the South African population. (Generated from Department of Transport, 1998)

Recommendations.

Goal: Create equitable living environments.

Objective: Maximize the integration of a wide range of the social spectrum.



Design Guidelines:

38. Houses & Lots ~ Provide a range of housing types, tenure options, and lot sizes within the same community and even on the same block, to facilitate social integration.

A lack of diversity in housing types, tenure options, and lot sizes contributes to segregation. A greater housing diversity within a community and even within a block, will allow a greater integration of people. This does not imply that all communities should achieve the same average integration. One community might still be more affluent than another, but severe differences should be avoided by locally providing housing, that suits the lifestyle, income, and needs of a variety of people.

(Taken form Calthorpe, 1993)

39. Diversity ~ Provide a diversity of facilities and entertainment, that cater for a wide range of the social spectrum.

To facilitate the integration of a wide range of the social spectrum, local entertainment and facilities should cater to as many preferences as possible. This can range from nursery schools to seniors' homes, childrens' playgrounds to nightclubs, opera to 'gumboot dancers' etc. This diversity contributes to a cultural richness in the community.

40. Flexibility ~ Allow for flexibility by providing adaptable spaces, multi-use facilities, and personalization opportunities.

The diverse South African population poses a great challenge for the integration of various preferences and practices within one community. Clearly not every preference can be incorporated in the community, especially where these are in the minority, but provision should

be made for these preferences by designing flexible spaces. Housing should allow for personalization, and spaces and buildings should be adaptable or have multiple uses. This allows everyone the freedom to express their individual preferences and to contribute to the greater diversity of the community.

Objective: Provide equal access to employment and amenities.

Design Guidelines:

41. Access ~ Allow everyone access to local and regional opportunities by providing access to the transit network within 400-600m walking distance.

The majority of the South African population rely on walking, cycling, and public transit as their mode of transport (Department of Transport, 1998). The sprawling pattern does not promote these modes of transport and so many people are left stranded. In an equitable society these needs cannot be ignored. With walking considered as the common denominator for design, walking access to basic amenities, and employment is encouraged. These can only be provided locally to a limited extend and for this reason, walking access to the public transit network is essential to allow access to other regional opportunities (see also guideline 1-2).

42. Poverty concentration ~ Avoid the concentration of large numbers of poor people, to allow them the same benefits as other more affluent groups.

Businesses and amenities in poor areas are often not viable (see guideline 93). This limits the economic opportunities of the people in the area. To allow the residents to have the same benefits as others, different income groups will have to be integrated so that poor communities do not have to compete with affluent communities for basic amenities and services.

QUALITY OF LIVING.

Basic needs.

Quality of living can, at the lowest level, be described as the provision of basic human needs such as food, water, and shelter. However, in modern urban society basic needs include necessities such as basic mobility, and access to education and employment.

Apartheid planning has moved the majority of the South African population far away from job opportunities, health care, education, and other amenities (RDP, 1994:2.9.1; Department of Housing, 1997; South African Government, 2001). To further contribute to the problem, people have poor access to basic mobility, so reaching these amenities is difficult. The Department of Transport (1998) stated that "many citizens still lack affordable basic access to the public transport system. This impedes the ability to deliver on national objectives such as basic mobility, basic access, and social integration. Workforce and scholar mobility is restricted, creating friction on national efforts to create employment and education opportunities".

"The central objective of [the Reconstruction and Development Programme] is to improve the quality of life of all South Africans" (RDP, 1994:2.2.3). This includes the provision of durable, basic housing with adequate provide protection from the weather, privacy, and reasonable living space (RDP, 1994:2.5.7). It was estimated that one million low-cost houses would need to be constructed over five years (RDP, 1994:2.5.2). Schoonraad (2000) stated that "because of the backlog, the housing programme has focussed on speed of delivery and affordability. These two factors inevitably lead to peripheral locations for new projects next to existing low-cost areas." These locations exacerbate problems by leaving "these projects without local economic development prospects and far from jobs and social infrastructure. The [$20m^2$] one-size-fits-all RDP house is often not environmentally suitable, nor is it able to be easily adjusted to specific family and economic needs" (RDP Development Monitor, 2000).

Figure 37: The typical $20m^2$ RDP house.
(Taken from Department of Housing, 1999)

Many low-income residents retain a link with the rural environment and continue rural practices such as keeping chickens and planting crops in urban areas (Schoonraad, 2000). These rural lifestyles are often essential survival strategies for new arrivals in the city.

The RDP house and lot largely fail to provide for these needs, as the lot is often too small to accommodate multiple families or to allow space for food production. With the short-term goal of one million houses completed, the country can now aim to achieve its goal of "decent, well-located and affordable shelter for all" (RDP, 1994). Low-cost subsidised housing will be a part of the South African urban form for many years to come. These houses should be considered as an extension of housing types within communities, rather than being perceived as a land use that needs to be separated from the rest of society. These houses should be integrated into communities and their residents should have access to jobs, education, and basic amenities (RDP, 1994:2.2.4.3).

South African housing in general does not cater for the changing demographic requirements of the people. Suburban single-family housing developments were designed for a conventional family with a bread-winning father and a full-time housewife. Contemporary households, however, seem to be characterised by smaller families, women working outside the home, and a growing numbers of single parents, elderly and singles living alone. Statistics South Africa (1998) shows that 48% of all South African households have a household size of 3 people or less, and this figure even excludes hostels and hotels (see figure 38). Yet, despite these demographic changes, the large suburban detached home is still perceived and sold as the ideal. Housing should adapt to the needs of the 21st century family.

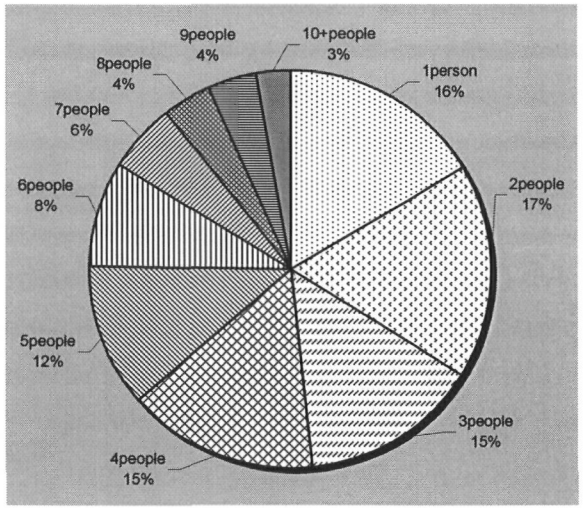


Figure 38: Average size of households, excluding hostels & institutions.
(Produced from Census 1998 information)

Luxury needs.

If these extended basic needs are met, it can be said that the most basic acceptable standard of living has been achieved. To improve the quality of living beyond this basic level, the urban environment has to deliver its richness and choice to as many individuals as

possible. This includes access to cultural facilities, recreational facilities, a variety of retail facilities, and access to nature. However, a lack of choice and variety is typically imbedded in the low-density pattern found in South Africa. This can be attributed to insufficient numbers of people located in any given area, preventing viable support for a rich texture of activities and services.

Regarding access to nature, a well know sociobiologist, Edward Wilson, wrote a number of books that address humans' inherent biological need to be in contact with nature. He calls it 'biophilia' and believes that nature may hold the key to our aesthetic, intellectual, cognitive, and even spiritual satisfaction (Braakman, 1995). According to Kellert "the biophilia hypothesis proclaims a human dependence on nature...as well as the human craving for aesthetic, intellectual, cognitive, and even spiritual meaning and satisfaction" (Kellert & Wilson, 1993:20). The hypothesis asserts the inherent human need to affiliate with nature (Kellert & Wilson, 1993). This need for contact with nature is confirmed in research from Kaplan (1983:155) who concludes that "nature matters to people. Big trees and small trees, glistening water, chirping birds, budding bushes, colourful flowers – these are important ingredients in a good life." Yet urban development often builds over any available space without recognition of this need. Realising this need, it becomes important to include nature, in its variety of forms, into communities where people can have easy access to its restorative qualities on a daily basis.

The outdoors is an integral part of the South African social culture as people regularly meet outdoors to play sport or to *braai* (barbeque). Families, which are typically confined to overcrowded living environments, also rely on these spaces as an extension of the house, an area to socialise, and find relief from the dense living conditions. These spaces can vary from public open spaces to private gardens.

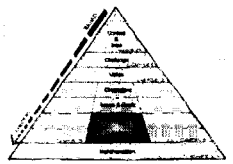
In South Africa the importance of private gardens should be noted. During Apartheid, the majority of the population was not allowed to own land and private open space became a luxury that most people did not have access to. It is therefore not surprising to see in a recent

study, that 95% of the surveyed group preferred the suburban detached house above any other typology (Schoonraad, 2000). This typology seems to be a measure of the quality of living and a symbol of the newfound freedom and rights.

Recommendations.

Goal: Improve the standard of living.

Objective: Increase access to modern basic needs.



Design Guidelines:

43. Shelter ~ Increase access to basic shelter for the poor, with a minimum unit size of $40m^2$ on a multi-unit lot.

Surveys in South African low-income areas generally show that household sizes vary greatly, from one person to more than ten, but typically with a median size of five people (USN, 2001). The minimum house size, as recommended by the United Nations International Union of Family Organisations and International Federation for Housing and Town Planning, range from a $38m^2$ three-room house for a family of two, to a five-room $62m^2$ house for a family of six (USN, 2001). Rather than designing such units as a single detached house, it is recommended that these low-income units be incorporated on multi-unit lots, where the unit is considered as an attached or detached accessory unit (refer to guideline 87). This allows a more balanced massing to the building and it allows for income integration on the same lot (refer to guideline 32).

44. Food ~ Provide walking access to a basic grocer and maximize opportunities for local food production in private gardens, communal gardens or small-scale agricultural areas.

The lack of food or access to food is a concern to many poor people in South Africa. As a minimum standard, all people should have access to buy basic food supplies or grow their own. With a large segment of the population relying on walking as their only mode of transport, a basic grocer would have to be located within walking distance of homes, in order to increase the accessibility to basic food purchases. With the growing unemployment a large segment of the urban population also rely on producing their own food. Therefore, opportunities for private or communal food production should be incorporated (see guideline 78).

45. Housing ~ Provide more affordable housing and a greater number of bachelor suites, one- and two bedroom units.

Contemporary households are characterised by smaller families and more people living as single parents or bachelors. Smaller units should be provided in the community to allow for this growing need. To make housing available to everyone, affordable alternatives should be incorporated (see guideline 82-87)

46. Mobility ~ Promote walking as the most accessible mobility option to most people by maximizing access to amenities, and transit within 400-600m proximity.

Walking is the one mode that is available to almost all people. With the poor as the lowest common denominator in the new democratic South Africa, there will have to be a renewed emphasis on planning and design of the urban form that provides for the majority of the population that can only afford to travel by foot and transit. Frey (1999) argues that urban structures that reflect intensified community- and neighbourhood cells encourage the provision

of services and facilities to those less mobile and fortunate. This includes the elderly, disabled and children, but in South Africa this also includes the majority of the population that cannot afford a car. Refer also to guideline 1.

Objective: Improve access to nature and increase the richness of the urban environment with options and choices.

Design Guidelines:

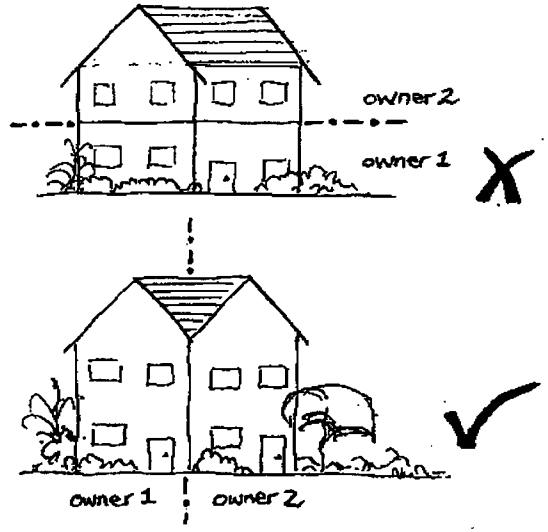
47. Housing ~ Provide a wide range of housing types, tenure options, and lot sizes within the same development, and even on the same block.

Different people prefer different living arrangements that suit their individual needs and preferences. South Africa's housing stock provides a limited range of housing types that mainly include the single-family detached house and apartments (Schoonraad, 2000). The provision of traditional single-family detached dwellings and apartment units should be expanded to include a wider range of housing typologies, and lot sizes (see guideline 38). Choices should also include tenure options that address the shortage of renting alternatives (see guideline 82). Clause 2.5.12 of the RDP (1994) states that the "government must ensure a wide range of tenure options...and facilitate a wide range of housing types."

48. Ground orientation ~ Maximize ground-orientated housing by limiting residential units to 3 stories where appropriate, and by dividing buildings vertically so that most people have access to a private garden.

Private gardens play an important role in socialisation and represents a new-found freedom to people that were never allowed to own their own piece of land. The private garden represents the high quality of living that has historically been found in white suburban homes. This

guideline challenges innovative design and policy that should aim at achieving higher density living (see guidelines 87, 91) while maintaining ground-oriented housing and private gardens for a large segment of the population. Note however that ground-oriented does not imply that we continue building sprawling single story homes. Instead solutions like vertical ownership vs. horizontal ownership should be explored. Typically, a double-story townhouse is divided horizontally with one unit on ground floor and another unit on the top floor. This only allows access to a small garden for the residents on the ground floor. Buildings should rather be divided vertically with living space on the bottom and sleeping space on the top floor, allowing both units access to the garden. Ground orientation also has implications for building height. Although not appropriate in all cases, the majority of residential units should be limited to about 3 stories where residents have ground access to their units.



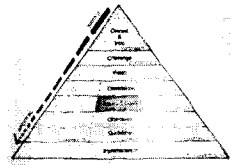
49. Amenities ~ Provide access to a wide range of local facilities (that include recreation, retail, cultural etc.) and establish connections to other regional urban centers of varying hierarchy that can expand the palette of richness and options.

The quality of living can be improved by providing access to a diversity of activities, entertainment, and amenities. These should be provided locally to increases the richness and choices for people in the area. In addition, regional transit connections should be established to other regional centres to further diversify the palette of opportunities and activities.

50. Nature ~ Green the urban environment with pockets of nature, functional nature, and wild nature.

The scale and purpose of nature in the urban environment varies. Nature might be incorporated in small 'pockets' such as private gardens or planters; it can have a 'functional'

purpose such as sport fields or street trees; or it can be considered 'wild' that typically refers to larger areas with little human interference and significant habitat value.



HUMAN HEALTH.

Physical health.

To maintain good physical health, a lifestyle that includes exercise among other things, is necessary. Low-density development and car dependence are counterproductive in that they push services and jobs further and further away from the home, and the only way to get around is to commute from one front door to the next. This allows little opportunity for daily physical exercise. Those that do seek out opportunities for exercise, find them however on stepping machines in air-conditioned concrete gyms, far removed from the restorative qualities of nature.

Physical health is also closely linked to the health of the environment. "Exposure to high concentrations of air pollution...adversely affects the health of humans. The impacts can range from irritation of the eyes, nose, and respiratory tract to more serious problems such as impairment of lung function, decreased resistance to respiratory infection, and increased incidence and severity of asthmatic attacks" (Sheltair & Ramsay, 1999:79). Recent studies have found that "the health threat from lower levels of CO is most serious for those who suffer from heart disease, like angina, clogged arteries, or congestive heart failure. For a person with heart disease, a single exposure to Carbon monoxide (CO) at low levels may cause chest pain and reduce that person's ability to exercise; repeated exposures may contribute to other cardiovascular effects...Even healthy people can be affected by high levels of CO. People who breathe high levels of CO can develop vision problems, experience reduced ability to work or

learn, reduced manual dexterity, and difficulty performing complex tasks. At extremely high levels, CO is poisonous and can cause death" (EPA, 2001).

In addition CO contributes to the formation of smog (together with other No_x gasses) that has adverse effects on human health by reducing oxygen delivery to tissues and the body's organs, including the heart and brain (EPA, 2001). "Children, people with lung diseases such as asthma, and people who work or exercise outside are susceptible to adverse effects such as damage to lung tissue and reduction in lung function" (EPA, 2001). Effects from prolonged exposure to acid rain "may reduce the function of the lungs in asthmatics, increase the resistance of the respiratory passages (healthy and asthmatics) and increase the receptiveness for infection of the respiratory passages. Population groups in heavily affected areas have a larger number of acute- and chronic respiratory diseases" (UNEP, 2001). Even particulate matter in the air contributes to aggravated asthma, increases in respiratory symptoms such as coughing and difficult or painful breathing, chronic bronchitis, decreased lung function, and premature death (EPA, 2001).

It is therefore evident that the health of the environment impacts greatly on the health of its human inhabitants, whether it is through the air we breathe, the water we drink, or the food we eat. A healthy environment is a prerequisite for good physical human health.

Mental health and social well-being.

The well-being of humans is just as much dependent on mental health as on physical health. The car however impacts greatly on the human development and mental health. It aggravates the stress experienced in an already time-crazed society, with the daily commute absorbing more and more time due to clogged roads and longer distances.

There is also a link between housing quality and social well-being. "Since housing provides the scenario for family life, recreation, rest, sleep and social interaction, it follows that many aspects of poor housing, such as overcrowding, noise, air pollution, bad odours or

dampness, give rise to considerable dissatisfaction and annoyance and perhaps contribute to poor health" (USN, 2001). The concentration of poverty in inner city high-density areas often leads to ghetto formation. Such "high population density has long been derided as it is widely believed to be associated with antisocial behaviour such as crime, delinquency, ill-health and so on" (Haughton & Hunter, 1994:82). Rather than the occurrence of density in itself, the real issues at stake are more likely to be the concentration of poverty and high-rise buildings.

Crowhurst Lennard and Lennard (1995) wrote that the concentration of poverty, often accompanies the concentration of people with serious social problems and a consequent amplification and escalation of these problems. It is a situation where 'the sum is greater than the parts' as poverty integrated into society in smaller parts seem to be much more manageable than the accumulated social problems of a large concentrated area. High densities are also often characterised by tall buildings, which isolate people from the restorative qualities of nature. Higher densities do not have to 'translate' into high-rise buildings. Innovative solutions can achieve higher densities and maintain contact with the landscape simultaneously (see figure 39).

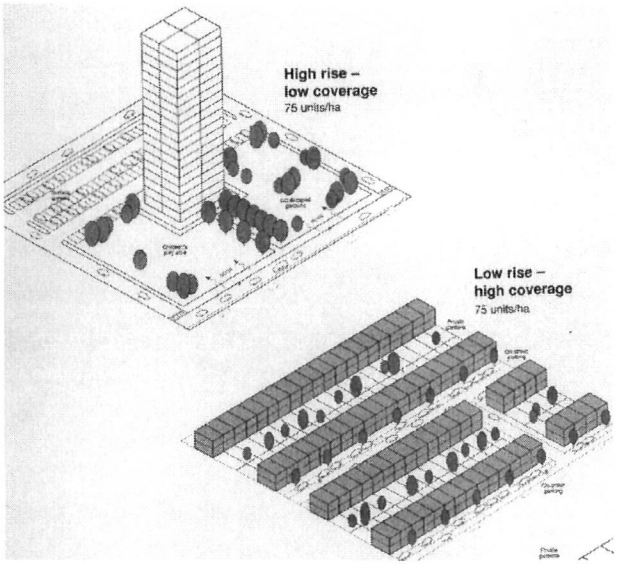


Figure 39: Various design solutions to achieving the same density.
(Taken from Urban Task Force, 1999)

Health care.

Human Immunodeficiency Virus (HIV) and Acquired Immune Deficiency Syndrome (AIDS) are probably the greatest challenges for health care in South Africa. The country has the largest number of people living with HIV/AIDS in the world, as well as one of the world's fastest-growing epidemics (Afrol, 2000). At least 4.2 million people, or one tenth of the total population, are infected. Youths are the hardest hit by this epidemic and already, 1 in 4 South African women between ages 20 and 29 are infected with the virus. It is estimated that about 10% of the total South African population are HIV positive and that more than 1500 new infections occur each day in the country (South African Government, 2001; Afrol, 2000).

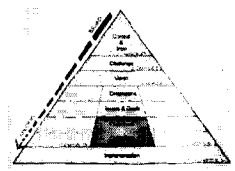
This raises a tremendous concern for health care facilities in South Africa that have to deal with such large numbers of patients on a recurring and escalating basis. The South African government is committed to providing basic health care as a fundamental right (South African Government, 2001). To achieve this, it is evident that at least partial responsibility for health care and support will have to be given back to the community, family, and individual. This is necessary not only to adsorb some of the financial strain on the public health care system, but also to make the final term of the people facing death more manageable by increasing support of family and friends and decreasing time spent in a sterile institute.

A similar problem faces the elderly in today's society. Dr Zola Skweyiya, MP Minister for Social Development, called for action-oriented measures to protect older persons from neglect, abuse and exploitation (Department of Social Development, 2001). Modern society seems to have lost the wonder of intra-generational support where each generation supports and cares for the previous, and next, generation. This process can run three or four generations deep. We cast the old, ill, and disabled aside into institutions even when there might be no real need to do so, to prevent the inconvenience of trying to accommodate them in the daily suburban dream. The generational support concept is one that still seems to be an integral part of the non-European South African cultures where grandparents, parents, and grandchildren all live together in a communal support system. It would be in the best interest of both the individual and the government to strengthen the bond between families and their dependants.

Recommendations.

Goal: Maintain good human health.

Objective: Maximize opportunities and conditions that attribute to better physical human health and social well-being.



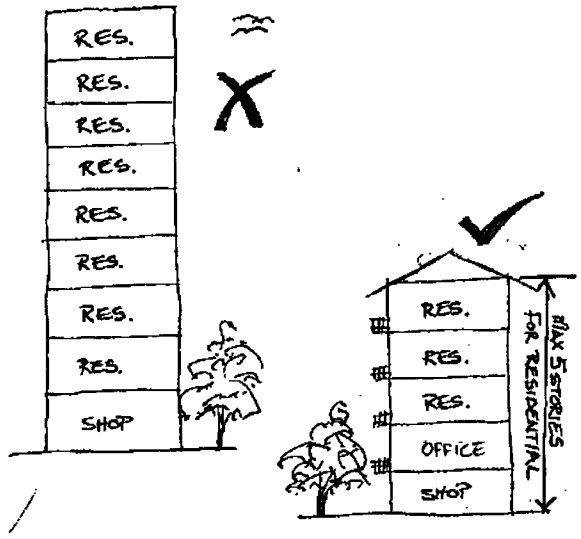
Design Guidelines:

51. Exercise ~ Provide local access to sport and recreation facilities and encourage physical exercise through walking and cycling.

Modern society provides little opportunity for exercise as people spend many hours behind their computers, steering wheels and televisions. The provision of sport and recreation facilities close to the home can serve as a magnet to draw parents and children from their homes for exercise. Development should also encourage and provide for the most basic daily exercise where one can walk or cycle to the shop or a nearby friend rather than exacerbating poor physical health by encouraging car dependence. Refer to guideline 1.

52. Poverty distribution ~ Distribute poverty more evenly to facilitate healthier living conditions.

The concentration of poverty in large areas aggravates the unhealthy living conditions of these people. When distributed in society these problems can be dealt with more effectively to create better living environments for the poor.



53. Building height ~ Restrict residential uses to about 5 stories in height.

People need contact with the restorative qualities of nature. In tall buildings this interaction gets lost and it can affect the social and mental well-being of residents. Crowhurst Lennard & Lennard (1995) suggest a five to six-story limit, while Alexander *et al.* (1977) proposes a four-story limit for residential buildings. Where building heights do extend beyond such heights, it should be avoided for residential purposes.

54. Environmental health ~ Promote the health of the environment to limit negative human health impacts.

Human health is closely linked to the health of the environment, and so it might be said that environmental health is an important consideration to the physical well being of humans. Refer to guidelines 1-37

Objective: Increase support for people in bad health.

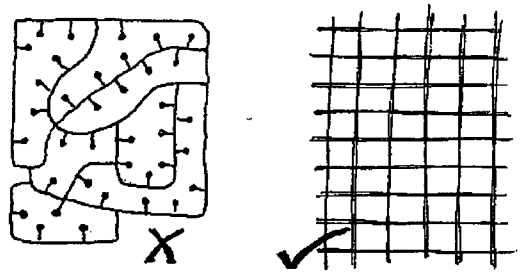
Design Guidelines:

55. Family support ~ Provide local access to health- and welfare facilities and promote accessory units to housing that encourage inter-generational support for the elderly, disabled, and chronically ill.

Modern society seems to cast the old, sick, and disabled aside into sterile institutions where they are isolated from society and their loved ones. Traditionally "in South Africa, ...lots allow[ed] for more flexibility in accommodating different life cycles as well as adult children on the same site. In most instances a single lot can accommodate three generations" (Schoonraad, 2000). With the economic strain on South African health and welfare facilities this might be a useful concept in the years to come. By providing accessory units, the elderly and disabled can be included in the family make-up while still maintaining independence. Such units can be attached or detached from the primary residential unit.

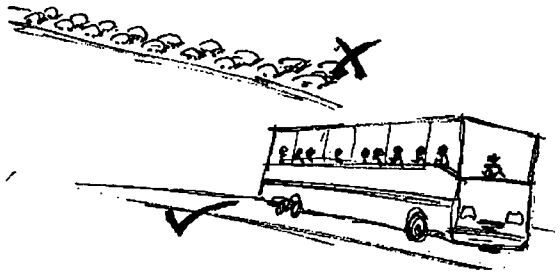
Objective: Reduce the impact of traffic on human stress.

Design Guidelines:



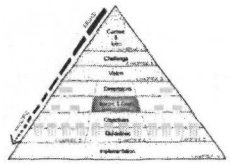
56. Interconnected Grid ~ Design an interconnected, grid road system to allow a legible pattern with many possible route options that reduces traffic congestion.

A hierarchical road system with cul-de-sac road patterns easily confuses newcomers to an area looking for 'a way out' and it forces all traffic from local roads onto major arterial roads, causing a consolidation of traffic and increased stress due to poor way-finding and traffic congestion. An interconnected road system provides many easy-to-find alternatives, distributes traffic more evenly and allows more direct travel between destinations, thus making non-motorised travel more feasible (VTPI, 2001).



57. Transport alternatives ~ Encourage public transportation alternatives to reduce the stress of having to drive in heavy traffic, and to increase the capacity of passengers per mode that consequently reduces clogging.

Driving in traffic can be very stressful. Public transportation provides a convenient transportation option, and passengers can attend to other more pleasant things without having to concentrate on where they are going. As more people use transit, fewer cars will clog the roads, leaving a more relaxed driving experience to those that need to drive.



SAFETY.

Crime.

"In its dying years, apartheid unleashed a vicious wave of violence. Thousands and thousands of people have been brutally killed, maimed, and forced from their homes" (RDP, 1994). Even thought the South African Government has placed a hold on the release of crime and violence statistics in the country, it is evident that the country is close to creating a culture of violence in which no person can feel any sense of security in their person or property. Some claim that it is a mere perception, but perception might be said to be just as important as reality. Prior to the freeze of information, statistics did not paint a peaceful picture.

The National Trauma Research Programme found that "although high levels of violence...were experienced in [the] country prior to...1994, there has been a marked increase in its prevalence, particularly with regard to interpersonal violence and rape" (Marais, 1998). "Violence is the leading cause of injury and mortality in South Africa. The 1996 homicide rate of 61 per 100,000 placed the country among the most violent in the world. In 1994 South Africa had the highest per capita incidence of rape recorded anywhere" (Marais, 1998). Car hijackings and property crime are also contributing to an even greater sense of insecurity (Robertson *et al*, 1999). The South African urban environment reflects this fear of crime and violence as people fence their properties and bar their windows. This alienates residents from the rest of the community, and the high boundary walls provide ideal hiding places for criminals and shelter properties from the safe 'eyes on the street'.

Preventing crime is a key challenge in the post-apartheid South Africa. The public is pressuring local governments to respond to the crime issue. "Communities participating in workshops...have in many cases prioritised the need for greater safety above all other needs. Local and international business interests have also highlighted the impact of crime on tourism and foreign investment" (CSIR, 2000).

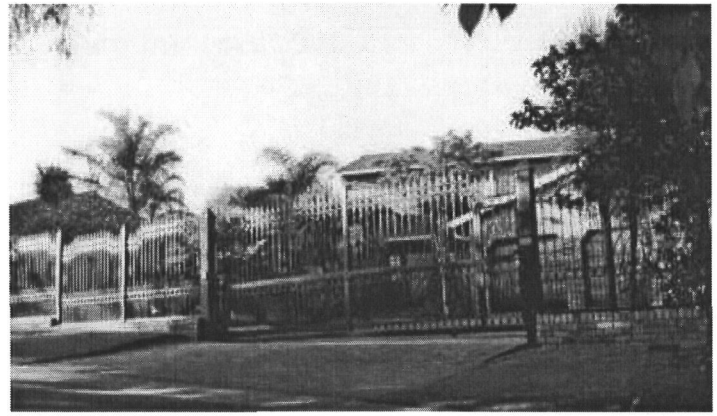


Figure 40: Fences or walls as security target hardening measures.
(Taken from Brekkhus, 2001)

The policy in South Africa realises that there is more to preventing crime than an effective police force, as the 'National Crime Prevention Strategy' calls for crime prevention through environmental design (Department of Safety and Security, 1997). Crime prevention through environmental design can be defined as "the implementation of measures to reduce the causes of, and the opportunities for criminal events, and to address the fear of crime through the application of sound design and management practices" (CSIR, 2000).

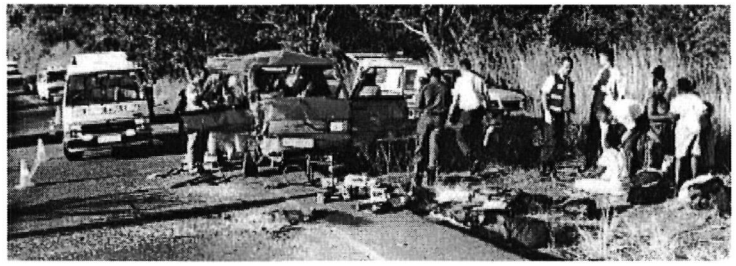


Figure 41: A common road accident sight in South Africa.
(Taken from PushDPT, 2001)

Road Safety.

In addition to crime, South African road safety is also a concern. South Africa's vehicle collision and fatality rates compare poorly with those of most other countries. Every year about 10,000 people are killed and 150,000 injured in approximately 500,000 accidents. The cost of these road traffic accidents is estimated at more than R11.9 billion a year (South African Government, 2001). Of these accidents, high speeds are a factor in 75% of all cases reported on the South African roads (Arrive Alive Campaign, 2001). Studies also show sprawling communities, where transportation systems are most biased toward the car, are the most dangerous areas for pedestrians (PlannersWeb, 2000).

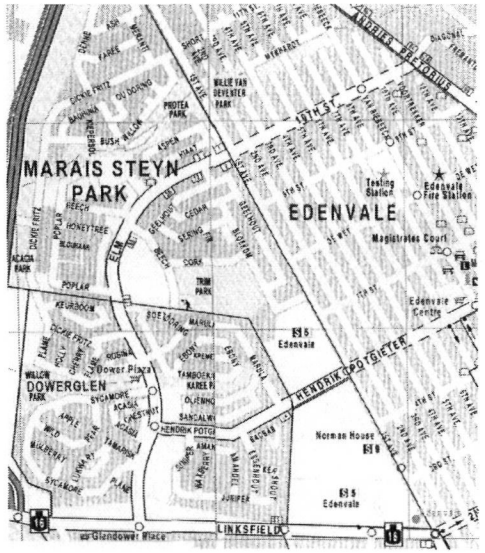


Figure 42: Restricted urban permeability evident in the road network in a gated community area in Marais Steyn Park (especially when opposed to suburban network seen in the Edenvale area).
(Taken from Map Studio, 2000/2001)

Emergency Response.

Recognising the safety issues facing the country, it is evident that an effective emergency response system needs to be implemented. However, the current low-density horizontal sprawling pattern impacts on the provision of emergency services and their effective response times. Emergency services are provided further and further away, and the number of people available to support such services is spread out over larger distances.

The ineffective response times of emergency services in the already sprawling development are exacerbated with the growth of 'gated communities' in recent years. Gated

communities refer to both 'enclosed neighbourhoods' and 'security villages' that are physically enclosed with a security gate or controlled access point" (Landman, 2000). This creates impermeable zones or pockets that restrict access within the urban fabric (Landman, 2000), (see figure 42). Motorists, pedestrians, and emergency services are forced to take alternative routes that are often congested and longer (Landman, 2000). Though the gated community provides security to its residents, it has implications for the safety of the greater public. Because of the severity of the crime situation in South Africa, some form of 'target hardening' seems unavoidable, but it is necessary to limit the size of such measures and to maximize security through pro-active design.

Environmental Hazards.

It is not only society that poses a threat to the safety of the South African public. The environment also plays a role. Informal settlements are often located in flood plains, or on steep river embankments, where there is risk of land slides (USN, 2001). The heavy South African rainstorms, combined with the impermeability of urban areas, deliver large volumes of water to downstream areas where low-income settlements are located on unsafe embankments and in floodplains (see figure 43). Flooding and landslides not only cause the loss of homes, but also often result in the loss of lives.

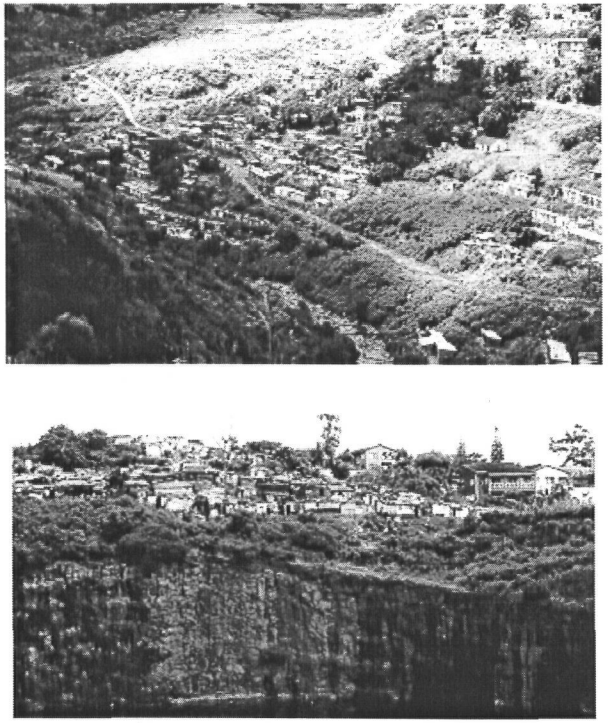


Figure 43: Informal development in floodplains and on unstable embankments in a Cape Town township.

Recommendations.

Goal: Create safe living environments.

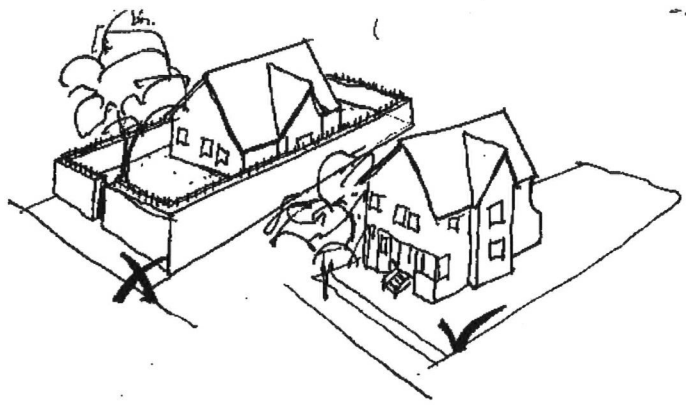
Objective: Improve community surveillance and limit areas of refuge for criminals.

Design Guidelines:

58. Mix uses & people ~ Encourage a mixture of uses and an integration of a wide range of the social spectrum to maximize a presence at all times.

Suburban living caters to mainly one segment of the social spectrum by providing typical single-family detached homes in large residential cells. In such developments it is easy to predict the daily schedules of people, seeing that everyone, more or less, live the same routine lifestyle. This leaves residential areas vulnerable to crime, not only because the coming-and-going of people are predictable, but also because it leaves the area deserted during most of the day when parents are at work and children in school. The integration of a wide range of the social spectrum (old people, children, business people, housewives etc.) will ensure varying lifestyles in the area and greater unpredictability. This mixture should also be applied to land uses. Commercial core areas are often the victims of crime during night when people are gone. The same happens in residential areas where people leave for work during the day and there is no one around. By mixing for instance commercial and residential uses, there is a presence (and thus surveillance) in the area at all times.

59. Setback ~ Eliminate security walls around houses and locate houses closer to the street with maximum 6m setbacks.



The typical South African suburban lot has a deep front setback and is surrounded by a high security wall. This negatively impacts on the security of people on the street, as well as the security of the property. The deep setback firstly reduces the presence of people looking onto the street from their homes and secondly it limits surveillance of the property from people passing by on the street. This situation is even exacerbated when combined with high walls that isolate the property from surrounding surveillance activities while providing ideal hiding

places for criminals. Security walls should be replaced by building facades, with maximum 6m setbacks (JTC, 1998). In doing this, the street can gain a presence of people, activity, and eyes that keeps both properties and passers-by safe. Refer also to guideline 68.

60. Interconnected roads ~ Use an interconnected street system to encourage surveillance from pedestrians and other traffic, and to provide escape routes to victims.

The development of a cul-de-sac road system creates quiet isolated pockets that are separated from the daily activities and people passing by. It is exactly this quality that makes them popular and dangerous at the same time. Cul-de-sacs are dead-ends with one way in and no way out if a criminal cuts off the one and only escape route. For this reason an interconnected street system is encouraged that allows many escape routes and little possibility for gangs to block access. It also increases surveillance through the presence of pedestrians, motorists, and cyclists passing by.

61. Open spaces ~ Encourage smaller scaled open spaces with good visibility, access, and populated edges.

Open spaces are often abandoned, dark places that can provide refuge to criminals. The larger such spaces become the more they tend to feel unsafe, unless they can attract sufficient numbers of people and promote a convivial atmosphere (CSIR, 2000). Large spaces tend to be too big to manage and it often become neglected, no-man's lands. Smaller open spaces, on the other hand, are more manageable by the community and increase the sense of ownership over such spaces (CSIR, 2000). When combined with good access routes, visibility and populated edges, opportunities for surveillance by users and passers-by are increased.

Objective: Increase road safety.

Design Guidelines:

62. Road width & Activity ~ Reduce road widths to a minimum and promote street activity such as cycling, walking, and on-street parking in order to reduce vehicular traveling speeds.

The wider the road, the faster people drive. "Narrower streets slow traffic and reduce accidents by requiring the driver to be cautious" (Calthorpe, 1993:62). "Street widths, design speeds, and number of travel lanes should be minimised without compromising auto safety, on street parking, or bike access" (Calthorpe, 1993:95). Lane widths of about 3m are recommended (Calthorpe, 1993; JTC, 1998). The reduced dimensions also allow for reduced crosswalk dimensions that not only reduce cost but also improve the safety of the pedestrian (Calthorpe, 1993). The exclusion of other uses on the street provides a 'freeway' for motorists to speed without caution. The integration of vehicular and pedestrian crossings, cycling lanes and parking along these roads can potentially increases the risk for conflict and safety between these uses, but at the same time it causes drivers to slow down and be more cautious, ultimately improving the safety. Calthorpe (1993) says that on-street parking is critical to keeping the focus of a community on the street and to help create street activity.

63. Responsible drivers ~ Encourage public transportation as a responsible driving option.

People driving in their private vehicles, can all potentially drive as responsibly as they please. For instance, if we have 20 people each driving in their private vehicles, they all have a personal choice of how responsibly they choose to drive. By encouraging public transportation options, these 20 people might, for instance, all be accommodated in a bus with only one driver. The management to ensure that this one person is a responsible driver is much more

effective than trying to ensure that all 20 people drive responsibly on their own. Public transportation also accommodates more people per vehicle that, in turn, reduces the number of vehicles on the road and consequently reduces the safety risk.

Objective: Avoid practices that aggravate environmental disasters.

Design Guidelines:

64. Hazardous areas ~ Avoid development on potentially hazardous areas.

Not all areas in the city are suitable for development. Hazardous areas such as floodplains, steep slopes, and contaminated soils should be avoided as they pose a threat to human safety.

65. Water quantity & speed ~ Reduce the amount and speed of urban runoff that create a safety hazard to settlements downstream.

The increased impermeability that accompanies urban development causes the rapid contribution of large volumes of water to into water systems. This creates a flood hazard to people downstream and the water erodes already unstable embankments where people live. Water needs to be managed locally through pro-active design. See guidelines 14-22.

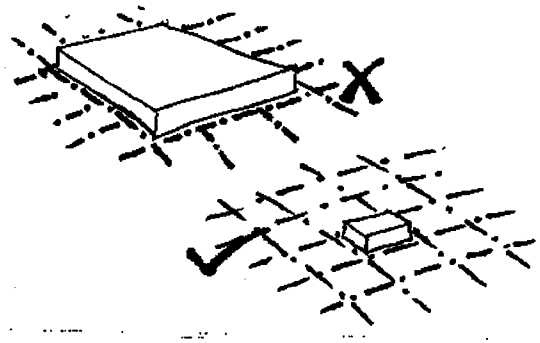
Objective: Maximize effective emergency support for victims.

Design Guidelines:

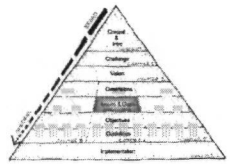
66. Interconnected grid ~ Provide local emergency services and design a fine interconnected, grid road system for fast and effective emergency response.

For effective response times to emergency situations, it is important that emergency services can get there fast. For this reason an interconnected grid system is proposed that allows access from anywhere to everywhere, with no dead-ends and roundabout ways. It also distributes traffic more evenly to avoid traffic hold-ups along congested routes (see guideline 56). A small grid size allows access through the shortest possible route and the grid pattern is legible and easily understood by response teams that are often strangers to an area, and cannot afford to lose time trying to find their way.

67. Gated blocks ~ Limit the size of gated developments within a street block so that it does not interfere with normal traffic flow.



Peoples' perceptions of security and safety do not change over night and it can take some time to re-build confidence in a safe society. For this reason it is realistic to assume that the Gated Community 'phenomenon' and other target hardening solutions like walls and gates will remain a part of the South African city in coming years. Such 'barrier' solutions should however be limited to the block so that it does not interfere with normal traffic flow and emergency response efficiency. Back lanes entrances (see guideline 86) can be fenced off as a substitute that allows secure entry into one's driveway and home within the safety of surrounding gates. By replacing walls with the facades or perimeter development, homes are made safer (see guideline 59) and it improves social isolation (see guideline 71).



SENSE OF PLACE.

Liveability.

Automobiles reduce the liveability of cities with increased noise, smog and acid rain being some of the most basic side effects (Sheltair & Ramsay, 1999). In addition, cars have a social impact. "The simple social intercourse created when people rub shoulders in public is one of the most essential kinds of social 'glue' in society" (Alexander *et al*, 1977:489). This situation is however largely missing in modern society, as the actual process of public outdoor movement is mainly taken over by cars.

The spatial requirements of the car push everything further apart at lower densities. The effect of this on the social fabric is clear. People are drawn away from each other and frequency of interactions decreases substantially (Alexander *et al*, 1977:65). People spend more and more time driving, decreasing the time spend on interaction with others. The car has distanced many people from their families who have traditionally provided social and economic support. This result in the loss of those things we once took for granted – family, community, and a sense of belonging (Canfield, 1990:49). A study done in San Francisco showed that the traffic levels were inversely correlated with the number of friends and acquaintances each person had within the street (see figure 44). It even found that the impact of the traffic intrudes right into the homes as it dictates the allocation of rooms and forces people to keep their windows shut (Appleyard & Lintell, 1970).

Community interaction represents an important aspect of the sense of belonging to an area (Sheltair & Ramsay, 1999). "Lively pedestrian-orientated spaces encourage such communal interaction and foster a sense of ownership" (Sheltair & Ramsay, 1999:51). When commuting on foot, bicycle, or transit to run errands, go shopping, or go to school or work, people recognise other frequent users, often exchanging greetings, which in time develop into conversations. Crowhurst Lennard and Lennard (1995:25) describe that such "spontaneous

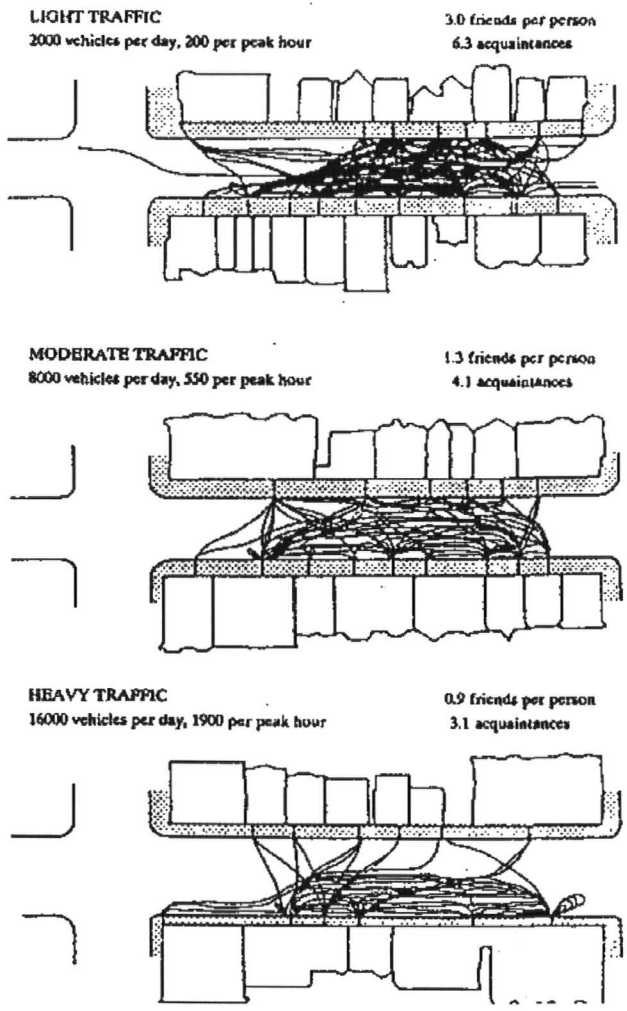


Figure 44: A study shows the friendship ties people had on three different streets with varying traffic levels.
(Taken from Elkin *et al*, 1991; Appleyard & Lintel, 1970)

social contacts are the seeds from which a sense of community evolves." Pedestrian friendly streets also provide safer environments for children to play, and are an incentive for cars to drive less. Yet, streets are perceived as 'places for cars' and the days when children could play and people could socialise on their residential streets seems long gone. Even walking and cycling along a street seems unthinkable in most urban areas in South Africa. Streets have been designed for the car, often ignoring the pedestrian and cyclist.

In addition to streets, other public places such as markets and restaurants should also be integrated into the community. This provides more places to meet acquaintances, close friends, and families and in addition, provides vibrancy to the area. Buildings should turn a friendly face to the street rather than hiding behind high walls or garage entrances so often seen in suburban areas (see figure 46).

Figure 45: The social 'glue' that is missing in the sprawling pattern.
(Taken from Crowhurst Lennard & Lennard, 1995)

Sense of belonging.

The urban hierarchy is important to maintain a sense of belonging in the city. The undifferentiated sprawling city does not provide a unit to which people can feel they belong. They are a mere number among the many residents of the city. To strengthen a sense of belonging, people should feel as if they have say in decisions made together with others that they know in their area. For these reasons, the neighbourhood unit becomes important as it subdivides the city into more intimate, democratic cells. Frey (1999) suggests a population of about 7,000 to achieve this.

In the sprawling pattern, there is also no central focus, except possibly for the downtown core and mega-shopping centres that are scattered through the urban fabric. As centres loose their importance at the heart of communities and neighbourhoods, individuals become alienated from their neighbours. These central areas are important places to meet other people and to foster a sense of belonging (PlannersWeb, 2000; Crowhurst Lennard & Lennard, 1995).

Figure 46: The unfriendly garage facade often found in suburban areas.
(Taken from Brekkhus, 2001)

Identity.

Today's cities seem to be characterised by architectural forms that either dominate or duplicate. Buildings are constructed in enormous proportions either vertically as skyscrapers or horizontally as mega-blocks, neither of which responds to the human scale. On the other hand buildings are often duplicated in one development using rubber-stamped solutions and one building looks just like the next. The RDP-housing scheme and typical gated communities are such examples, where housing is built in bulk, with only the paint colour distinguishing one unit from another in some instances. Calthorpe states that this pattern produces "a growing sense of frustration and placelessness, a fractured quality in our suburban mega-centres, which overlays the unique qualities of each place with chain-store architecture, scaleless office parks, and monotonous subdivisions" (Walter, 1992:29). Such developments do not capture the sense of place, and people cannot identify with them. Buildings ignore the human scale, and also fail to identify their use and importance in the public realm. These structures do not respond to the surrounding landscape, its history, or the surrounding buildings (see figure 47).

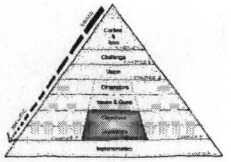
Figure 47: An example of how a building fails to 'belong' in its surroundings.
(Taken from Cowhurst Lennard & Lennard, 1995)

Recommendations.

Goal: Maximize a strong sense of place.

Objective: Maximize the livability of the area.

Design Guidelines:



68. Isolation ~ Limit front setbacks to about 3m (max 6m) and minimize isolation behind property walls to encourage interaction with others in the community.

Houses are often found in the back of the lot hidden behind high walls. These developments isolate people from one another to such extend that they do not even know their neighbours. The front garden seems to serve little purpose, other than being a colourful flower foyer to the house, while the backyard is intensively used for socialising, food production, playing etc. With reduced front setbacks of 3m (6m max), backyard space can be maximized to allow for these functions, while still allowing some decorative space gardening space in the front (JTC, 1998). Refer also to guideline 59.

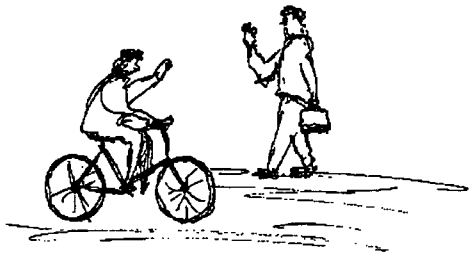
69. Garage ~ Incorporate vehicular garages or parking spaces in the back of the lot with back lane entry or side lane entry, or design garages into the main building.

In the car dependent society, the typical suburban house is often charaterised by a garage facade. The garage becomes the centre of focus on each lot and it fails to provide a welcoming invitation. The garage should be treated as a utility and should be located towards the back of the house, with either rear lane or side lane access. This can improve the affordability of housing (see guideline 86) and provide opportunities for safe enclosed communities (see guideline 67). Were the garage occurs in the front of the lot, it should be designed 'into' the main building, under a communal roof.

70. Vibrant places ~ Encourage vibrant public spaces, such as plazas, markets and restaurants, where people can socialize and meet with others.

Opportunities for socialisation should be provided in public places like parks, squares, restaurants, markets etc. where people not only meet with friends, but also interact with other residents of the area.

71. Interaction ~ Encourage people to walk, cycle, and use transit to encourage interaction between people and reduce the negative effects of car dependence.



In addition to pollution, traffic, and noise that affect the liveability of an area, car dependence isolates people form others and they never get an opportunity to exchange a friendly word. Reduce cars and instead encourage walking, cycling, or transit, where there are more opportunities for interacting and meeting other people.

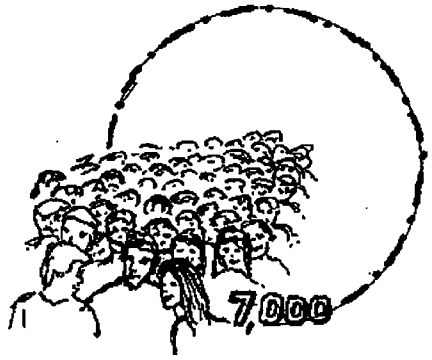
72. Major roads ~ Limit locating residential development directly along major regional routes.

Major roads often associated with excess noise, pollution, heavy traffic etc. This affects the residential suitability of the areas directly adjacent to these roads. Although housing should be encouraged around public transportation nodes, the areas along regional corridors might be more suitable of other uses (see guideline 94).

Objective: Maximize places to which people feel they belong.

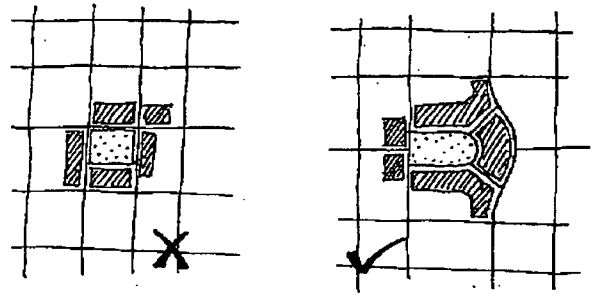
Design Guidelines:

73. Intimate unit ~ Create small neighbourhoods of 7,000 people, where people feel part of a unit.



It is important for people to feel as if they belong to a smaller unit in the city where they know some people and where they can have a say in decisions that affect them. A neighbourhood population, of about 7,000 people, provides such a structure where people can democratically participate in their surroundings and get to know others (Frey, 1998).

74. Core ~ Provide a center to each neighbourhood and community where people can meet, shop, relax etc. and mould the road network around focal points.

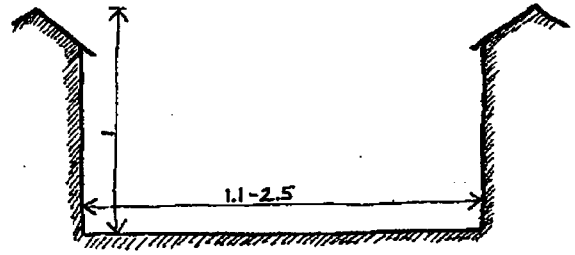


Every development needs a central public node or 'heart' that people relate to and where they meet other people living in the area. Such a core is an important part of the daily life in the community and the road network should respect these locations while strengthening the importance of community landmarks.

Objective: Maximize design with which people can identity.

Design Guidelines:

75. Building scale ~ Maintain a building height:right-of-way width ratio of between 1:1.1 to 1:2.5 to maintain an intimate scale.



Building heights should respect both the human scale and the scale of other buildings in the area in order to strengthen the sense of place and to ensure that people can identify with the place. To maintain an intimate scale when dealing with building heights, it is clear that the width of the road plays a role. For instance, a 6m tall building might appear overpowering on either side of a narrow pedestrian lane, while appearing too small when used on either side of a six-lane road. Jacobs (1999) recommends a building height:right-of-way width ratio of between 1:1.1 to 1:2.5 to maintain an intimate scale. For streets that run in an east-west direction, this ratio should be adapted to allow for solar access (see guideline 8).

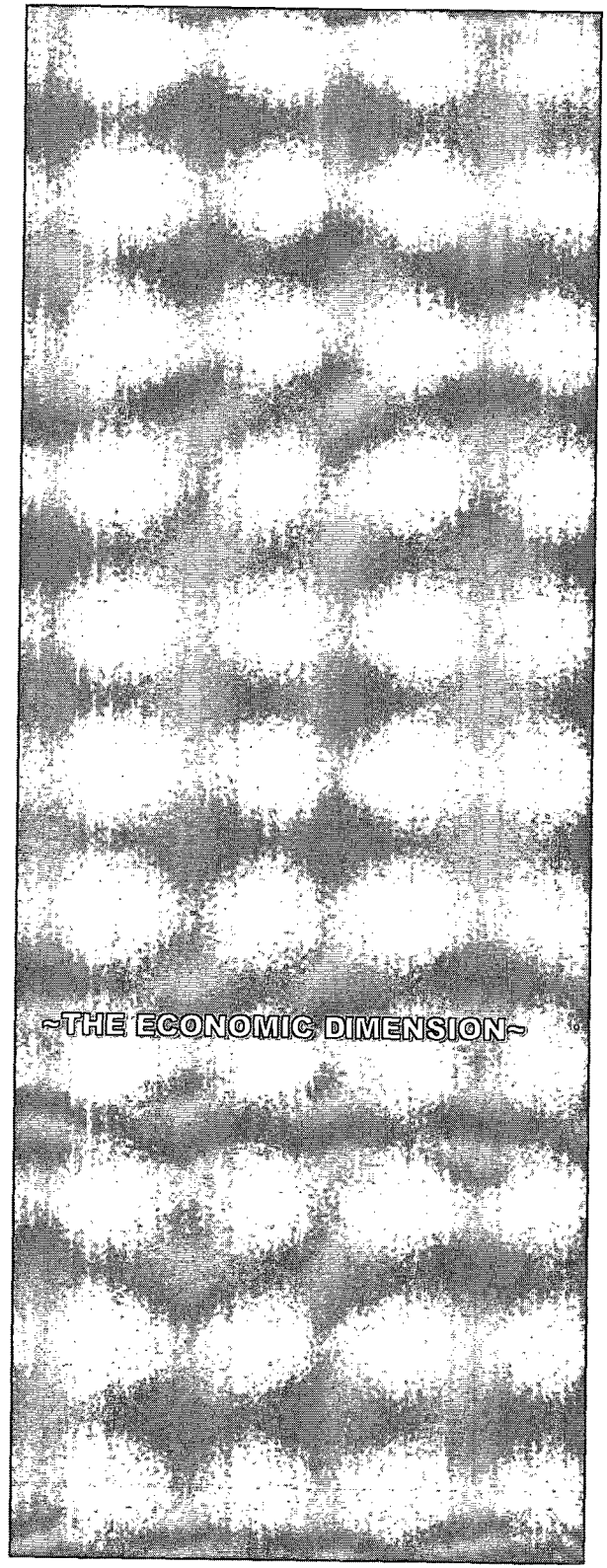
76. Personalization ~ Provide variations in design and allow opportunities for people to personalize their homes, to avoid identical rubber-stamped developments.

For people to feel if they belong to an area, they need to identify with their surroundings. However, residential developments often create sterile, duplicate environments in which

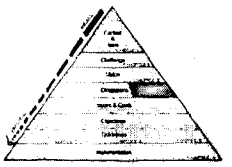
people are a mere number. Instead, developments should allow people to personalise their own living environments into a place that reflect their personality and that they can call it a true home rather than just a place to live.

77. Architecture ~ Buildings should look as if they belong to the regional context and history, and the architecture should fit in with the surrounding buildings and reflect the use and function of the building.

Modern architecture is often seen overpowering its context in an egoistic display. For people to identify with the buildings in the community, buildings should be kept true to their function and use, and it should merge into a coherent whole with the surrounding architecture, regional context and history of the place (Crowhurst Lennard & Lennard, 1995). This does not deny the importance of landmarks in the community, but it aims to reserve those rights to monumental or communally important buildings rather than allowing everyday buildings (such as a residential tower block) to dominate the community.



CHAPTER 5 ~THE ECONOMIC DIMENSION~



AN OVERVIEW OF THE ECONOMIC DIMENSION.

"Economic sustainability involves the production and distribution of wealth in a manner that provides goods and services for both present and future generations and that ensures the long-term promotion of a satisfying, high quality life" (Sheltair, 1998:22).

Geoffrey Heal stated that "sustainability is a metaphor for some of the most perplexing and consequential issues facing humanity [and that] almost without exception, these issues are rooted in our economic behaviour and organisation" (Heal: 1998:xi). He continues to say that "sustainability is above all about what happens in the long term: about whether we can continue 'forever' as we are, and whether the economic rules of the game lead us to make choices that are viable in the long term" (Heal: 1998:3). Typically, economic time differs from ecological time. For economists, thirty years is a long time, but in nature this is short. Hence the long term, typically at least half a century, "denotes a period much longer than that normally considered in economic analysis...[and therefore] poses a particular challenge for the economists' traditional practice of discounting" (Heal: 1998:3).

"The economic approach to sustainability originated in the Hicks-Lindahl definition of income as the maximum flow of benefits possible from a given set of assets, without compromising the flow of future benefits. This requires the preservation or increase of the base of assets over time" (Munasinghe & McNeely, 1995:24). This calls for a more sophisticated understanding of 'income' that includes in addition to man-made capital and human-resource capital, the measurement of the base of assets to include natural capital where the depletion of environmental assets then plays a large role (Heal, 1998; Munasinghe & McNeely, 1995).

It has however been argued that "maintaining the stock of natural capital is not essential to the development of a sustainable economy [seeing that] technological change improves the efficiency of resource use, and more productive man-made capital can be substituted for natural capital" (Munasinghe & McNeely, 1995:25). This neo-classical

interpretation of substituting inputs fails in a number of ways. Firstly, energy (and matter) cannot be created or destroyed according to the First Law of Thermodynamics. They can merely be transferred from one state to another. Therefore, "man-made capital and natural capital are not independent [as] the latter is often needed to make the former" (Munasinghe & McNeely, 1995:25). Secondly, "natural capital fulfils life support functions that are not met by man-made capital; for example the ozone layer" (Munasinghe & McNeely, 1995:25). Finally, "substitutability between inputs cannot be easily applied to natural capital, given their multi-functionality and difficulties of physical quantification and economic valuation" (Munasinghe & McNeely, 1995:25).

"The neo-classical production model assumes that capital and labour are primary inputs to production [while] ignoring the substantial quantities of energy used in the process of harvesting resources itself" (Munasinghe & McNeely, 1995:25). When re-analysed from an ecological perspective "energy use increases with resource depletion, because lower-quality deposits require more energy to locate and upgrade" (Munasinghe & McNeely, 1995:25).

Munasinghe and McNeely (1995:26) argue that ecological systems underlie the productive basis of human society and therefore, the preservation of natural capital (ecosystems) may be viewed in economic terms. The challenge for economists is therefore "to expand the analysis of resource values to consider the function and value of ecological systems, to make greater use of ecological information, and to extend economic theory and analysis to examine more fully the implications of [ecological] resource limits" (Munasinghe & McNeely, 1995:27).

Overexploitation of resources is believed to be partly a result of international trading and stock markets that have evolved into a single global system. In such a system "where we are all part of a single system connected by powerful economic forces, it becomes easier to overexploit one part of the global system because other parts will soon compensate for such overexploitation" (Munasinghe & McNeely, 1995:32). In addition, "it is economic forces [and] economic decisions that are driving phenomena such as global warming and biodiversity loss.

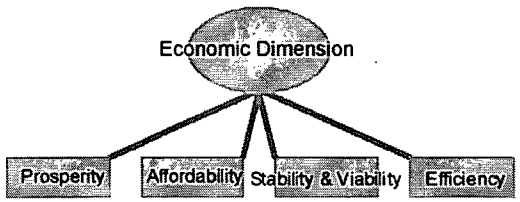
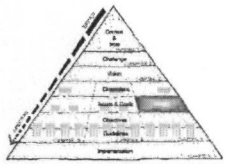


Figure 48: Issues related to the economic dimension.

The decision to use fossil rather than solar energy is an economic decision...the changes in habitat which lead to extinction are again economically driven [as] it appears more profitable to chop down rainforests and plant coffee or other cash crops..." (Heal, 1998:2). Heal concludes that "we will not significantly change the potentially unsustainable aspects of human activity unless we can develop an economical environment within which they are no longer attractive. In other words, we need to change the rules of the economic game so that it becomes rational to pursue sustainable alternatives" (Heal, 1998:2).

This chapter describes four economic issues in greater detail. These include Prosperity, Affordability, Stability and Viability, and Efficiency. These issues are discussed with relevance to urban form and the South African situation. Each issue concludes with a set of recommendations for the planning and design of more sustainable communities and neighbourhoods.



PROSPERITY.

Unemployment.

Unemployment remains South Africa's most formidable economic challenge to a prosperous future. Since the advent of democracy in 1994, it has become clear that the number of people looking for employment far exceeds the availability of jobs in the formal sector. The official unemployment rate was 31.5% in 1994, decreasing to 29.2% in 1995. Since then however, unemployment in South Africa has increased, rising to 35.6% in 1996 and to 37.6% in 1997 (Statistics South Africa, 1998), (see figure 49). The majority of the unemployed are black men and women under the age of 35 years. The high unemployment might be attributed to both the lack of jobs and also the poor access of people living far away

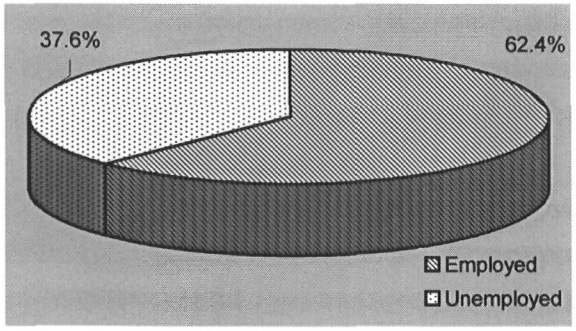


Figure 49:Unemployment among the economically active population.

from job opportunities. Job opportunities can be made more accessible to people if distributed more evenly throughout society.

The Reconstruction and Development Programme (RDP) realises the importance of "boosting production and household income through job creation...and creating opportunities for all to sustain themselves through productive activity" (RDP, 1994:2.2.4.2).

Figure 50: Street hawkers selling their goods on the sidewalks.
(Taken from Tourism Johannesburg, 2001)

Informal income.

The decline of formal sector employment has led to an increase of employment in the informal sector, with almost 1.9 million people earning a living in this sector (NEDLAC, 1999). Enterprises from this sector include hawkers, vendors and subsistence farmers who generate income below the poverty line. The Reconstruction and Development Programme (RDP, 1994) encourages such enterprises and calls for the support of small-scale agriculture, as well as micro-, small-, and medium sizes entrepreneurial businesses.

A large segment of the population rely on generating their own income in the informal sector, typically in small or micro enterprises like producing food, repairing shoes, making crafts etc. These products are then sold informally in markets, on the street, from the home, or from a small trailer.

With the increasing unemployment, the home lot is found to be an important income generator for families (Schoonraad, 2000). A survey in the Mamelodi township "revealed that 80% of backyard units were rented out, and up to 60% of properties were used to generate an income in the form of shops and services: in this way, residents...satisfied a vital need for rental housing stock not provided in significant quantities by any other sector (Schoonraad, 2000). Lots are also used for producing food that is then sold with other crafts and goods on street corners, at markets, or from attached home businesses.

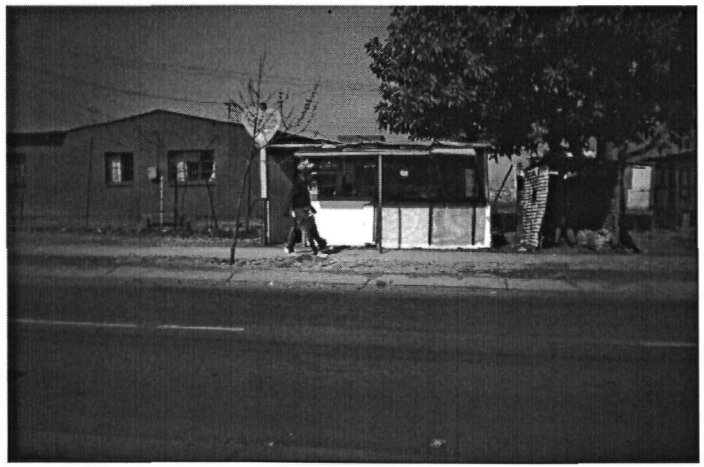
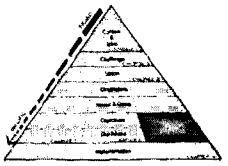


Figure 51: A shop extension on a residential lot in Atteridgeville township.

Recommendations.

Goal: Provide opportunities for a prosperous future.

Objective: Increase local opportunities to boost personal income.



Design Guidelines:

78. Street hawkers ~ Provide central market places and design commercial sidewalks to accommodate street hawkers.

Street hawkers (vendors) are a common sight in South Africa with mobile stalls along main pedestrian routes, selling anything from colourful fruits, to hand made crafts, and shoe repair services. The allocation of sufficient sidewalk space is an important consideration to allow these vendors to sell their products without obstructing pedestrian flows. Central market places, like a community square, can also be used at certain times of the day or week to promote the trading of local goods and crafts. Such informal trading spaces are ideal to support small- and micro-enterprises that cannot afford to pay monthly rents.

79. Food production ~ Encourage small-scale food productivity by providing small agricultural areas, communal gardens, and private vegetable gardens.

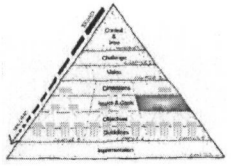
Many people who migrate to the city from rural areas and low-income families still rely on producing their own food (see guideline 44). With the increasing unemployment in South Africa many people also use the production of food as an entrepreneurial source of income. However, opportunities to encourage this source of employment are often neglected in urban areas, and should therefore be reconsidered.

80. Accessory units ~ Design houses with attached or detached units that can either be rented for extra income or used for home businesses.

As small entrepreneurial businesses start off, they are often seen selling their products from their houses, sometimes with an attached shop facing to the street (see figure 51). To encourage such income opportunities, housing types should therefore include live-work options, where people can live and conduct business from the same house, in an attached or detached office or shop. In households where the need for a home business does not exist, such attached units can generate a steady income, especially when considering the increasing demand for rental housing in South Africa (see also guidelines 55, 82).

81. Employment ~ Locate housing closer to employment centers, provide employment within the community and establish transit connections to other employment centers.

Many people in South Africa do not have access to jobs. This reduces economic opportunities for these individuals and therefore every attempt should be made to bring people and jobs closer to one another and to improve peoples' mobility to other regional opportunities.



AFFORDABILITY.

Housing.

The majority of South African families cannot afford a large lot with a single-family suburban house (Schoonraad, 2000). The average South African household income is about R55,000 per annum (Department of Housing, 2000). Information from real estate agents show that an annual gross income of R55,000 would mean R1,375 per month allowed by the Banks

to service a mortgage bond of about R110,000. This amount is at the lower end of the scale for buying property in urban areas. It can possibly buy a small apartment or townhouse, or a more spacious but older house (Topteam Management, 2001; Ghyoot, 2001). For new developments however, renting seems to be the more affordable option and as development ages, the option to buy becomes more feasible.

It is however important to note that household income is not linked to the amount of people per unit (see figure 52). One-person households earn roughly the same as households of eight or more (Department of Housing, 2000). This highlights the discrepancy that exists between what a household can afford and what they need spatially. The cost of the house is also not the only cost involved in the purchase of property. The total cost of a very basic 20-30m^2 unit is around R8,000-R10,000. When the costs for servicing and bulk infrastructure are included the figure increases threefold to about R25,000-R30,000. (USN, 2001). It is clear that the cost of the land, services, and infrastructure are important considerations in the affordability of housing.

Household Type	Average monthly household income (R)
Urban	**4 583**
One person	2 083
Two persons	4 083
Three persons	3 917
Four persons	4 250
Five persons	3 833
Six persons	3 083
Seven persons	2 500
Eight or more persons	2 333

Figure 52: Average income of South African households.
(Adapted from Department of Housing, 2000)

Transportation.

The personal costs of car dependency are enormous, as are the hidden costs such as government subsidies, environmental-, and social costs (BEST, 1999). With such a large segment of the South African population living in poverty, it is essential to provide more affordable options to serve the needs of this key group of users. Recent Canadian cost estimates (see figure 53) show that alternatives to driving, such as cycling, walking and using transit, are in every aspect less costly to individuals and to society as a whole (BEST, 1999). This further supports the argument that the provision of lower cost alternatives, such as walking, cycling, and public transit, are essential in South Africa.

Public transportation is, however, relatively costly when compared to international benchmarks with services costing users 32% more than world averages. This is primarily a

result of the travelling distances (Department of Transport, 1998). A hypothetical reduction of 10km in trip distances in the city of Pretoria would save an estimated annual R350 million in passenger fares, R110 million in bus and rail subsidies, and 100,000 person years of travelling time (Department of Transport, 1998). The long travelling distances also impact the national economy, as different levels of South African government spend R2.8 billion annually to subsidise long-distance buses, municipal buses, and commuter rail services (Department of Transport, 1998). To make public transit more affordable, the inefficient travel distances will have to be reduced.

Transportation Mode	Total monthly cost (fixed & variable costs) in Canadian Dollar
Car	$650
Transit	$65
Cycling[1]	$23
Walking[2]	$12

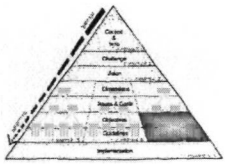
[1] *commuting 12 km/day & cycling 10 km /week, based on$800 bicycle with 10% depreciation.*

[2] *cost of shoes when walking 6km/day.*

Figure 53: The cost of transportation modes when used on a regular basis. (Adapted from BEST, 1999)

Recommendations.

Goal: Create affordable living options for all.



Objectives: Increase the affordability of housing.

Design Guidelines:

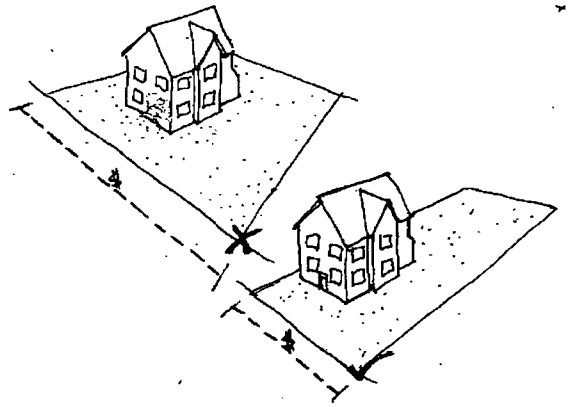
82. Renting ~ Provide tenure options that allow people to rent houses, units, floors, or even rooms.

There is a vital need for rental housing stock in South Africa (Schoonraad, 2000). Most people cannot afford to purchase a house and rely on renting as the only affordable option. Renting options should be made available and range from renting full units, to renting a floor or a single room within a unit. Clause 2.5.12 of the RDP states that the "government must ensure a wide range of tenure options including individual and collective home ownership as well as rental".

83. Housing types ~ Provide a variety of housing types and lot sizes, that can meet the budget of varying income homebuyers.

The South African housing typology provides mainly for two housing typologies viz. detached houses and apartments. This allows little flexibility for homebuyers who can generally not afford the cost of a detached suburban home. Housing options should include a variety of housing types on various lot sizes to ensure affordable options. Refer to guideline 47.

84. Lot sizes ~ Reduce lot widths to about 6-12m and maintain lot sizes of about 100-300m^2 while maintaining a width:depth ratio of 1:2 to 1:5.

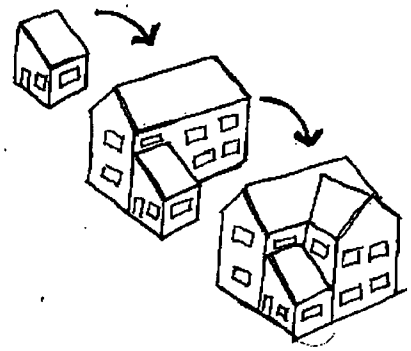


When purchasing a house, the owner is also buying the land and paying for the cost of all roads, piping, cables, sidewalks etc. that run along the width of the property. The affordability of the house is greatly influenced by the size and width of the lot and therefore smaller, narrower lots are necessary for more affordable options. Lot sizes may vary according to the type of house but might generally range from around 6-12m in width and with areas of around 100-300m^2 (USN, 2001; JTC, 1998). An economical width:depth ratio of between 1:2 and 1:5 should be maintained so that lots are longer than what they are wide (USN, 2001).

85. Core units ~ As a minimum, provide 20m^2 core-units to allow people to gradually construct their home over time.

For low-income households it is usually impossible to raise enough money to buy a house or to commit to monthly mortgage payments with their sporadic income. An incremental approach to housing, where the household starts off with a core house that is gradually enlarged over time when the household can afford to do so, is more suitable. About 4-6m^2 of built dwelling per person is considered a reasonable standard to aim for in low-income areas in developing countries (USN, 2001). Assuming an average household size of 5 people for low-income

families (USN, 2001) these core units should be about 20-30m^2 as an adequate minimum size. The Association of Mortgage Lenders' guideline for incremental housing, stipulated that foundations and slabs must be for a minimum house size of 40m^2 (as stipulated under guideline 43) on which a walled and roofed area of not less than 20m^2 must be built (USN, 2001). Due to their small size, these units can often appear as 'stipples' in the landscape that that do not form a coherent whole with surrounding building mass. For this reason, these units should rather be treated as ancillary units that are used in conjunction with other units on a common lot (refer to guideline 87).



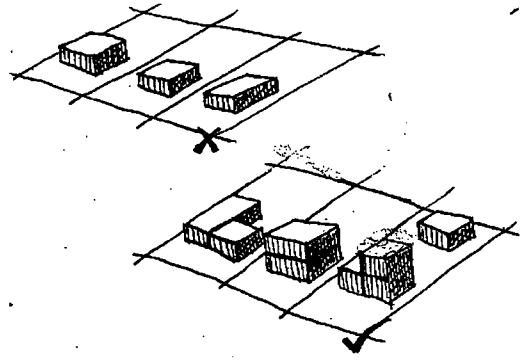
86. Lanes ~ Incorporate vehicular garages or parking spaces in the back of the lot with back lane entry or side lane entry.

When aiming to reduce the lot width and to increase the density in an area the space taken up by the car poses a problem. The average house might have a garage next to the house that houses one or even more cars. With a width of about 5m the garage extends the lot width by at least this much. This results in higher costs payable for infrastructure (see guideline 84) and it allows fewer dwelling units on a block (see guidelines 87, 91). Back lanes can also be closed off with gates for secure access that allow only residents of the block to enter (see guideline 67).

87. Density ~ Increase the residential density and provide multiple units on one lot, to reduce the infrastructure costs per capita.

Higher densities are one of the most basic and potentially effective techniques for promoting housing affordability. High densities reduce land and infrastructure costs for developers, allowing them to spread these costs over a larger number of units, and therefore, reduce purchase prices for homes and rents for apartments (MRSC, 1992). A higher density does not

always imply high-rise developments that are typically more expensive in terms of building construction costs. It can take many forms with varying building costs but similar savings in terms of infrastructure costs. These types might vary from duplexes, townhouses, apartments, and to even single family detached houses on smaller lots. In low- to middle-income areas, there is also a greater tendency for multiple families, couples, or individuals to live together on one lot (Schoonraad, 2001). Development should therefore make use of the opportunity to promote multiple units per lot, thereby increasing densities and allowing people to share costs.



Objective: Increase access to affordable transport.

Design Guidelines:

88. Public transportation ~ Encourage the use of public transportation as an affordable option that avoids capital and running costs.

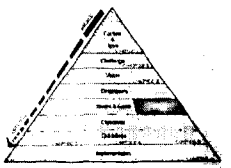
Owning a car can be very expensive. Not only is the cost of cars high, but it also costs a great deal of money to operate a car. This cost can be minimised through the use of public transport, where the costs are subsidised and shared among many people.

89. Walking & cycling ~ Encourage walking and cycling as the most affordable transportation alternatives.

Walking and cycling can be regarded as the cheapest modes of transport. With the cost of walking virtually free, it is affordable to just about everyone. Local circulation should provide for these commuters and uses should be provided within walking distance so that people can walk or cycle to their destinations (refer to guideline 1).

***90. Proximity ~ Reduce the cost of** traveling by providing **amenities, and employment** closer to the home.*

In South Africa the costs of travelling are very high due to the long distances people travel. Longer distances mean more gas and more maintenance on the vehicle. In the case of public transportation it also means more busses, taxis, and trains to serve people to their diverse distant locations and higher salaries for drivers that has to drive longer. "The policy of apartheid has moved the poor away from job opportunities and access to amenities. This has burdened the workforce with enormous travel distances to their places of employment and commercial centres, and thus with excessive costs" (RDP, 1994:2.9.1). The RDP (1994:2.5.11) states that "land for housing must be suitably located...with respect to economic opportunities and social amenities." The Development Facilitation Act clause 3(1)(c)iii continues to say that "the availability of residential and employment opportunities [should be promoted] in close proximity to or integrated with each other" (DFA, 1995). By providing uses closer to the home, travelling distances and, consequently, costs are reduced, whether people use public transit or private vehicles.



STABILITY AND VIABILITY.

Customers and users.

It might be said that an economically stable business has a stable flow of customers. The number of customers it draws determines the success of every business. The same general rule can be applied to any amenity that relies on users, for a viable existence.

To be viable, every amenity and business requires a given population size within a specified distance (catch-basin or catchment). A variety of documents including the 'Guidelines for Human Settlement Planning and Design' (CSIR, 2000) and 'Time-saver

Standards for Residential Development' (de Chiara, 1984) set out such catch-basin guidelines (see figure 54). As a rule of thumb, populations of around 7,000 are required to support neighbourhood provisions, while populations of around 35,000-45,000 are necessary to support community uses.

The low-density sprawling pattern found in South Africa, results in people being pushed further and further from these amenities and businesses, with many falling outside catch-basin distances. This phenomenon has two implications. Firstly, it reduces the number of people that live within the catch-basin and as a result, there are less customers and users that can support the local businesses and amenities. Secondly, the people that live outside the catch-basin might not have access to other businesses and amenities in their area, forcing them to commute by car in order to reach such provisions.

The low-density distribution of the population also distributes potential passengers further away from transportation access. These people therefore choose other alternatives and thereby limit the viability of the transportation system. Research from Newman and Kenworthy (1989) and later Kenworthy and Laube (1999) investigated the relationship between density and car/transit use (see figure 56). They found, in an international comparison of cities, that "as density increases, per capita energy use and per capita car use decline, while the proportion of passenger kilometres accounted for by transit increases" (Kenworthy & Laube, 1999:550).

To provide sufficient support to transportation services, residential densities should be maximized in the 400-600m walkable zone that surrounds transit nodes (Calthorpe, 1993; Urban Task Force, 1999; Cape Metropolitan Council, 1996). The 'Guidelines for Human Settlement Planning and Design' (CSIR, 2000:18) set out gross residential density guidelines for public transport frequency in South Africa (see figure 55). To be competitive with the convenience of the car, 5-15min intervals are suggested as the minimum frequency to consider. This requires a gross residential density of 22-37du/ha (dwelling units per hectare), or gross population densities of about 88-148persons/ha when assuming an average

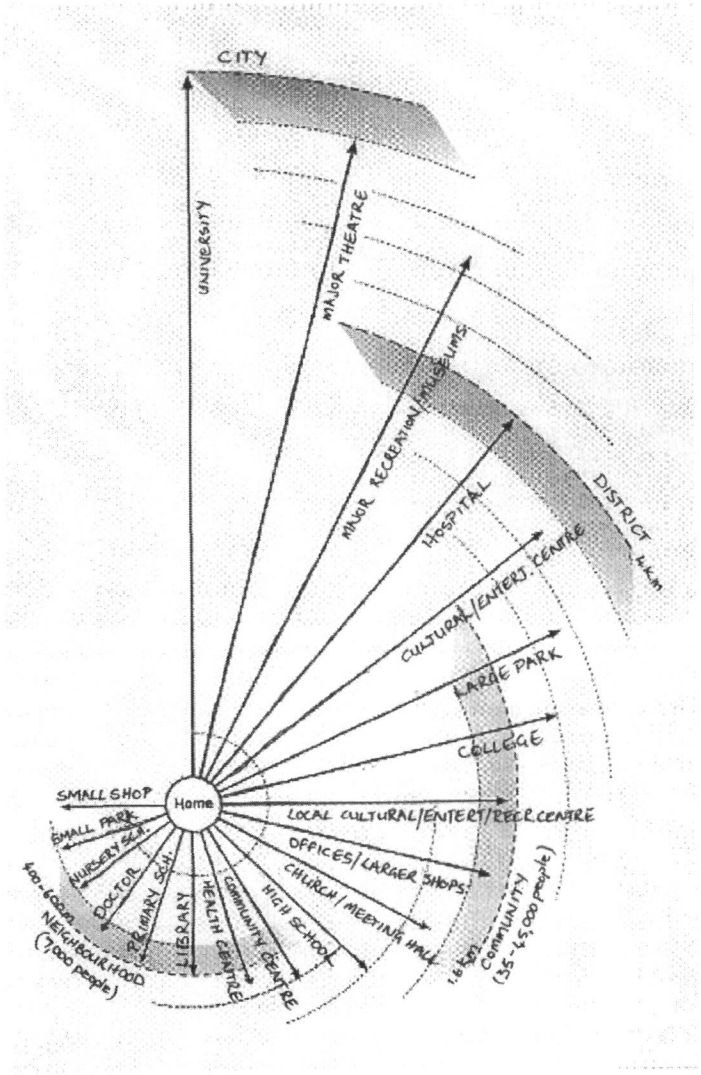


Figure 54: Catchment distances and populations for required for various amenities.
(Adapted from Urban Task Force, 1999)

household size of 4 people in South Africa. This corresponds with gross densities suggested by Cervero (1997) at 30-40du/ha, which might be said to be in the order of 60-120persons/ha in the American context. The Urban Task Force (1999) also proposes gross population densities of 100people/Ha. As a rule of thumb, it seems that, given a socially mixed population, aiming for gross residential densities of around 80-100persons/ha in each walkable neighbourhood is most suitable. This would translate to an average neighbourhood population of around 7,000 residents that are sufficient to support the basic facilities and amenities in the area (Frey, 1999; Urban Task Force, 1999), yet small enough to maintain local autonomy and community participation (Frey, 1999; Yates, 1973). In the South African context, population densities seem to be a more accurate measure than residential densities. Seeing that household sizes vary a lot, high population densities can be found in areas with low residential densities i.e. where large families live together in a single house (Schoonraad, 2000).

Lastly, the social class of the customers and users also impacts on the stability and viability of amenities and businesses in an area. In South Africa the development of profitable enterprise in affluent outlying areas has been powerfully promoted, while the city core has been left to cope with the residual poverty and its adversities. As development, and with it job opportunities and wealth, migrate to the outlying areas, poverty and crime slowly move into the city centre. The large concentrations of poverty stricken people negatively impact on the individuals' economic opportunities and the communities' wealth as a whole. In addition to leaving a decaying core in their wake, large businesses, locating in outlying areas, cause property price increases that force local shops to re-locate to more affordable areas. The concentration of poverty is often accompanied by the provision of substandard services and amenities, as the concentrated poor population cannot financially support businesses and amenities in their area.

Transport frequency	Gross residential density	Gross population density *
5-10min intervals	37 dwellings/Ha	148 people/Ha
15min intervals	22 dwellings/Ha	88 people /Ha
30min daytime intervals & extended services every 60min	17 dwellings/Ha	68 people /Ha
60min daytime intervals	10 dwellings/Ha	40 people /Ha

**Assuming 4 people per household as calculated from census 1996 figures*

Figure 55: Gross residential densities required for various transportation frequencies in South Africa.
(Taken from CSIR, 2000)

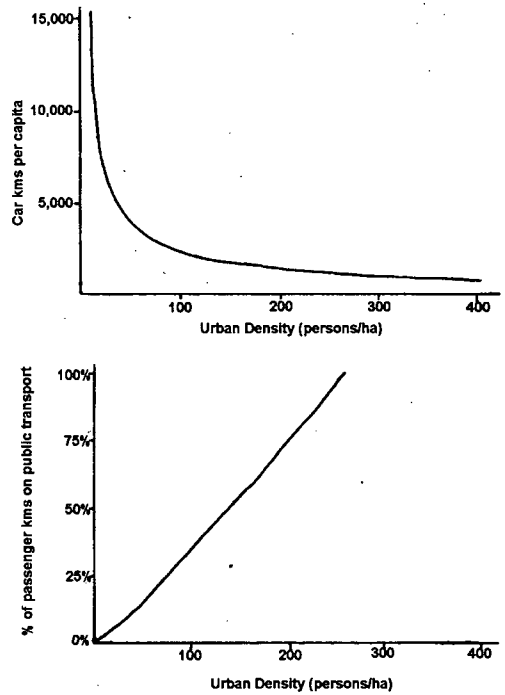


Figure 56: The impact of metropolitan density on transportation patterns.
(Taken from Kenworthy & Laube, 1999)

Diversity and competition.

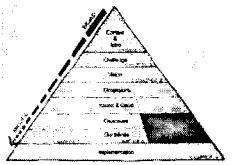
The stability of the economy is closely linked to its diversity. Local community economies should include a diversity of sectors, and a diversity of business ages and sizes. This provides more diverse choices to the users, and it promotes the stability and viability of businesses in the area.

A diversity of economic sectors in one area ensures a more stable local economy when the economies of the individual sectors fluctuate. For example, if a community's businesses are comprised of mainly technology and construction industries and businesses, the local economy will fluctuate as these industries fluctuate. If the community diversifies into a larger number of industries such as academic, financial, technology, agriculture, retail, construction, automotive etc., the success of some will even out the failures of others, increasing overall stability. This diversity applies to different sectors and does not imply a duplication of the same type of businesses. Businesses that locate within the catch-basin of competing businesses reduce the potential customer-base. This strains economic stability and viability, and results in a greater risk of bankruptcy. This does not imply that all businesses should be spread out. On the contrary, businesses of varying types should be located close to one another to promote the convenience of the customer.

Buildings of varying age and size also promote the viability of businesses in an area as more businesses can find properties that meet their needs and budget. Mixed buildings draw a diverse range of businesses to the area. These in turn provide stabile 'anchors' for smaller, younger businesses. This is an important consideration if the RDP's objective, to encourage new, small businesses in South Africa, is to be achieved (1994).

Recommendations.

Goal: Maintain stable, viable local economies.



Objective: Increase local economic support for transit, facilities, and businesses.

Design Guidelines:

91. Density ~ Increase gross population densities to about 80-100persons/ha within walking distance of transportation stops, facilities, and businesses to ensure effective support for such uses.

The RDP (1994:2.9.3.10) encourages high-density development to ensure efficient use of public transport. Research shows that about 80-100 persons/ha are required within walking distance from transit stops, to viably support transportation services (CSIR, 2000; Cervero, 1997; Urban Task Force, 1999). This density correlates with the neighbourhood catch-basin distance and population that is necessary to support core amenities (see guideline 92).

92. Populations ~ Ensure neighbourhood populations of about 7,000 people within 400-600m, and community populations of about 35,000-45,000 people within 1.6km of core amenities.

To sufficiently support amenities, a required population is necessary within a catch-basin distance. As a rule of thumb, the neighbourhood has a recommended population of about 7,000 people within 400-600m of amenities, while communities should have a population of about 35,000-4,000 within about 1,6km of core amenities (Frey, 1999; Urban Task Force, 1999; De Chiara, 1984). The neighbourhood population also correlates with the democratic neighbourhood size (see guideline 73).

93. Economic mix ~ Reduce the concentration of poverty and distribute income groups more evenly throughout developed areas.

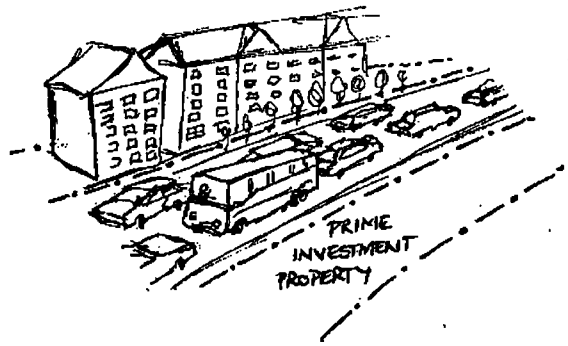
Businesses and amenities in poor areas are often not economically stable or viable, as the large concentration of poverty does not provide sufficient financial support to these uses. A local population, with diverse incomes, ensures that businesses and amenities have a sufficient customer-base and users.

Objective: Increase regional support for local businesses and amenities.

Design Guidelines:

94. Location ~ Allow local economic investors access to property along prominent regional circulation corridors.

Larger investors, rely on public exposure as a means to attract customers. The prominent location of a business can increase its customer-base as these locations effectively serve as marketing. Prominent areas, adjacent to major regional circulation routes, should therefore be used to attract larger local investment and employment to the area.



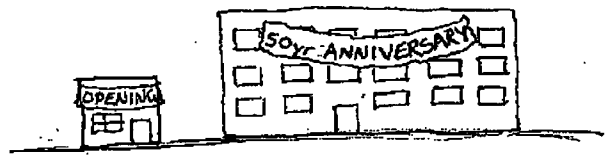
95. Transit ~Establish regional transit connections that draw customers and users from outside the community.

For a viable, stable existence, many larger businesses and amenities cannot only rely solely on the support of local people. To expand the client- and user-base for local businesses and amenities, the community needs to be connected to other centres in the region, from which it can draw more people to support local businesses and amenities.

Objective: Increase local economic diversity and reduce competition.

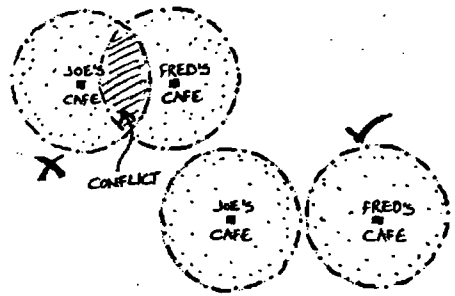
Design Guidelines:

96. Age & size ~ Provide a mixture of buildings of varying age and size.

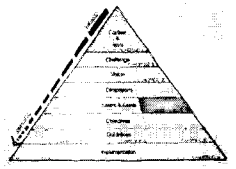


Encourage a mixture of buildings of varying age and size, so that there are affordable rents for enterprises just starting out as well as high quality space to keep successful enterprises from leaving the area (Cohen, 1997). A varying mix of small and larger businesses creates a stable environment for small enterprises that can benefit from the stability of the larger anchors.

97. Mixed uses ~ Provide a diversity of business types in a central core of about 1-3ha for neighborhoods and about 7-16ha for communities, but avoid locating competing businesses in the same catchment.



Every economic sector brings with it a different dynamic and economic fluctuation that impacts the local economy. A diversity of businesses allows a more even distribution of these fluctuations for an overall stability. These businesses should be promoted in close proximity to one another in a central core area where people can buy what they need without having to commute to the next shop. This also provides communal support between businesses as one relies on the other's customers to also shop at their business. The neighbourhood core allows for basic provisions in a recommended area of about 1-3ha (Calthorpe, 1993; Frey, 1999; Condon, 1996). The community core caters to a larger population and can therefore provide for more specialized and wider range of uses. Depending on its regional location, this core can ranges from 7-16ha in size (Calthorpe, 1993; Frey, 1999; Condon, 1996). Competing businesses should however not be located within the same core where they are competing for the same customer-base. This can lead to bankruptcy of local businesses, and should therefore be avoided.



EFFICIENCY.

Transportation.

The low-density sprawl pushes land uses further and further apart, causing people to commute for longer distances and longer times, along congested roads. Almost 50% of South African public transport users are dissatisfied with travel times. This is mostly due to the fact that the average public transport trip in South Africa is 20 km, causing commuters to spend almost 40% more time travelling than in developing Asian countries (Department of Transport, 1998). The time people spend on the road is inefficient and could be better spent on earning income, recreating or spending time with family and friends.

In addition to the long commuting times, there is also a lack of integrated planning between transportation modes. This causes unnecessary competition, resulting in inefficient use of modes that do not take fixed- and marginal costs into consideration. Fixed costs are defined as costs that do not vary depending on the amount of passengers, such as the cost of the bus (Lexico, 2001). Marginal costs, on the other hand, are defined as the increase or decrease in costs as a result of having more or less passengers, for instance the cost of gasoline (Lexico, 2001). In most countries, rail, with the highest fixed cost and the lowest marginal cost, carries a substantial base-load of passengers. Buses carry the next band and the peak-load traffic travels are carried by taxi, which has the lowest fixed cost and the highest marginal cost of the three modes. In South Africa the typical modal roles are reversed, and taxis carry the base-load of traffic (Department of Transport, 1998). On many routes, taxi buses are in direct competition with public busses and trains. This impedes on the transportation network's ability to recover higher fixed cost investments.

Infrastructure and facilities.

The inefficient sprawling pattern in South Africa is a burden to local government because it forces limited resources to be allocated to the creation of new infrastructure, rather than maintaining existing infrastructure. Sprawl "requires government to spend millions extra to build new schools, streets and water and sewer lines. In its wake, sprawl leaves boarded up houses, vacant storefronts, closed businesses, abandoned and often contaminated industrial sites, and traffic congestion stretching miles from urban centres" (PlannersWeb, 2000). The problems of this sprawling pattern go deeper than just affecting the suburbanite.

Sprawl absorbs large amounts of government spending in order to provide additional infrastructure and services in outer-lying areas that might otherwise have been used to deal with inner city problems (PlannersWeb, 2000). This amount to large sums of money when considering that about 40% of the cost of development is related to the provision of infrastructure and amenities (USN, 2001). This problem is exacerbated by the inefficient urban patterns of the past that pushed the majority of people to the excluded peripheries where they had poor provision of services and infrastructure. With the turn to democracy, the South African government has attempted to improve provision of services to those developments. Needless to say this involves great costs, and in spite of the lessons learned, government still promotes development on the periphery where land is cheap, but the cost of providing infrastructure and amenities is high (DPC, 1999:12). With the scale of this problem and the lack of funds, it is evident that new developments will have to make more efficient use of existing infrastructure and amenities by utilising it to its full capacity.

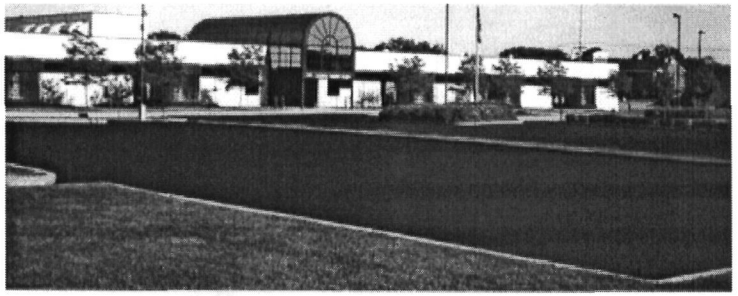


Figure 57: Inefficient use of parking lots during off-peak times.
(Taken from H & L parking lot maintenance, 2001)

Recommendations.

Goal: Promote the development of communities that are economically efficient.

Objective: Maximize the efficiency of infrastructure and facilities.

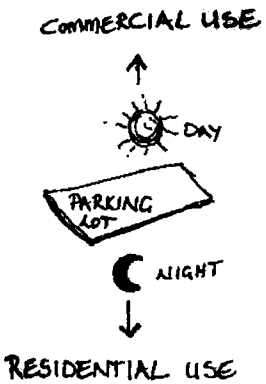
Design Guidelines:

98. Re-use ~ Re-use existing infrastructure and facilities to their fullest potential, through densification and intensification around existing amenities, and within existing serviced areas.

Using facilities and infrastructure more efficiently, means that they should be utilised to their fullest capacity. This not only has implications for the residential densities in the area (see guideline 91), but also implies developing within existing urban areas rather than promoting new growth development on the urban periphery (see guidelines 23-25). The South African government promotes "higher density in respect of housing development to ensure economical utilisation of...services" (USN, 2000).

99. Multi-use ~ Encourage multi-use facilities that consolidate uses and promote round-the-clock usage.

In a diverse society the users will inevitably have a diverse range of preferences and needs. It is not efficient to provide for each of these individually, for instance a soccer field, rugby field and cricket field, and it would be more efficient to combine uses together, in for instance a multi-use lawn area. The same applies for the regularity of use, where round-the-clock usage is ideal. For instance parking in mixed-use areas might be used as commercial parking during the day when residents are at work, and at night when shops are closed, residents could use the parking.



Objective: Maximize the efficiency of the public transportation system.

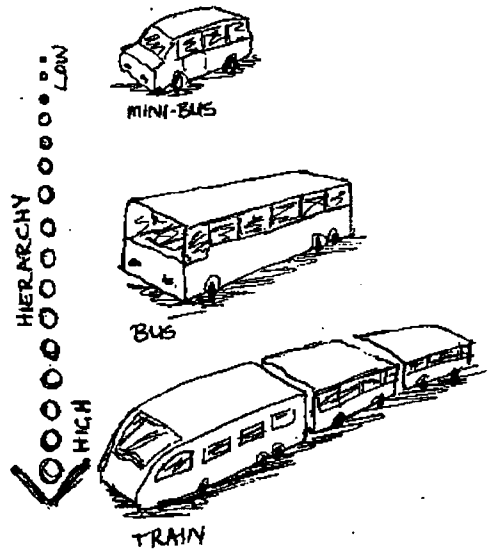
Design Guidelines:

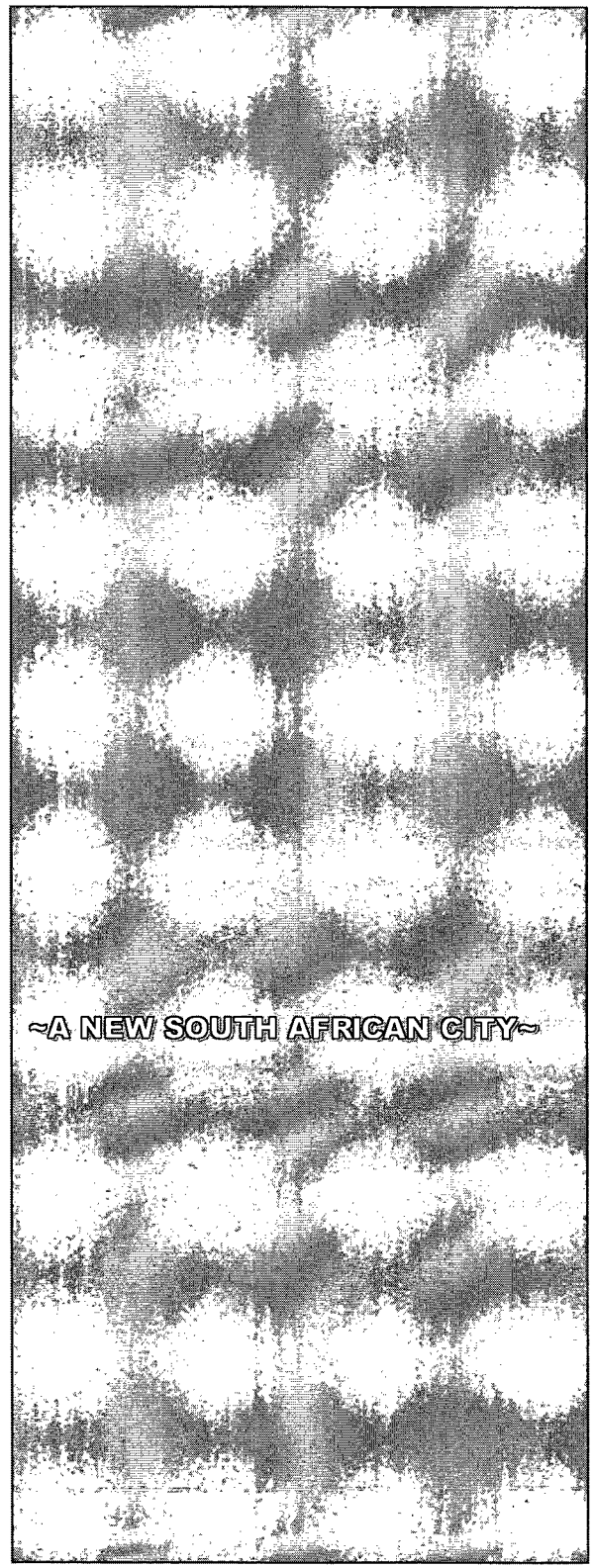
100. Proximity ~ Reduce the amount of inefficient time wasted commuting by providing a mixture of amenities, and employment closer to the home.

Commuting times are closely linked to the travelling distances. By locating homes and a variety of destinations closer to one another, people have to travel over shorter distances and get to spend more time doing what are important to them while at the same time cutting down on the cost of travelling (see guidelines 88).

101. Transportation hierarchy ~ Provide a modal hierarchy in the public transportation system that improves the efficiency of capacity vs. cost.

The higher up in the hierarchical system, the higher order transportation is required. Mini-bus taxis, that can transport only a small number of people, have the lowest fixed cost, but high marginal costs. Rail transport can move a large number of people and has the highest fixed cost but lowest marginal cost with busses in between the two modes. Mini-bus taxis should therefore be encouraged to collect passengers in a small area, and 'deliver' them to bus stops. Busses collect people over medium distances and 'deliver' them to rail stations. In doing so the passenger load increases proportionally to the effectiveness of each mode.





CHAPTER 6 ~A NEW SOUTH AFRICAN CITY~

SUMMARISING THE SUSTAINABLE SOUTH AFRICAN CITY.

This document provided a broad context for a sustainable South African city. This section aims to put the pieces together in a general discussion that references the recommended design guidelines from the preceding chapters. The referenced guideline numbers are indicated in brackets.

The hierarchical honeycomb.

Discussions from Chapter 2 showed that the sustainable city is a 'honeycomb' that consists of individual 'neighbourhood cells'. These cells cannot function in isolation as they form part of a greater urban hierarchy. Developing certain cells and leaving others undeveloped creates a patchwork of varying intensity that gives rise to larger urban hierarchies. Neighbourhood cells cluster together into small groups to form 'communities' and these communities again cluster together to form 'districts' within the city.

Cells might fit tightly together in some places and be distributed loosely in other areas. As a rule of thumb, these cells never overlap (97) and they are all contained within the urban boundary (23)(37). Any new development respects this urban boundary and utilises existing infrastructure (98) through infill (24) or redevelopment strategies (25), and avoids development in sensitive (34) or hazardous areas (64).

This document focuses on the 'community cell' as a means of incrementally creating a more sustainable, democratic city at large. The following provides a summary of what the community cell might look like if we utilised the proposed guidelines as a guide in the planning and design of such a cell.

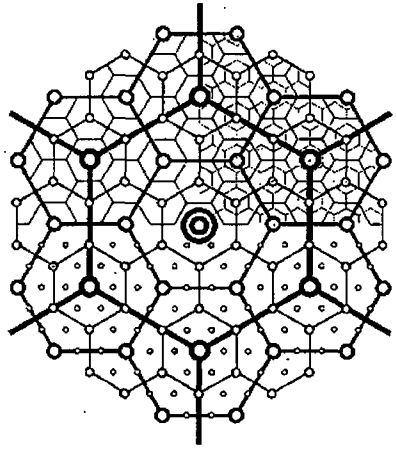


Figure 58: The urban hierarchy.
(Taken from Frey, 1999)

The community structure.

The community cell consists of about four to six individual neighbourhood cells, each with a population around 7,000 (73)(92). At the centre of each neighbourhood is the 'neighbourhood core' (4)(74)(97) that is about 1-3ha in size (97). To encourage walking and cycling within the neighbourhood boundary, the mixed-use neighbourhood core should be no more than 400-600m walking distance from the majority of homes (1)(13)(41)(44)(46)(51)(54)(62)(71)(89). This results in a neighbourhood size of about 80ha.

Due to its limited population and size, the neighbourhood only provides for basic daily needs and basic amenities. A greater variety of needs are better catered for within the 'community core' (4)(74)(97), at the next level in the urban hierarchy. The neighbourhood cell, that is located most centrally in the community, has a prominent position and it therefore contains the community core that serves the larger community population of 35,000-45,000 (92). The community core provides larger amenities and a wider variety of uses than those found in the surrounding neighbourhood cells. Typically the community core is about 7-16ha in size (97), however, the size and mix in each of the core areas can vary depending on the location, and overall function of the cell in the region.

Access to the community may fall outside a comfortable walking- or cycling distance for those that do not live in the central neighbourhood. To prevent these people being stranded (46) and to discourage them from travelling by car, a local public transportation network is incorporated that links neighbourhood cores to one another and to the central community core. This would ensure that the majority of the residents in the community are no more than 400-600m walking distance away from a transit stop that can again deliver them within 400-600m walking distance to their local community destination (2)(41)(46). In the South African city, such a local transit system might be best serviced through the use of mini-bus taxis that are managed

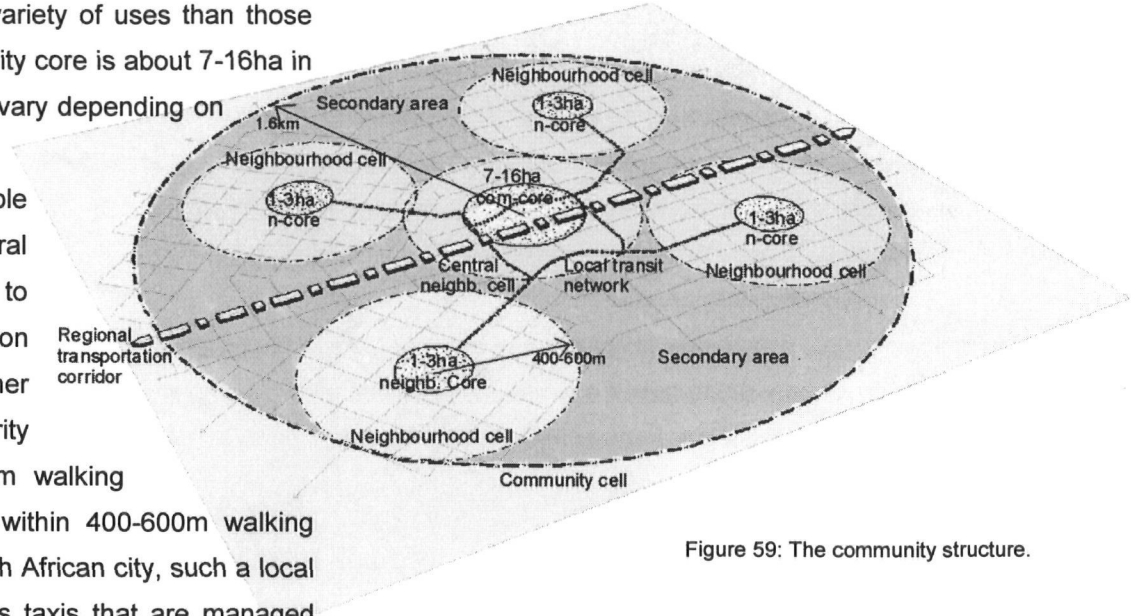


Figure 59: The community structure.

locally and that can carry small passenger loads at frequent intervals (101).

Although the community provides a wide range of amenities and uses that satisfy the majority of daily needs, travel outside the community boundary is inevitable and should not be discouraged (41)(49)(81)(95). Though car travel might become more common and viable when travelling over longer distances, public transportation alternatives should still be encouraged (2)(13)(57)(63)(71)(88). The aim is not to eliminate car travel all together, but rather to avoid the need for car travel in the lower urban hierarchical structures, such as neighbourhoods and communities. This is done by providing walking, cycling, and transit alternatives. For this reason the community core is connected to a regional public transportation network. The local mini-bus transit network connects with the regional transit network allowing passengers to transfer to a higher order system such as a bus or light rail network (101), connecting them to other communities and larger urban centres (41)(49)(81)(95). Such a regional transit stop should be located within at least 1,6km of the majority of homes (2)(92). This results in a total community size of about 800ha.

Land uses.

Unlike traditional zoning principles, the community cell concept employs 'spot zoning'. The cell has a much finer grain of land uses and the various land uses are not truly contained in zones. Instead, land uses are considered as areas of concentrated use, allowing each use to spill into neighbouring uses, creating a 'spotted' distribution pattern. The community provides a variety of land uses within its boundary, all of which are in close proximity to homes (3)(21)(81)(88)(100). Certain land use areas might even overlap with one another and occur in the same street block or vertically within the same building (4)(46)(58)(74)(97), typically the case in core areas that have retail, office space, and residential units layered on top of each other.

The walkable 400-600m zone, that surrounds each core, is considered prime land for residential use. Areas falling within the community boundary, but not within a 400-600m distance from a core area, should be considered as 'secondary areas' that are more suitable for non-residential uses. These areas make essential contributions to the mixed-use character of the community by expanding local productivity, employment and investment opportunities. These secondary areas might include uses such as small-scale agriculture (44)(79), larger open spaces (32), and light industries that provide local employment and investment (3)(21)(81)(88)(100). Light industrial areas can best be incorporated into the community setting where such secondary areas are adjacent to the major transportation corridor (72)(94).

Each land use category also includes variation. For example, agricultural areas include variations that range from medium to micro-scale production (44)(79); commercial areas include businesses of varying type, age and size (96)(97); open spaces vary in size and habitat types (32)(50), and residential areas include a range of housing types and tenure options (38)(47)(82)(83).

The community also provides a range of amenities close to the home (3)(21)(88)(100), that include a variety of public-, cultural-, recreational-, entertainment-, educational-, health-, and welfare facilities (39)(49)(51)(55)(70)(78). Where possible, these facilities provide multiple uses and are adaptable to a variety of uses (40)(99).

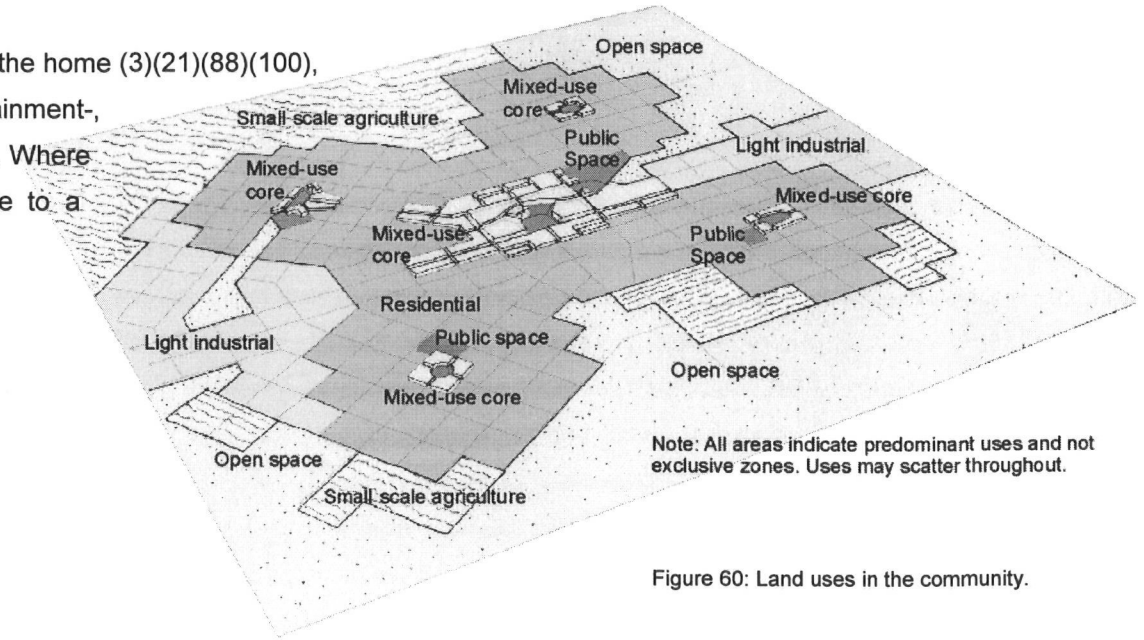


Figure 60: Land uses in the community.

Density.

The residential neighbourhood cell is a compact unit (21)(28)(87)(91)(98). To ensure sufficient support for transportation services and local amenities in the core areas, the neigbourhood cell maintains average gross densities of about 80-100persons/ha (87)(91).

Densities vary from one cell to another, depending on the regional location and the hierarchical order of the transportation network the cell connects to. For instance, a neighbourhood cell that connects directly to a regional bus system has a higher average density than a neighbourhood cell that lies along a local mini-bus network. As a minimum however, every neighbourhood cell that connects to a transit system, should maintain an average gross population density of at least 80 people/ha.

Densities are also not uniform throughout the cell. The central mixed-use core areas contain the primary transit stop and the largest number of amenities and businesses. To maximize access to these provisions, the density climaxes around the mixed-use core and slowly decreases towards the respective cell boundaries. Such densities correlate with the proposed neighbourhood population of about 7,000 people (73)(92) when considering the walkable cell as roughly 80ha in size.

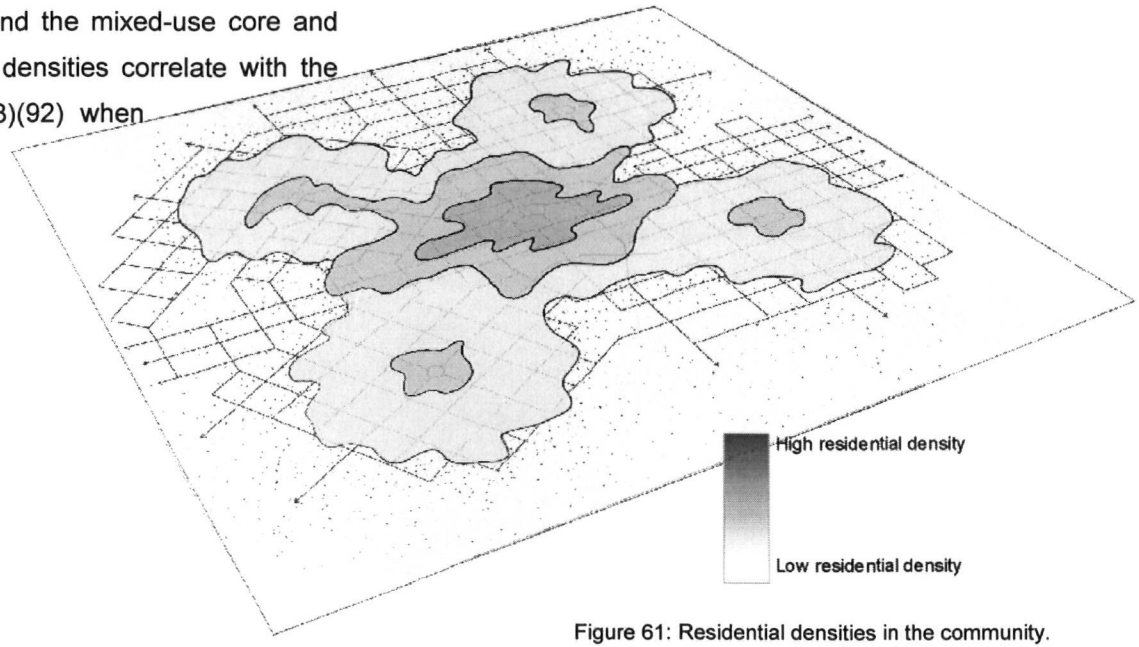


Figure 61: Residential densities in the community.

Open space.

Development within the community respects environmentally sensitive areas (64) and considers natural open spaces as an integral part of development rather than a conglomeration of all the leftover spaces that development discarded (11)(30)(31)(37)(51). The community has an overlay of open spaces of varying size, habitat, and character that might range from small manicured neighbourhood parks and sport fields to large natural grassland areas and forests (32)(50). Local urban parks are relatively small (61) in scale with surrounding uses such as restaurants and schools (36). These spaces provide places for congregation, socialisation, play, and recreation (39)(51)(68). Urban parks are designed to be flexible, multiple use areas (40)(99). Where appropriate, these parks should incorporate indigenous (34), drought tolerant vegetation (6), and be designed to act as temporary retention areas for urban runoff (16).

Individual open spaces within the community are connected to one another, creating a continuous network of open spaces (33) that incorporate regional greenway connections for pedestrian and bicycle movement (1)(41)(49)(51). Agricultural areas in the community are also incorporated into the continuous open space network.

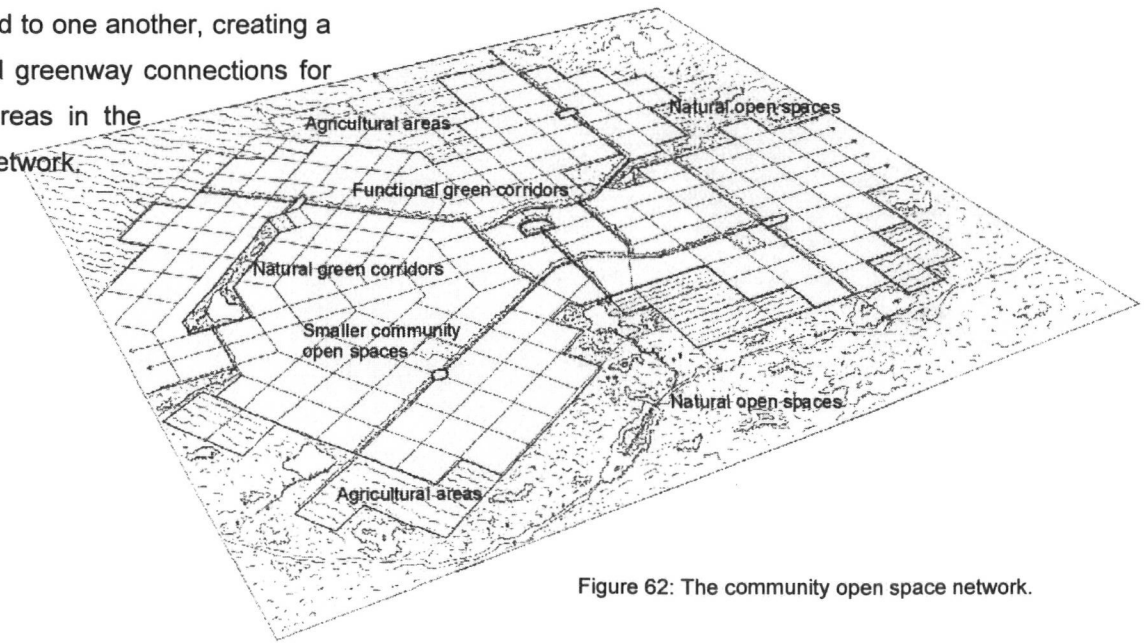


Figure 62: The community open space network.

Hydrology.

The community manages local runoff volumes and runoff speed through the retention, infiltration, and filtering of stormwater (65). More water is directed into the ground, by reducing roof-, road-, and parking coverage (11)(19)(20)(27)(29)(62) and increasing vegetation and porous surfaces (22)(30)(37).

Surface runoff from roads is directed into roadside infiltration trenches (15) that convey runoff along gravel trenches underneath the surface, where it is sheltered from evaporation, while at the same time allowing infiltration. The infiltration trenches direct water towards open spaces and agricultural areas within and around the community that serve as filter strips (17), temporary retention basins (16), and infiltration areas. Excess water is retained in larger community retention ponds from where it is slowly released into the greater regional water system.

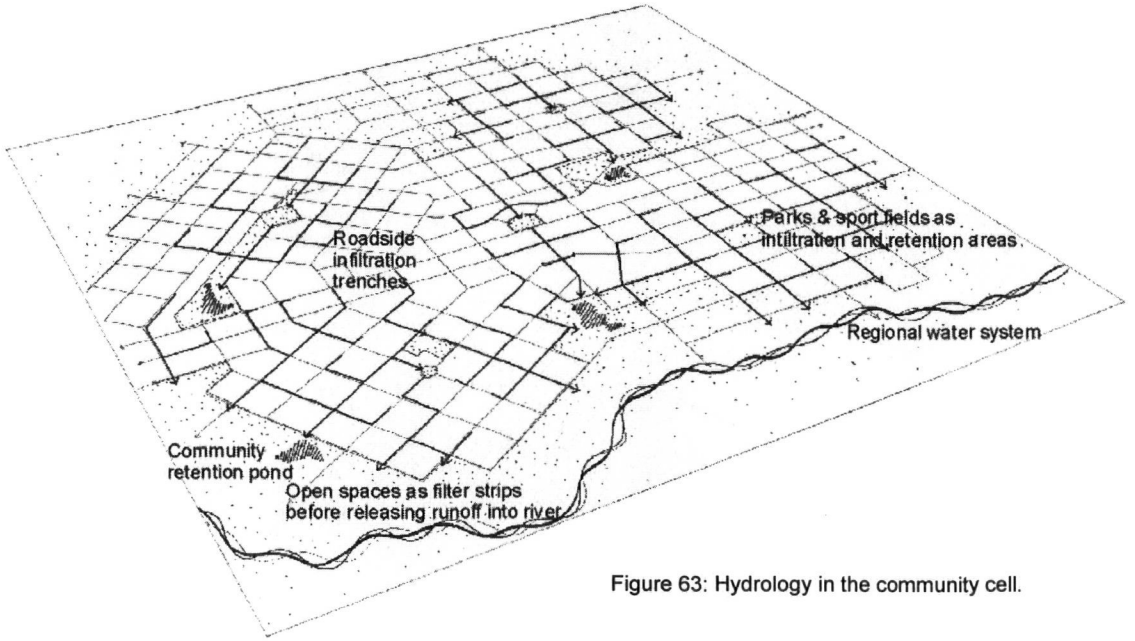


Figure 63: Hydrology in the community cell.

Streets and parking.

The local street network is an interconnected grid pattern (56)(60)(66) that respects the prominence of each core (73). Street blocks are about 100-150m in length to aid pedestrian permeability. Mid-block pedestrian paths occur were blocks exceed these distances (1)(19). Streets within the community are narrow (11)(19)(29)(30)(37)(62) and accommodate pedestrian sidewalks, cycling lanes (1)(62), street hawkers (78), and permeable (22)(30)(65) on-street parking (62) under a shaded tree canopy (7)(9)(50). No barrier curbs are used on residential streets (14) to allow runoff to infiltrate in roadside infiltration trenches.

Streets edges are defined by building facades with a building-height:right-of-way ratio of 1:1.8 to 1:2.5 (8)(75). Buildings are located close to the street with narrow 3m setbacks (59)(68) and parking is accommodated at the back of the lot with access along back- or side-lanes (69)(86). These lanes are narrow single-car routes that are constructed from porous material (22)(30)(65). Where parking cannot be incorporated at the back of the lot, it is accommodated on the street (62) or in a garage that is integrated with the main house (69). In central core areas, where parking needs cannot be satisfied through on-street parking or access lanes, underground parking (11)(20)(27)(29)(37) is used. In limited circumstances, surface parking might occur in less prominent core areas. In such cases, parking is also of porous surfaces (22)(30)(65) or designed as a temporary basin (16). These parking lots are broken into smaller lots (11)(20) that are sufficiently greened (9)(10), and where possible, serve multiple interest groups and functions (40)(99).

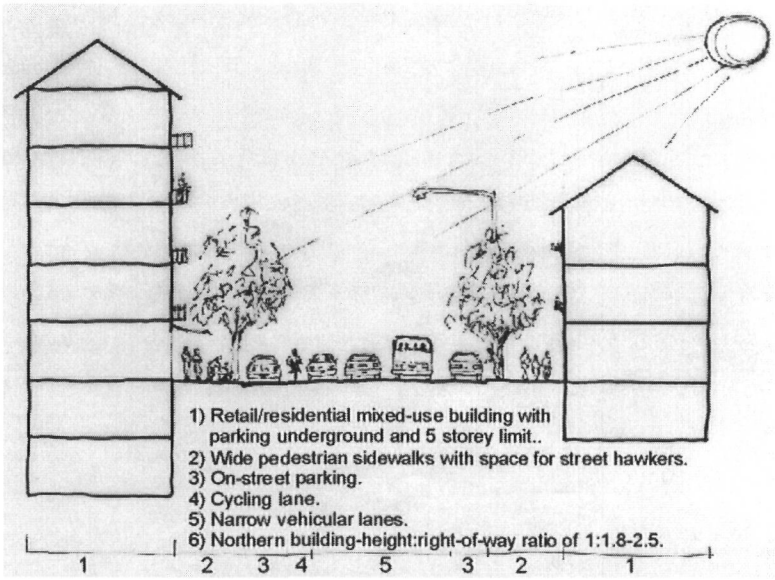


Figure 64: A typical main street.

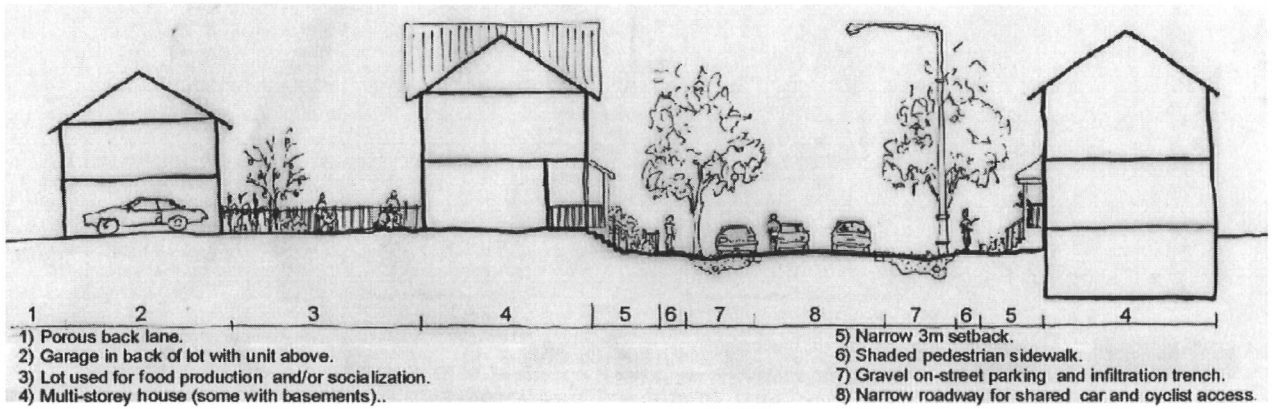


Figure 65: A typical residential street.

Lots and houses.

Every community has a wide variety of housing types, tenure options and lot sizes within each block (38)(47)(82)(83). Lots are about 100-300m^{2}in size, 6-12m wide, and have a width:depth ration of 1:2 to 1:5 (84). Lots contain multiple units and accessory units are encouraged (43)(55)(80). The housing typology includes apartments, townhouses, duplexes, detached houses, subsidised housing, farmhouses etc. The proposed development makes greater provision for bachelor units, one-and two-bedroom units, and rental units (45)(82). Units are minimum 40m^2 in size (43), but in low-income situations basic 20m^2 core units are used initially and can be expanded over time (85). Houses are north facing (12) multi-story buildings (18)(26) that include basements (27). These buildings however, maintain ground orientation for the most part, and allow the majority of homes access to a private garden (44)(48)(50)(79). This is not always feasible around the mixed-use core areas, where higher densities are sought. In such areas, residential building heights are limited to 5 stories (53) and direct access to public- or communal open spaces is established. Nearer the periphery of the community, such communal open spaces can be used as communal agricultural gardens (44)(79) because densities are lower.

Such a range and distribution of housing alternatives is intended to attract a wider, more evenly distributed range of the social spectrum (42)(52)(58)(93). While income groups are distributed throughout, there is a slight emphasis on lower income housing towards the periphery of the neighbourhood cell and higher income housing closer to the core (5). Housing around the core is often more expensive due to its central location. In order to maintain core densities, only limited multi-family (43) agricultural lots (44)(79) can be provided at the centre. Lower densities, towards the periphery, allow a greater opportunity for larger multi-family units and agricultural production.

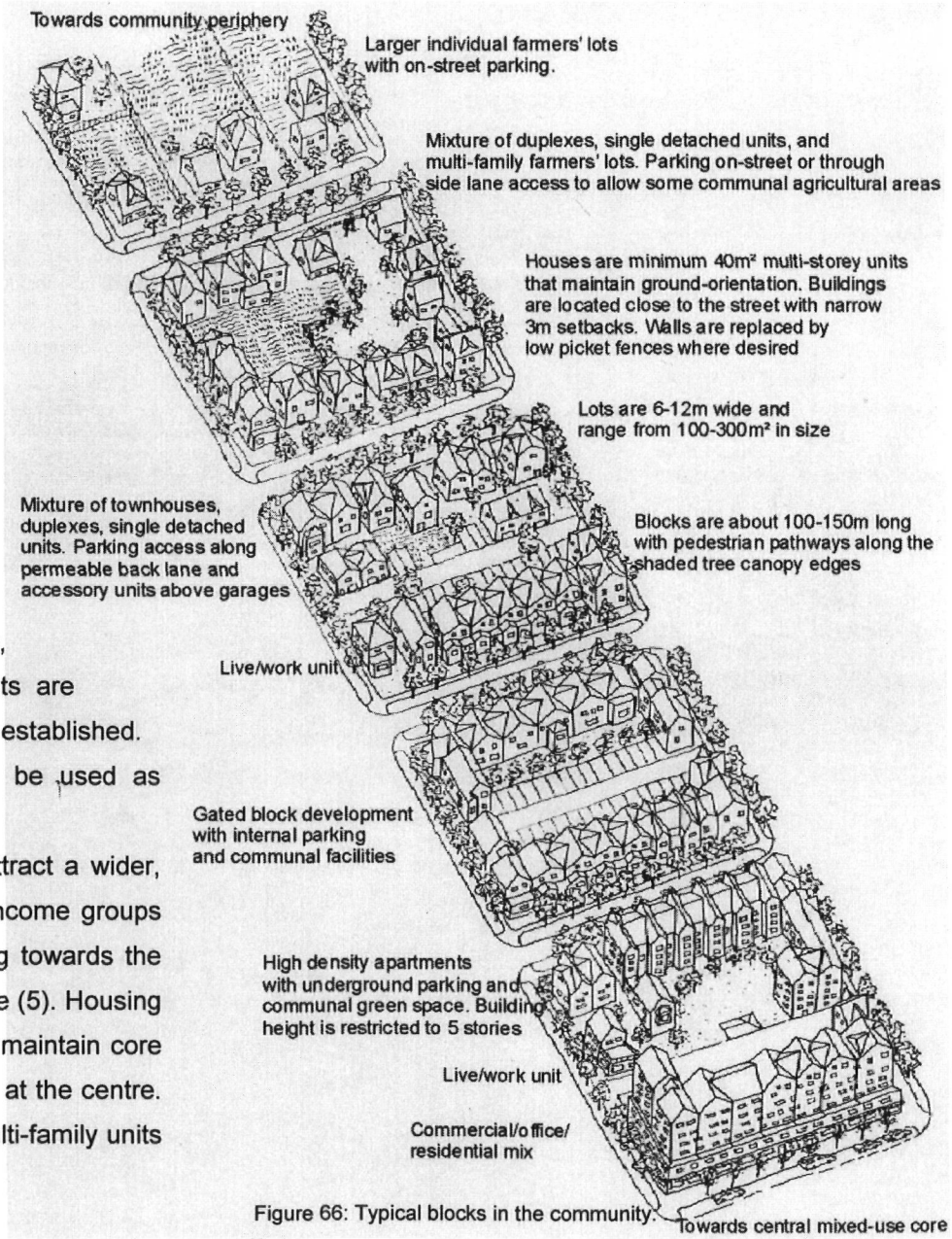


Figure 66: Typical blocks in the community.

The architecture of the buildings is visually appropriate to their function and context (77) and allows opportunities for people to personalize their homes (40)(76). Security walls are eliminated in the community, and replaced by building facades close to the street (59)(68). Where gated communities occur, they follow the same principle and are confined within the street block (67), allowing central communal space for parking and/or communal facilities.

A CONCEPTUAL SUSTAINABLE, DEMOCRATIC SOUTH AFRICAN COMMUNITY.

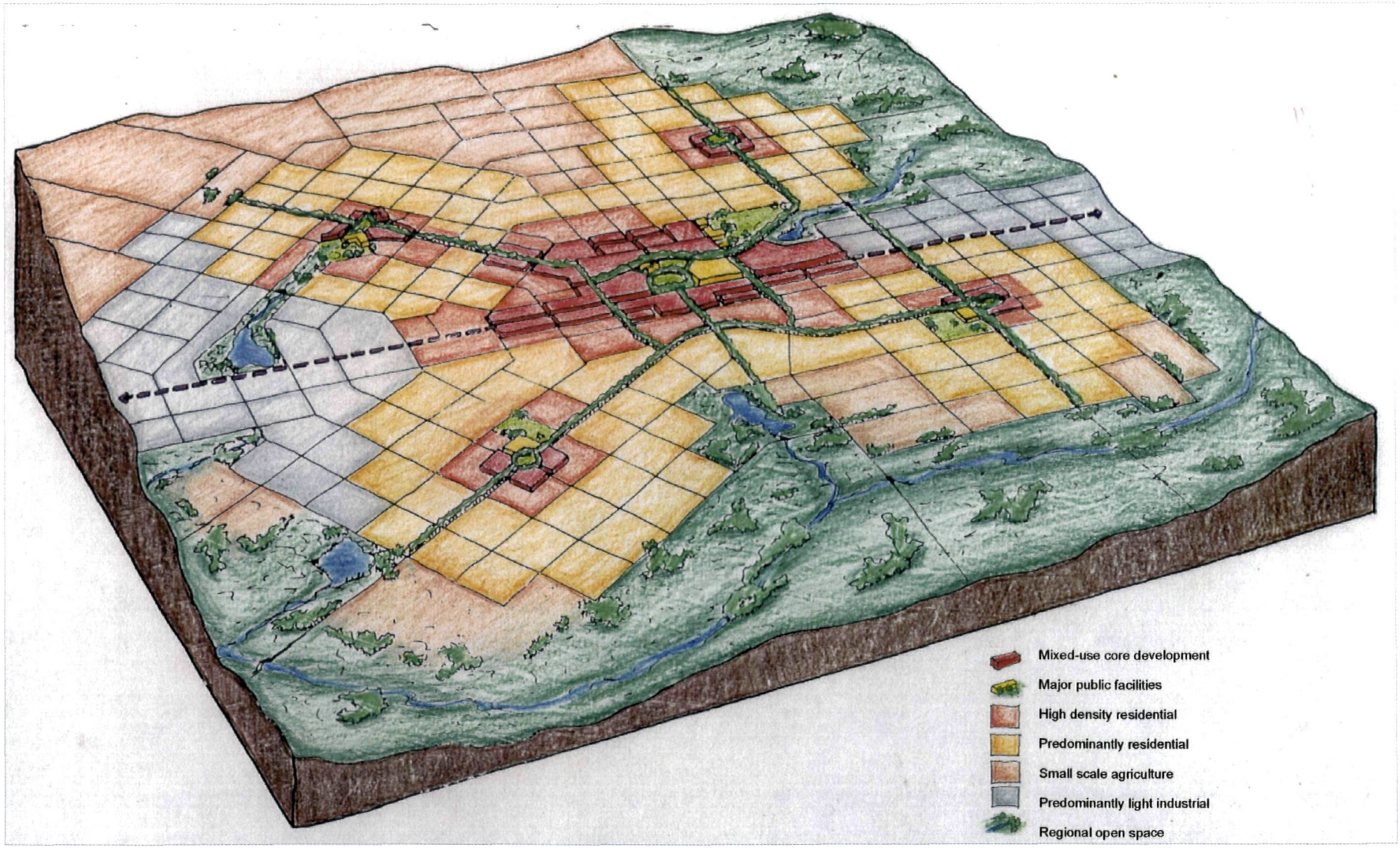


Figure 67

ACHIEVING THE SUSTAINABLE SOUTH AFRICAN CITY.

Incremental healing of the city.

One challenge remains; that is for these conceptual ideas to evolve into the physical implementation of sustainable cities. This challenge is indeed the most difficult for South Africa, as it requires a paradigm shift away from the current South African sprawling pattern. It is at this level where most planners and urban designers seem to get discouraged and the glamorous concept of sustainable urban development gets muddied in the twisted entanglement of politics, development, and money.

It is once again necessary to stress that sustainability should not be viewed as an 'unachievable destination or endpoint', but as a 'systematic direction' of being more sustainable than the status quo (Haughton & Hunter, 1994). This transforms the concept of sustainability into a much less daunting challenge, one that each planner and designer can start to implement. No effort is futile for "just as the health of the human body is dependent on the health of the individual cells in it, so too is the urban region dependent on the health of the individual [cells] that comprise it" (Condon, 2001).

This cellular view of the city provides an ideal opportunity for incremental healing. In South Africa, where urban planners and designers often have to deal with growth and development within an already sprawling framework, the neighbourhood and community cells provide a useful tool for gradually healing the city through incremental growth, steadily fostering more democratic living environments. Such a method does not require us to envision the incomprehensible task of redesigning the entire city; instead it focuses attention on a more manageable cell. If we strive to create healthy, viable cells that are more sustainable and democratic than the *status quo*, we might just achieve the same for our cities at large. It is a gradual process and not and overnight solution. The problems that we see today are a result

of many years of sprawl. Even if we reversed the pattern of development today, it would take many years to see a change in the larger urban fabric and even more years before we might feel the benefit of such a change. This slow, incremental progress allows us flexibility in analysing and adapting our vision of the sustainable city. "The very notion of what constitutes a sustainable city will inevitably change over time, as our understanding of global and local environments become more sophisticated" (Houghton & Hunter, 1994:285).

Initiating change through gradual phasing.

It can be concluded that the goal of the South African city is to incrementally 'tighten' its loose sprawling network into a series of more sustainable and democratic community- and neighbourhood 'knots'. But how do we go about creating these tight knots?

The first consideration should be given to determining an appropriate area. When selecting an area, it is important to respect the existing urban boundary, regional open space system, and sensitive- or hazardous areas. Make use of redevelopment or infill development opportunities. The South African city provides an ideal opportunity for the use of infill and redevelopment. Out-migrations to the suburbs have left large areas of the city neglected and forgotten. In addition, the Apartheid system's use of vacant barrier strips between urban areas and townships, caused cities to have a lot of undeveloped land within its new extended post-apartheid boundaries that now include peripheral townships and the vacant land in-between. The proposed area should be close to existing urban centres and be centrally connected to an existing major transportation network that links it to other major urban centres.

Once a possible area is selected, a site can now be identified by conceptually analysing the area (see figure 68). Identify the existing locations of prominent shops, schools, parks, community centres etc. Envision the future cellular structure of the area by predicting the possible neighbourhood and community centres with their respective boundaries. These cell boundaries should not overlap with one another. Once again, identify local ecologically

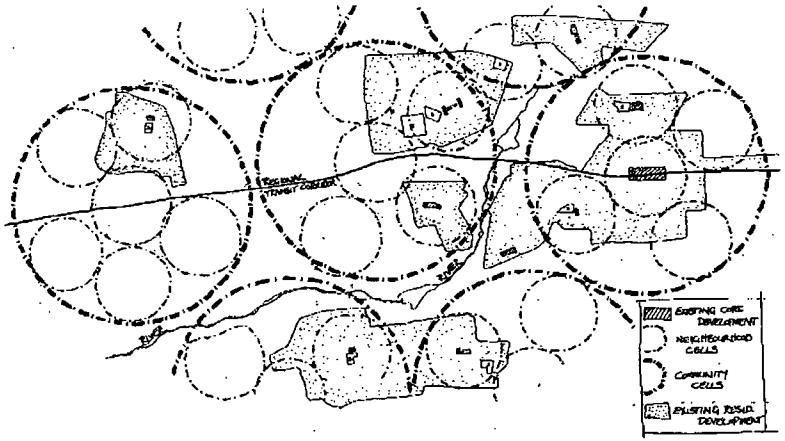
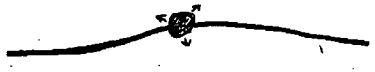


Figure 68: Envisioning the cellular structure by identifying current nodes.

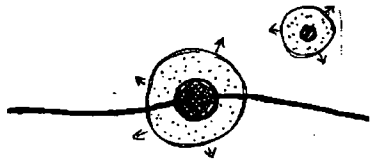
sensitive and hazardous areas and avoid development on these areas. They might be utilized as natural boundaries to the cells. After visualising how the cells in the area will function in future, one of the community cells can now be selected as the site that will undergo redevelopment.

From this point on, a process of phasing is used to gradually develop the community over time (see figure 69). At the centre of the community, along a major transportation route, lies the community core. This core serves as the catalyst for development in the community. Such a core could be part of a new development project or it could be a revitalised and expanded redevelopment or infill project. The core at this stage does not yet represent a community core, but is similar to a neighbourhood core that includes a transit stop with some retail, offices, and high-density residential uses. The core provides just enough to create a catalyst that draws people and further development into the area. Gradually the central neighbourhood is build up into a compact unit with larger facilities and services in its mixed-use core. As the popularity of the central neighbourhood evolves, the creation of other neighbourhoods in the community becomes feasible. Such neighbourhoods will most likely not develop at the same time or at the same rate, but follow in series. Once again, the initial focus in each neighbourhood is on the development of the individual neighbourhood core, as a secondary catalyst, to draw more residents to the community. As each neighbourhood expands, a local transportation network is set in place that links it to the central core. The central core, by this time, will already be evolving into a community core with an expanded palette of community facilities. The expanded population and development, serve as a catalyst that draws larger agriculture and employment opportunities into the secondary areas. From here on the cyclical process is evident as catalytic development draws more people, and more people draw more investment and development.

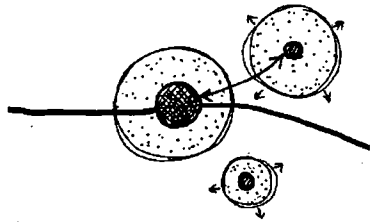
When the community reaches its 35,000-45,000-population capacity, growth should be directed into another community cell by repeating the same process of identifying an area, selecting a site, and phasing in development. Arthur Morgan described this principle. He stated



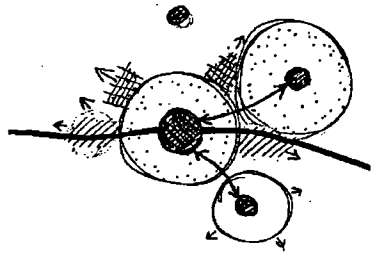
a) Central neighbourhood core developed around regional transit corridor.



b) Second neighbourhood core re-developed. Larger facilities and high-density residential uses expand around central core.



c) Third neighbourhood core re-developed. Second neighbourhood expands and local transit connection established. First neighbourhood at full capacity with expanded community core.



d) Fourth neighbourhood core developed. Third neighbourhood expands and local transit connection established. Larger investment and agricultural uses established in secondary areas.

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that a community should "only [be] large enough to supply necessary services and to serve useful and productive purposes. If there are enough food stores or gasoline filling-stations in a community, then for others to be added...is a social waste – a form of parasitism...A community should be like an excellent automobile, which has all the parts it needs, but no mote than it needs...Such [extra] parts should be used to make another automobile" (Morgan, 1942:123).

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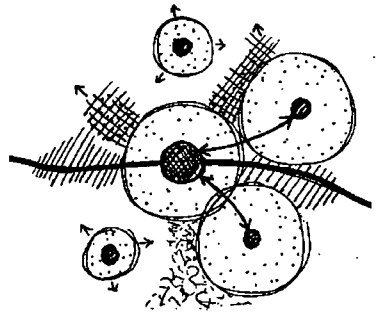
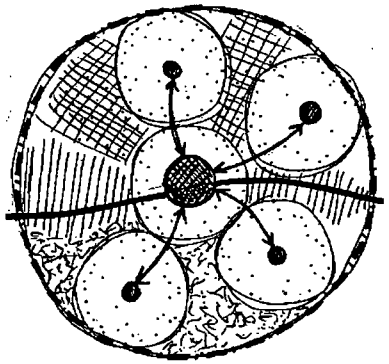
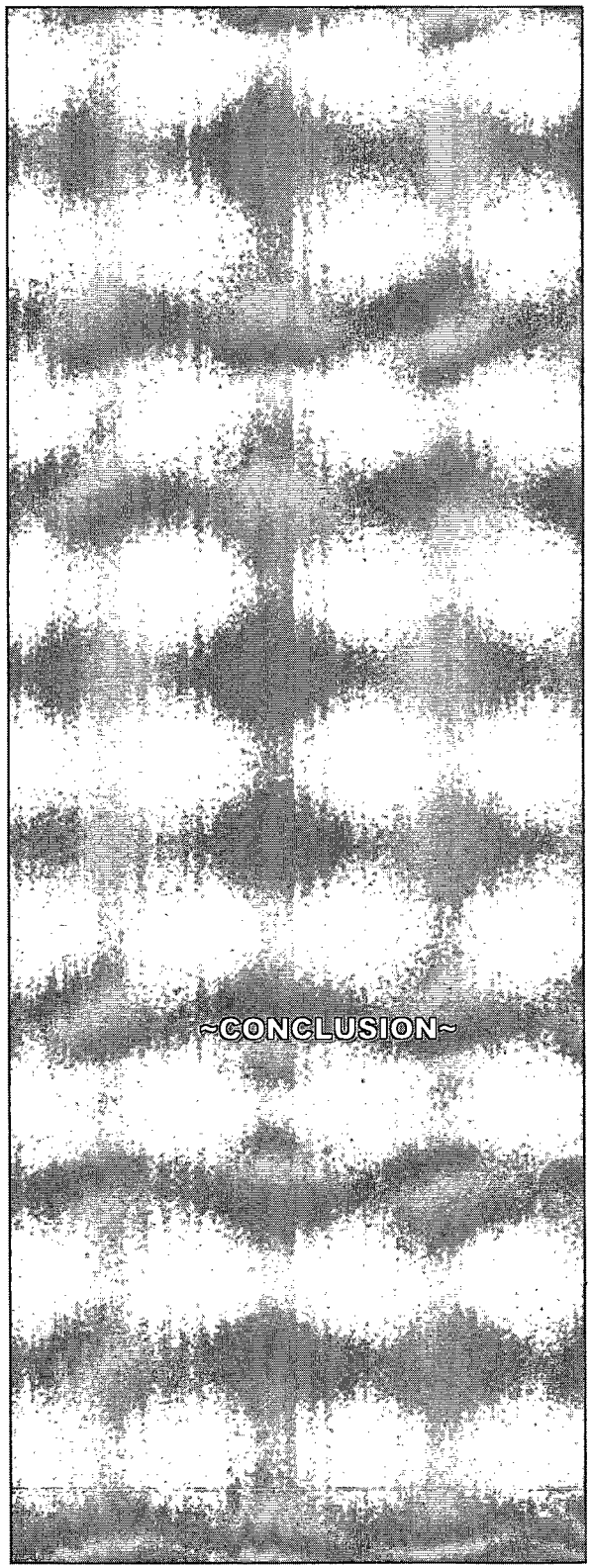


e) Fifth neighbourhood core developed with expanding residential uses. Fourth neighbourhood expands. Larger investments, agricultural uses, and open spaces expand in secondary areas



f) Local transit connections established to fourth and fifth neighbourhood cores. Community at full capacity. Development directed to another cell.

Figure 69: Gradual phasing for the implementation of a community development.


~CONCLUSION~

LIMITATIONS AND FUTURE RESEARCH.

Limitations of the study.

The topic of sustainable urban development is indeed a broad area of research that spans several professions. This document aims to provide a broad understanding of sustainable concepts related to the planning and design of communities. It is not intended as an in-depth understanding of all possible related areas of sustainability expertise.

The physical layout of our surroundings, determines the qualities of our environment and this in turn provides the framework for how we live. Change to this structure, eventually changes our way of live. This document aims to initiate change towards sustainability by physically altering the skeleton or structure in which we live. The research focuses on the community, with its neighbourhood cells, and explores sustainable development from an urban form point of view, where progress can be made through the physical manipulation of our surroundings. Although important, some aspects required to initiate change towards more sustainable cities are considered beyond the scope of this research. These include sustainable energy flows, local management initiatives, government initiatives, technological inventions, and site-scale interventions.

This document should be regarded as a broad platform. It is one step in a whole series of steps that will be required to mould a vision for a more sustainable, democratic South Africa. The research focuses on the broad South African context and therefore does not provide answers to all of the complexities that might come in to play when dealing with the varying characteristics of a specific community and its people. It is intended as a guide to help shape the approaches of the planners and designers that are at the forefront of implementing the sustainable challenge.

This document should not be regarded as an absolute scientific study that dictates right or wrong. It provides general guidelines that have a wide range of implementation

approaches, each with varying degrees of success at achieving the goals. For this reason the proposed concepts should not be seen as the one and only solution, but as one possible interpretation that might vary when attempted by another designer or planner. Though no two designs may be alike, the essence of the approach will stay the same when the guidelines are considered. This document suggests that when these guidelines are considered, in design, planning, or policy, progress will be made towards a more sustainable state.

Limitations for implementation.

Probably one of the greatest challenges to implementing sustainable communities is the paradigm limitation. The low-density sprawl pattern is an integral part of life and many years of sprawl have created a culture that values their cars and distant suburban homes. Although the South African people are in desperate need of a more sustainable, democratic urban form, the leap from car dependent, sprawling suburban cells, to that of pedestrian-scaled, compact cells, might conflict with the general public's perceived ideal. "[Peoples'] views and aspirations will not change spontaneously. Examples are needed of what compact living could be like...where government [gets] involved in pilot projects to develop alternative typologies, which could educate people on the possibilities of compact living" (Schoonraad, 2000). Government plays a key role in bringing about change in the urban environment, through initiatives such as higher land and vehicle taxes, developer density bonuses. Through a gradual process of education and pilot projects, people will be able to experience the immediate benefits of change and only then can a general shift in perception arise, pushing sustainable alternatives ahead of sprawling patterns.

In addition, the development of sustainable communities does not happen over night, nor is it as simple as envisioning the ideal solution and then building it. Policies and laws that support sprawling patterns will have to be adapted to initiate change. This can be a timely process that involves long deliberations and further research.

Future research.

Developing targets and indicators.

Due to its general scope, this document does not cover specific targets and indicators for developing sustainable communities. Targets and indicators provide very specific criteria and it may therefore be best to research these in relation to a specific site, as opposed to the broad context of this document. Further research is required to develop specific measurable targets and indicators, from the proposed guidelines, that can assist in the monitoring of sustainable community development.

Investigating policy limitations and opportunities.

The South African policy documents are currently in a time of flux. This provides the ideal opportunity to incorporate sustainable guidelines into legal documents. Research on the South African policy documentation is necessary in order to determine shortcomings and opportunities that might restrict implementation or that might be used to enforce positive change.

Analysing prototype developments.

One of the restrictions on implementing change is the fact that there is no proof of its validity. Though research can provide numerous arguments, its source is primarily outside South African borders where a different set of dynamics is at play. Research within a South African context, that analyses current developments so as to support the development of sustainable communities, is required. Ideally, the pilot development of a neighbourhood might be considered, followed by an analysis of its successes and failures.

Researching self-sufficient communities and systems.

A critical influence on the distribution of community cells within the sustainable city is the ability to balance local demand and supply. The community cell should therefore be analysed in terms of its self-sufficiency (to create jobs, generate food, treat sewer, manage stormwater etc.), to provide a deeper understanding into the overall structure of the community cell and its distribution.

Investigating political structures of management and authority.

To facilitate local autonomy (such as community participation), and the management of sustainable activities (such as recycling), a fine political structure is necessary that functions at the community and neighbourhood level. The current management or authority structures in the South African city should be investigated and the future of these political structures should be analysed in the context of the fine network of the cellular city.

A FINAL WORD.

To initiate change in the South African urban form, there are five key challenges facing designers, planners, and politicians that should be considered throughout the decision-making process. That is to progress from:

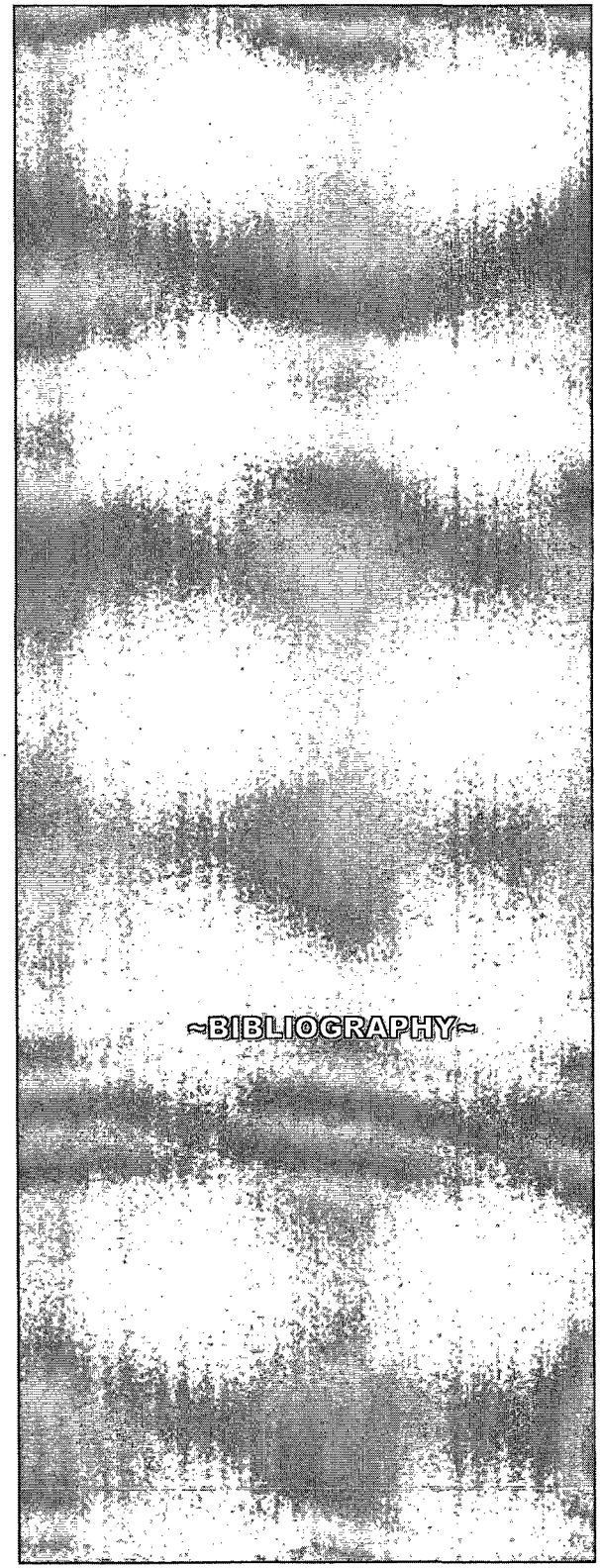
- Car dependence → Walking, cycling, and public transit
- Low-density → High density
- Fragmented land uses → Integrated, mixed land uses
- Social segregation → Social integration
- Regional re-activeness → Local pro-activeness

These challenges seems overpowering when focussing on the opposing ends of the continuum, but again one should be reminded that sustainable development is not an end goal, but rather a 'systematic direction' of continuously aiming to be more sustainable than the status quo (Haughton & Hunter, 1994).

The concept of sustainable community cells is not new. As early as 1960 Mumford already recommended "tightening the loose and scattered pattern of the suburb, turning it from a purely residential dormitory to a balanced community...with a more varied population and with sufficient local industry and business to support it...The parts of the neighbourhood should be joined together by green ribbons, pedestrian malls, and pleasances" (Crowhurst Lennard & Lennard, 1995:17). South African planners and designers should in the same way aim to tighten the sprawling South African network into a series of knots that improve the status quo, towards a more ecological-, social, and economic sustainable state. This cellular view of the city allows us to gradually heal the city over time and eventually the weight of sustainable communities will tip the scale in favour of a sustainable pattern rather than sprawl.

The South African situation provides numerous opportunities for the shift in urban form to occur. Firstly, the needs of the majority of the population are imbedded in the principles of the sustainable community, for instance walking and using public transit. Secondly, there is a desperate need for an alternative urban form that addresses the change in demographics and urban lifestyles. Thirdly, the growth of the gated community provides many positive qualities such as social integration and higher densities. This provides a window of opportunity to utilise these developments in the implementation of sustainable communities where, for instance, a number of these developments not only share a swimming pool, but also a shop, local transit network etc. Finally, the current political transformation provides an ideal opportunity to initiate changes that include sustainability concerns.

South Africa cities are indeed at the crossroads and planners and designers now have the exciting opportunity to mould the future of our cities.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