The financial assistance of the Centre for Science Development (HSRC, South Africa) towards this research is hereby acknowledged. Opinions expressed and conclusions arrived at, are those of the author and are not necessarily to be attributed to the Centre for Science Development.

A Study of Urban Form; its Analysis and its Implications for Sustainable Settlements in Desert Environments, with Walvis Bay as a Case Study.

by

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A dissertation submitted in partial fulfilment of the degree of **Master of Philosophy in Environmental and Geographical Science** to the Department of Environmental and Geographical Science, University of Cape Town, South Africa.

July 1996.

ABSTRACT

The purpose of this dissertation is to prove that there are urban forms that are appropriate to the desert environment, and that such forms together with basic design principles, can provide substantive design oriented steps towards the environmental goal of sustainability in an urban context.

The term "sustainability" has often been applied at a global level, and is a holistic concept that tries to find solutions to a number of global issues. However, many of these problems are highly visible at an urban level, where by the year 2000 over 50% of the world population is expected to manifest itself in urban areas. Sustainability therefore needs to be addressed at an urban level, a level which is closer to the people who both consume the most resources and produce the most waste. Among the many strategies available for addressing sustainability at a number of levels, sustainability as reflected in city design has played a small role.

The stark reality that our living environments influence our daily activities and consumption patterns, and that these have been reflected in an unsustainable manner in many western settlements due to the physical layout of settlements, needs to be addressed. The planning system (with design as both a component thereof and a result of the planning process) has a major role to play in addressing issues of sustainability from a physical perspective.

Much research has been done on urban sustainability and urban form in the European context, and is still developing. However, little research has been undertaken on the issues of urban sustainability in arid zones.

Arid zones can be considered as the last frontiers of urban and rural expansion, and the prevailing trends of the last 30 years have indicated that these areas are experiencing rapid urbanisation. Due to extreme climatic conditions, it would be expected that these settlements would develop within the constraints and opportunities such environments present. However, contemporary desert settlements have been founded on planning principles and standards adopted from other regions that are not arid in nature. This has resulted in settlements being inappropriate for their environments.

Determining what is appropriate is rather difficult, especially from a physical perspective and could be perceived as very static. A proposition was therefore made to determine whether or not a sustainable urban form for desert environments existed, and whether there were specific design principles for desert settlements. This was intended to produce basic guidelines, which could then be used to facilitate discussion.

The development of a coastal zone management plan (CZMP) for the Erongo region in Namibia, provided the opportunity to investigate the proposition. The CZMP required that a variety of issues (biophysical, infrastructural, legal, social, institutional, etc.) be investigated and presented in a baseline report. This baseline report highlighted a number of urban problems (such as urban sprawl, high infrastructural costs, and accessibility problems), which need to be addressed by the coastal zone management plan. Walvis Bay, a settlement within

the CZMP area, and a settlement in an arid zone (namely within the coastal area of the Namib Desert) proved to be an interesting case study, one that could be used to verify the proposition.

Urban sustainability, urban morphology and urban design are discussed in detail in this dissertation, in order to present the theoretical tenets with which urban forms can be analysed, and from which an appropriate urban form can be developed for arid zones. Various tenets and principles of sustainability are addressed, and principles pertaining to sustainable design are outlined. Of notable significance is the fact that human design interacts with the natural world. A relationship can therefore be said to exist between the natural and human environments.

Urban morphology is presented as a basis for illustrating that settlements develop from a number of influencing factors. Furthermore, the discussion of urban morphology also reveals the agendas which shape settlements, thereby giving certain settlements particular forms. The contempary debate between the respective merits of sprawling and compact settlements, raises a number of implications for sustainability. However, this dissertation proposes that the adoption of a compact settlement could achieve the means of sustainability better.

The discussion of urban design emphasises the relationship between the built and natural environments, while at the same time presenting vital attributes that all settlements should either have or strive towards.

Empirical research on urban settlements in the desert environments of Israel, Australia and the United States, and research on ancient and Arabic settlements in general, highlights design principles that could enhance the sustainability of settlements in desert environments.

From many of the older settlements in the middle east, valuable lessons can be learnt regarding urban form in desert environments, lessons which are still applicable today.

Walvis Bay's urban environment is analysed through an understanding of the basic performance dimensions inherent in urban forms, as well as urban form patterns and elements, sustainability principles and the vital attributes that urban environments should have. From this analysis, it becomes clear that certain urban forms are more suitable for desert environments, and that, as a consequence of an inappropriate urban form, Walvis Bay is unsustainable.

By combining design principles of the Arabic settlements with aspects of a compact settlement, an appropriate urban form can be achieved. The attainment of a sustainable urban form (and one that encompasses the concept of "liveability") can be achieved for Walvis Bay, through the concrete suggestions made through this dissertation's analysis.

This dissertation is a facilitating study, proceeding largely by a review of the existing literature on the subject. This "literature review", together with an analysis of Walvis Bay, is intended to present design principles for a sustainable urban form for desert environments.

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"Biological communities seem to evolve towards increased efficiency of energy use, and it is important to consider whether human systems can ignore this example and retain any kind of thermodynamic, economic or social stability."

(Watt, 1973:254)

CHAPTER ONE : INTRODUCTION

1.1. BACKGROUND TO THE STUDY

1.1.1. Worldview

Two competing paradigms can be identified in the sustainability debate. They are the Expansionist Worldview and the Steady-State (Ecological) Worldview (Rees, 1995).

The Expansionist Worldview is characterised by a central scientific premise that nature is knowable through reductionistic analysis, observations and experimentation. In this premise, the observer is separate from the observed. Its models tend to be linear and deterministic. Its attitude emphasises the present (or immediate interests), where humankind is the master of nature and people can adapt the environment at will to serve their wants and needs. The Expansionist Worldview is highly dependent on technology. As a result, natural capital is considered substitutable with manufactured capital (Rees, 1995).

Contrary to this paradigm, the Steady-State (Ecological) Worldview is rooted in complex systems theory, deterministic chaos and systems ecology to name a few. Its premise is based on uncertainty. That is, behaviour of natural systems is unpredictable. The Steady-State Worldview emphasises holism and considers humankind as an integral part of the ecosphere. Its models tend to be dynamic, complex and non-linear. The paradigm's attitude emphasises the community, considering both the present generation and those still to come. Man is furthermore considered to be dependent on nature irrespect of technological progress. Natural capital is therefore complementary to human made capital, where the earth's carrying capacity is finite (Rees, 1995).

Since a comprehensive analysis on the debate of the two sustainability paradigms is beyond the ambit of this dissertation, Rees' (1995) article is recommended for further reading. However, in support of this dissertation the two paradigms lend some interesting concepts which will be discussed further.

Firstly, the manner in which people perceive their environment varies. Therefore, development policies and planning decisions will differ as a result of varying perceptions. This is important to note, since planning decisions are ethically based. The mere notion that planning is a social science affecting society directly and indirectly, has bearing on the need to act in a specific manner. The kind of actions taken has ethical implications. After all, all human action has meaning and this meaning has to be accounted for. Whether these decisions are teleologically or deontologically achieved, depends upon how people and planners perceive the environment as well as what means are available to exploit or utilise natural resources. Yet humans have limited perceptual capabilities, creating a limited

knowledge that distorts their understanding of the environment as well as the means adopted in exploiting the environment.

It has been argued that the Expansionist Worldview, laid the foundation for Modernist planning, which builds on rational assumptions concerning the ability to know, and attempts to change the world by using scientific methods. Post-modernists would point out that knowledge is inherently unstable, with action only coming about through the revelation of differences which increase understanding. It becomes clear that meaning is important to understand our action, and hence, it becomes clear that the Steady-State Ecological Worldview would have greater bearing on planning.

It follows that with an appreciation that views differ as a result of our limited perceptions of the environment, any shift in paradigm will be met with resistance. Embracing a new worldview is not easy. All too often humans have assumed that the world is an open, static system. "Open means that it could supply our resource needs and absorb our residuals. Static implies that the environment would return to an equilibrium situation fairly quickly" (White, 1994:108). For change to occur, parameters for comparison are required. Should one consider the degree of fit of the present worldview, the state of the environment would indicate that something is wrong. Change is warranted if the high levels of pollution in urban streams, the ozone depletion, the high rate of finite resource extraction, loss of tropical rain-forests and resultant damage, and the population explosion, are considered. This in itself, would justify a paradigm shift towards the Ecological Worldview.

Linked to the Ecological Worldview, is the concept of sustainable development. Before this concept is defined, it is important to note that sustainable development "requires a transformation of both human to nature and people to people relationships on the local to global scales. There is more to be gained from changing behaviour and values than there is from technological fixes" (Rees, 1995:355). It therefore follows that sustainability, under the Ecological Worldview, needs to reconcile the ecological, cultural and economic dimensions of human well-being.

Sustainability issues are often discussed at a global level, since many environmental problems have been highlighted as having global bearing. An example is the implementation of new standards by various countries to phase out the daily use of CFCs. This has lead to the development and adoption of new products or the alteration of designs to facilitate change. The political will of countries to accept these problems and respond to change has in many cases been influenced by global political pressure. Nevertheless, responses to change for sustainability have come about through national initiatives.

1.1.2. The Urban Bias

This dissertation contends that a large degree of the response to sustainability should come from cities and urban areas. It has been reported that up to 50% of the world's population live in cities (Girardet, 1996:www). Urban growth is changing the face of the earth and the condition of humanity. Urban areas are becoming our habitat. White (1994:109) also argues that the response for sustainable development should come from the cities, "because that is where the most intense environmental damage is taking place, and it is there that many improvements can effectively be made. The political drive comes from the fact that many environmental problems are highly visible in the city, including traffic congestion, dirty air, untreated sewage, and the accumulation of uncollected solid waste".

At present, the world's Northern cities and Southern cities are (in general) following paths of unsustainability. The cities of the north depend on a vast amount of resources, and their footprints are of a global nature. In many of the poorer southern countries, their "economies have stagnated, or at least failed to match the rate of population growth; hence conditions in urban and rural areas alike have deteriorated rapidly" (White, 1994:113). Both Northern affluence and Southern poverty are increasing the pressure on the planet, so the latter cannot be reduced by emulating the former. Cities have followed the Expansionist Worldview, but the limits to growth are becoming apparent and now an alternative model needs to be developed. White (1994) argues that the city is especially important in the search for sustainability and lists three reasons:

- The environmental impacts of the human species are most evident in the city;
- The opportunities for impact reductions are most concentrated in the city;
- In the past ten years, certain city governments have shown far more initiative than national governments in taking on their environmental challenge (White, 1994).

Sustainability therefore needs to be addressed at the local level. A possible solution in achieving this could be in adopting the concept of the sustainable city.

It should be kept in mind that local problems and experiences differ. Policies and actions adopted need to be appropriate to specific local areas, irrespect of encompassing principles. Although basic sustainability principles exist, their adoption as policy will vary.

As noted in the above discussion, sustainability can be conceptualised and implemented at any spatial level. Each level, from local through to global, is interconnected in achieving one single aim: the longevity of our planet. The complex nature and interconnectedness of sustainability reiterates the Ecological Worldview. In order to address this worldview at the local level, the concept of urbanity needs to be analysed. Within the urban setting, Rees (1995) states that "sustainability means developing and promoting plans that contribute to a more efficient urban form and to a stronger social fabric".

This is the duty of urban planners and the challenge is to promote and create sustainable urban areas. The task is challenging since urban settlements reflect the ideologies and social constructs of humans and also represent the economic situation of the nation, region and town. Furthermore, our urban areas are nodes of consumption. Paradoxically, this means that "while there is no hope for the city *per se* to achieve sustainability independent of its vast and scattered global hinterland, it is in cities that the greatest opportunities exist to make the changes necessary for general sustainability. . . All of this means that policies for sustainable development gain their greatest leverage in cities" (Rees, 1995:356).

Due to the complexity of cities (urban areas), the perception of a city needs to be redressed. The city is much more than just its visible qualities (i.e. roads, buildings and skyline). It is a system, constructed from human perceptions and relationships which transcends from the intrinsic and functional relationships between people and buildings, buildings and function, people and people, and between city and hinterland.

The complexity of the city implies that the achievement of sustainable cities is complex. It requires both technical and policy responses. Undoubtedly they are interrelated; the former depending upon the latter and vice-versa. Rees (1995:365) sums this up by stating: "because of complex system linkages, seriously addressing even a single issue in the city inevitably forces attention onto many related contributing factors. This might be called the urban sustainability multiplier". As a result urban planners need to address the issues in a holistic, participatory, inclusive and innovative manner.

From this it follows that planners will have to use their skills as facilitators and mediators in shaping an urban sustainability agenda. This would help in convincing people of the need to change and become actively involved in issues of sustainability. Undoubtedly people will also have to be educated and informed about sustainability issues. Attitudes need to change. Once this is gained, these people could become active partners in designing their new way of life in accordance with their means. This will reflect the social, cultural and economic context in which people find themselves. Planners and policy makers ultimately need to respect people's values and translate them into effective policy and design, if sustainability is to be achieved.

Ultimately the ability to sell the concept of sustainability depends upon the outcome. That is, people and politicians alike, will only buy the idea if sustainable policies, plans and designs improve the general welfare of the people. The concept of sustainability can be sold in various ways. It was earlier mentioned that policies and plans could be used to achieve sustainability. Yet the role of design in urban planning has often been minimal. The lack of importance given to design is manifold (such that it is an elitist and expensive exercise). In addressing these misconceptions, the role of design in urban planning could prove fundamental in attaining sustainability.

The concept of a sustainable city through urban design is often associated with grandiose projects, especially for big cities, where finance is readily available. This concept should rather be seen as a metaphor for all human settlements and activities.

Furthermore, both literature and practical examples predominantly apply these concepts to cities and urban areas in cold, temperate and tropical regions. Literature on hot arid regions and coastal desert regions is not extensive particularly in relation to sustainable urban form. Namibia therefore presented an opportunity, where recommendations for sustainable urban form, incorporating the concept of the sustainable city, could be applied.

1.2. THE COASTAL ZONE MANAGEMENT PLAN

In 1995 the Namibian Government commissioned a project that would develop a coastal zone management plan (CZMP) for the Erongo region. In order for this plan to be as integrated as possible, a number of issues (ecological, social and economic) need to be explored. In 1996 the University of Cape Town Environmental and Geographical Science Masters students, prepared a Baseline Report for the CZMP. This baseline report outlines a number of issues that need to be addressed by the coastal zone management plan.

The baseline document reports of a number of issues that require urgent attention, and these primarily have an urban bias. These issues include rapid urbanisation, urban sprawl, housing shortages, excessive urban costs, economic development pressures that would require urban services and infrastructure, as well as many socio-economic problems such as poor health.

The baseline report also indicates that Walvis Bay (excluding the fact that it is the second largest town in Namibia) could become a major development node in the country and within southern Africa. With Namibia's inclusion into the Southern African Development Community (SADC), and Walvis Bay having a harbour that is accessible to the northern and Western areas of the SADC (not to mention that it is the only harbour in the area with a well developed infrastructure). Walvis Bay could face considerable economic growth. Furthermore, the possible discovery of oil and gas off the Namibian coast, and a recovery in the fishing stock, would imply a major boom for the town. This future scenario coupled with present problems, such as a sprawling settlement with inappropriate planning standards, as well as an influx of people from the northern regions of Namibia, could create a badly planned settlement that would be unsustainable, unless addressed at once.

All these issues are placing developmental pressures on Walvis Bay and if urban development is not managed now, and no guidelines for development are offered, major environmental problems (economic, social and natural) could manifest themselves within

the town. As these issues are highlighted in the baseline report, they would need to be addressed in a management plan.

This dissertation therefore takes the opportunity to address the urban problems of Walvis Bay, through the contemporary discourse of sustainable urban form. Since Walvis Bay is situated in an arid/desert environment, the sustainable urban form would have to be applicable to such an environment.

It is therefore necessary to develop a research proposition that addresses the topic of sustainable urban forms in desert environments. Furthermore, since this dissertation is to provide some input into the CZMP, recommendations need to be made. From this perspective, the dissertation adopts a two-pronged approach: both discussing sustainable urban form, and applying sustainable urban form in such a manner that this dissertation could provide guidelines, not only for the CZMP, but also, and more importantly, for Walvis Bay.

1.3. THE PROPOSITION[1]

In order to address the issues facing Walvis Bay, and to determine whether or not its urban form is sustainable, a proposition has to be set. However, before the proposition is given, the following are the presuppositions that lead to the proposition.

From the baseline data, it becomes clear that the nature of the urban settlements in the Erongo region in general, and Walvis Bay in particular is unsustainable. This supposition is based not on factual evidence but on an educated feeling[2] derived from the author's personal experiences in these urban settlements. Furthermore, the baseline report indicates that urban sprawl occurs in most settlements within the Erongo region. Urban sprawl, based on a combination of Western style houses with suburban gardens in a desert environment, where water is apparently scarce and where the region faces harsh climatic extremes, seems contradictory. It therefore becomes necessary to pose the question based on a mixture of theory and empiricism, what would be compatible? A proposition has therefore been made as follows:

There is a sustainable urban form for desert environments and there are specific design principles which are appropriate to desert environments.

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[1]Proposition is synonymous with hypothesis.

[2]Shirvani (1985) and Lynch (1990) along with other urban related practitioners and academics refer to this feeling as an educated instinct.

1.4. METHODOLOGY

In order to address the aforementioned proposition, three techniques have been used to collect data, namely: literature review, interviews and personal observations. Extensive literature has been reviewed in terms of the three themes of the proposition (i.e. sustainability, urban form theory and urban design). Interviews were conducted with Namibian officials who were familiar with the Walvis Bay environment, and who could contribute towards the identification of certain problems facing Walvis Bay. Personal observations have also been made of the environment, and this has involved driving and walking through many parts of the town. All three techniques have been correlated, so that a study on urban forms in desert environments could emerge and, furthermore, formulate recommendations that could promote a sustainable urban environment in Walvis Bay.

This dissertation's process is linked with that of design and decision making. This process is considered to be appropriate to the nature of the dissertation in terms of both sustainabiity principles and design processes. Due to the close relationship between the dissertation's process (i.e. the way in which the study was undertaken) and design processes and decision-making, the process is discussed in Chapter 4.

The approach used in this dissertation, can however, be summarised as a move from the general to the specific in order to arrive at a synthesised conclusion with recommendations.

1.5. ASSUMPTIONS AND LIMITATIONS

In recognition of this dissertation's limitations (those being the lack of reliable data, such as projections and Maps of Walvis Bay, as well as limited and outdated information on arid zone settlement planning), the implications of this dissertation are likewise limited. Three limitations in particular need to be highlighted:

1. Research on arid/desert zone settlement planning is limited, with only dated information being available in South Africa.
2. No research literature could be found on coastal desert settlement planning. This placed a severe constraint on this dissertation, in that the implications it raises for settlements in hot-arid desert environments had to be cautiously used. Nevertheless, this imposed a "pioneering spirit" on this dissertation. Where necessary information was modified, but it became apparent whilst reviewing the available literature that in both coastal and non-coastal desert areas, conditions might be similar.
3. The accuracy of the information presented in this dissertation, is of necessity dependent upon the accuracy of the literature reviewed.

In order to reduce the impact of these limitations to some extent, it became necessary, in a number of instances to make certain educated assumptions, based on casual observations and on personal interviews with various people and organisations. The following can be considered as the main assumptions made in this dissertation:

1. The literature and research reviewed is still valid and applicable.
2. In terms of settlement planning information on coastal desert environments, closely resembles that on hot arid environments.
3. Information from the Erongo Regions baseline report for a CZMP is accurate.
4. The reader is familiar with aspects of urban form and design.
5. Data used for calculations is accurate for the dates given.
6. Arid zones are defined as those areas where the average annual precipitation is less than 200 mm and is unable to support dry farming, and has an annual rate of evaporation greater than that of precipitation. In this dissertation the term "arid region" is synonymous with the environment of the Namib desert.

1.6. SIGNIFICANCE OF THE RESEARCH

Arid zones are one of the last frontiers of urban and rural expansion. Settlements in arid zones have been growing rapidly both in terms of population expansion and physical development. Unfortunately, limited information is available on the unique problems such settlements face, and on methods of solving these problems sustainably.

To meet an expected world-wide demand for knowledge of urban planning in desert environments, it is envisaged that this dissertation will contribute positively towards filling the gap in the existing literature on desert settlement planning. This dissertation is therefore directed towards planners, land developers and urban environmentalists who require more information on sustainable urban forms in desert areas. The dissertation also offers specific guidelines for urban and regional planners interested in planning new developments in the Namib coastal desert environment. Furthermore, on a general level, by exposing planners, developers and decision-makers to the unique conditions of desert settlements, the dissertation intends to introduce professionals to the need for planning urban environments comprehensively and in an environmentally conscious manner.

On a more specific level, this dissertation provides recommendations for the town of Walvis Bay in attaining a sustainable and "liveable" urban form. This dissertation is therefore a facilitating study, which could be used as a guide for the future urban development of Walvis Bay. Moreover, it could provide information and guidelines for a policy on urban settlements along the Erongo region's coastline. The CZMP could therefore base both its urban form policy and urban development policy on this dissertation's findings.

This dissertation is also significant academically, in that no previously known research has been conducted on desert zone urban forms in Southern Africa, and their implications for urban sustainability and suitability for human habitation. Furthermore, this dissertation is a contribution to the limited body of information on sustainable desert settlement planning. As such, it is envisaged that this dissertation will stimulate further research on sustainable desert zone urban forms. It is also significant in that urban design principles and urban form performance dimensions are considered to be factors that all settlements should have and should strive to maintain. As such, these principles and dimensions can be considered as indices for sustainability, while, at the same time, there are sustainability principles inherent in them.

1.7. FUTURE RESEARCH DIRECTIONS

This dissertation has revealed that little information is available on sustainable urban forms in desert environments. With an increasing world-wide trend towards urban development in arid environments, more research is required on the subject.

Particular research emphasis should be placed on coastal desert environment settlement planning. Coastal desert environments, although having environmental extremes common to all desert areas, especially hot-arid regions, the lattitude of coastal deserts and their proximity to the sea may distinguish them from other arid regions. Architectural adaptability may therefore differ from that of hot arid regions. For this reason future research is also required in terms of architectural suitability for coastal deserts. The issues of sustainable construction and appropriate building technology in desert environments also require further research.

1.8. STRUCTURE OF THE DISSERTATION

This dissertation has twelve chapters. Chapter One, the introduction, provides the ambit of the study. In order to address the proposition of this dissertation, three themes needed to be addressed, namely urban sustainability, urban form theory and urban design.

Chapter Two outlines this dissertation's philosophical approach. Chapter Three addresses sustainability, the first theme of the proposition. Definitions of sustainability and sustainable development are introduced, their tenets are discussed and basic sustainability principles are outlined. Sustainability is also considered from a purely urban perspective, and the concept of the sustainable city is discussed.

Procedural theories of integration are discussed in Chapter Four. This chapter discusses the methodologies used and envisaged by this dissertation, as well as those which are inherent to the argument of urban form theory and urban design.

In order to understand urban form, urban form theory is discussed in Chapter Five with special emphasis on urban morphology. Urban form elements and performance characteristics are also highlighted in Chapter Five.

The contemporary debate between sprawl and compact urban settlements is discussed in Chapter Six. This chapter will propose that compact settlements are more sustainable than sprawled settlements. This chapter therefore proposes the thesis that a sustainable urban form is a compact one.

Urban design, as a final part or process of the planning system, is considered to be an integral aspect of urban form. Therefore, it can play a pivotal role in the analysis of urban areas, as well as recommending suitable urban forms. This is highlighted in Chapter Seven.

Where the previous chapters are predominantly concerned with theory, Chapter Eight seeks to determine appropriate urban forms, based on an empirical study of settlements in desert environments. A variety of settlements (in the Middle East, Australia and the United States) are reviewed and analysed in terms of the theory presented in the earlier chapters. The experiences of settlements in these countries, have permitted the dissertation to formulate basic design principles, and these are stressed in Chapter Eight as well.

Chapter Nine, summarises basic points that could help evaluate urban settlements according to sustainability principles, urban form theory and urban design.

Walvis Bay is then analysed in Chapter Ten, in terms of its characteristics, urban form and quality. The relationship between the built and natural environments is particularly emphasised, as is that between the built environment and its human occupants.

Chapter Eleven, in the light of the issues presented in Chapter Ten and the design principles highlighted in Chapter Eight, provides a number of recommendations that could set Walvis Bay on the path to urban sustainability and greater liveability.

Finally, a conclusion is provided in Chapter Twelve. The information presented in this dissertation in general is both descriptive and analytical.

"The neglect of the urban physical environment arose historically from the prevailing philosophy of the superiority of human beings over nature."

(Hartshorn, 1992:97)

CHAPTER TWO : PHILOSOPHICAL APPROACH OF THE DISSERTATION

As discussed in Chapter One, two basic worldviews are defined. The Expansionist and the Ecological Worldview. It was mentioned that a paradigm shift needed to occur, where humans viewed themselves as part of the ecosystem. The discussion illustrated that sustainability could best be achieved with an Ecological Worldview. Nevertheless, the dichotomy of technocentric and ecocentric approaches to the environment can be regarded as simplistic. Gibbs (1994) argues that even within the environmental spectrum there are broader approaches in adopting sustainability. O'Riordan (1995) takes the concept of environmentalism further, when he suggests that humans relate to the environment in three distinct ways. These range from a Dry Green approach, with a reliance upon scientific judgement, through to a more radical Deep Green approaches. These are summarised in Table 1.

Table 1: The environmental spectrum

	Dry Green	*Shallow Green*	*Deep Green*
Environmental Management Strategies	Relies on science, modelling, prediction	Design with nature, eco-audits for accounting & assessment	'Whole earth' view, global stability
Philosophy	Human-centred		Earth-centred
Characteristics	Self-regulation through a corrected market economy	Adjustments to management and business via environmentally-sound products & consumption	Green rights, new age economics, self-reliant communities
Political Structure	Centralised national power with new international structures	Devolved power in internationally federated structure	Self-reliant communities connected to global programmes

Source: Adapted from O'Riordan, T., 'The Environment' in Cloke, P. (ed.), *Policy and Change in Thatcher's Britain*, Oxford, Pergamon, 1992, p. 306

(Source: Gibbs, 1994)

Table 1 illustrates three environmental conditions: Dry Green, Shallow Green and Deep Green. The way we relate to the earth, develops from the way we perceive the earth, and our feelings about our relationship to nature. As mentioned in Chapter One, our approach is value shaped. Since values and ethics are moulded by time, it becomes difficult to typecast a people statistically within each of the three conditions. As O'Riordan (1995:13) states, "At various times of our lives, our days, our circumstances one or other of these orientations rise to the surface". O'Riordan (1995) and Gibbs (1994) note that the present trend seems to be the middle ground, where shallow green approaches are influencing policy makers, industrialists and environmental scientists.

Built environments, with over 3000 years of history have illustrated the advantages and disadvantages of designing with and without the environment in mind. However, within the last 100 years, especially during the modernist period of the late 1950s to the late 1970s, humans have come to believe that they can over come the limitations imposed by nature. Environmental criteria in planning have always been fundamental to the planning process, but the emphasis was placed on the screening of areas for suitability criteria and the best area that could be used with minimum alteration. In other words the minimum resistance from nature so that it could succumb to human needs. As Kaiser (1973:28) states: "elements such as soils, slopes, flood-plains, and other physiographic features were considered only insofar as they affected the suitability of the land for urban use. Emphasis was on the impact of the natural environment on urban use and the extent to which it limited development". Selman (1981) noted, environmental issues were given very little attention in planning schools. Shirvani (1985), Lynch (1990), McHarg (1969), *inter alia*, have stressed the importance of environmental issues in physical planning. Most notably Lynch (1990) in his book "Good City Form" calls for a return to old-fashioned physical planning. This call was largely spurred by dissatisfaction with traditional planning approaches such as the master plan and the comprehensive plan. New methodologies and approaches have been developed in planning, often to take into account man's inability to predict the future due to imperfect knowledge, as well as to consider pluralism in planning decisions, but the lack of environmental focus still holds true (Chapter Seven will put forth certain reasons as to the failure of planners, policy makers and urban designers to incorporate stronger environmental considerations in their work).

A new awakening in the planning and design professions needs to occur, especially in Southern Africa, where environmental degradation has had major socio-economic and ecological implications. The incorporation of environmental criteria in urban design and town planning could bring about ecological gains and socio-economic benefits which would greatly improve the standard of living for many people at various levels.

This dissertation adopts a human-centred approach to sustainability, insofar as saying that its orientation is shallow green. Its human approach is based on the fact that cities were made for man, and therefore should reflect man in the most appropriate way. The urban

form should be human centred embracing principles of comfort, commodity and accessibility. As Sherlock (1991), Lynch (1990) point out, it is time to take back the city and develop it once again according to our needs. Its "greenness" is sincerely based on the premise that our world is facing an ecological crisis and our cities are central to this crisis. As White (1994), Elkin *et al* (1991) and Breheny (1992) argue that it is within our cities that we can really begin to see how unsustainable our lifestyles are and what damage we have incurred upon the environment; this dissertation hopes that this trend can be reversed by using practical design solutions which have proven to have beneficial effects upon the environment.

The statement, ***"By designing with nature in recognising that natural processes actually do us a great service and that we should appreciate that inestimable benefit by adjusting to it and nurturing it"*** (O'Riordan, 1995:12) is the crux of this dissertation. As O'Riordan (1995) would argue, it is the way of knowing about the world and the feeling for nature, that encapsulates the shallow green quality.

The argument proposed here is that existing planning practices and designs must be altered through adopting a shallow green approach. This will involve fundamental change in the nature and direction of planning urban form, but it does not presuppose a radical restructuring of society. It also does not state that their is a single good plan. Rather it supports the sentiment that their are principles and elements in planning that purport good practice. As such, the shallow green approach is essentially a reformist one which attempts to devise a framework to implement local level sustainability development policies, through the analysis of urban form.

"Think global, act local."

CHAPTER THREE : SUSTAINABILITY

3.1. INTRODUCTION

This chapter discusses the tenets of sustainability. Its definition is given and attributes of this definition are analysed. The debate on sustainability is then brought to scale, into the realm of the urban environment. Principles of sustainability are outlined and divided into two sections; the one giving broad sustainability principles and the other referring to sustainable design principles. In due course, it will become evident that they are inherent in many urban qualities discussed in Chapter Seven and are reflected in the design principles mentioned in Chapter Eight. These principles also form the basis for an analysis of Walvis Bay in Chapter 10. Furthermore they are reflected, if not explicitly then implicitly, in the underlying norms of the recommendations discussed in Chapter Eleven.

This chapter also emphasises the holistic concept of sustainability and the need to consider development issues holistically. Finally, a brief description of the sustainable city is given and its implications.

3.2. DEFINITION OF SUSTAINABLE DEVELOPMENT

In 1987 the Brundtland Report defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

Pearce and colleagues (in Breheny, 1992:1) elaborate on the definition of sustainable development, "as the economic, social and environmental aspirations of groups, which may or may not have economic growth as a priority. The achievement of these aspirations, however, is subject to a set of conditions. These include intergenerational equity, which requires that the stock of environmental resources passed on to the next generation should not inhibit their aspirations, and intragenerational equity, which seeks to increase the likelihood that the current aspirations of different groups will be met".

Orrskog and Snickars (1992:110) offer a concise definition: "sustainability means that costs and benefits should be distributed over time and individuals in such a way that everyone gets a fair share".

A number of characteristics of sustainability can be noted from the above three definitions. They are: equity, constant natural capital stock, the ability to fulfil basic needs, and the dimensions of space and time.

3.2.1. The Dimension of Space

The dimension of time as a notion of sustainability is explicitly pondered upon, whereas the dimension of space is often ignored. Breheny (1992) convincingly argues this point and emphasises that if urban sustainability is to be achieved, it would be necessary to be explicit about the spatial dimension.

The spatial dimension is introduced on four premises here through three points. The premises are: the city scale is becoming an important feature; urban management is best achieved at a local level; changes in lifestyles are best achieved when people become involved, and land use has major sustainability implications. The three points follow.

Firstly, the issue of sustainability was introduced at a global level, where international co-operation was sought. This permitted various states to create policies that would be more applicable to their situations. To ensure that the concept of sustainability trickles down further, it becomes necessary to localise issues and policies so that they can be managed more efficiently. It is often suggested that in order to effectuate change, people at grass-root level should become involved. This is best achieved at a local level, where issues can be quantified and worked upon with tangible results.

Secondly, it has been predicted that over 50% of the world's population will be living in urban areas at the turn of the century (Walmsley & Botten, 1994; Girardet, 1996; Hart, 1991). Since urban areas are net centres of natural resource consumption as well as net producers of pollution and waste, the debate on sustainability essentially has an urban focus (UNCED, 1992). A number of authors tend to agree with the urban bias of sustainability and Breheny (1992:2) states that "if cities can be designed and managed in such a way that resource use and pollution are reduced, then a major contribution to the solution of the global problem can be achieved".

Finally, the way land is used invokes major sustainability issues, since the demands placed on land, whether land for forestry, tourism, urban development or arable land, are greater than the resources available. "Our basic needs of food, water, fuel, clothing and shelter must be met from the land. Land is in limited supply. As population and aspirations increase, so land is becoming an increasingly scarce resource" (FAO, 1989:5). These competing interests need to be addressed and evaluated in terms of the best optimal use focused upon set goals. Sustainability is therefore central to the allocation of land use, since in many areas competing interests cannot be accommodated simultaneously. Land use planning therefore tries to make the most of limited resources.

The dimension of space is important to consider, because it is limited and allows us to quantify impacts and work on manageable strategies. In this dissertation sustainability has been quantified spatially to that of urban settlements.

3.2.2. The Dimension of Time and Equity

The temporal dimension illustrates that human activities have social, economic and environmental implications, whether costs or benefits, that must be taken into account. The effect of these activities will place limitations on the future.

The dimension of time is also linked to the concept of equity. The concept of equity relays the meaning that "each person in the world has the same right (although no obligation) to use an equal amount of global environmental space" (Friends of the Earth, 1995:5), where "environmental space is the global total amount of environmental resources: such as absorption capacity, energy, non-renewable resources, agricultural land. . ." (*ibid.*). The need to reduce inequality so as to afford everyone an opportunity is also a fundamental human right as dictated by the United Nations Charter on Human Rights. Equity in itself could be achieved through two objectives. That is threshold standards of living could be set and popular participation in decision making could be increased (FAO, 1989). In retrospect, Elkin *et al* (1991) state that equity can be inter-generational, where there is a commitment to equitable access to resources between generations (note the dimension of time), as well as intra-generational. Elkin *et al* (1991) make the valid point that a greater degree of equity needs to occur within the current generation. This sentiment is also maintained by, amongst others, the Friends of the Earth (1995), UNCED (1992), O'Roirdan (1995), White (1994) and WCED (1990). Elkin *et al* (1991:3) continue by stating that "even the average Western rate of resource consumption cannot be achieved by the entire global population without ecological catastrophe, yet that is the aspiration of most developing nations. And, [*sic.*] as the Brundtland Report demonstrated, the effect of poverty in less developed countries are also ecological degradation. The only solution therefore is more equitable access to resources". Within the towns and cities of Southern Africa the disproportionate allocation of resource in comparison with population size and land area can also be noted between rich and poor, and in many cases between former white and black areas. This trend needs to change, but in a sustainable manner.

3.2.3 Basic Needs

It follows that intra-generational equity can also be linked to basic needs (another characteristic of sustainable development). Fulfilling basic needs would reduce poverty, which as argued by the Brundtland Report would decrease unsustainable tendencies. Although sustainable development "means meeting the basic needs of all and extending to all the opportunity to satisfy their aspirations for a better life" (UNCED, 1987:2), it also

implies the "acceptance of consumption standards that are within the bounds of ecological possibilities and to which all can aspire" (*ibid.*).

3.2.4. Constant Natural Capital Stock

By maintaining constant natural capital stock renewable resources are consumed at a rate at which natural systems can replenish them. The maintenance of a constant natural capital stock is also linked to the equity and temporal characteristics of sustainability. That is the maintenance of a constant natural capital stock will not compromise the needs of future generations. Other benefits of maintaining a constant natural capital stock and developing it in a sustainable manner include meeting the needs of the socially disadvantaged, a respect for our environment, an aversion to risk in the face of uncertainty and long-term economic efficiency (Barbier, 1987; Pearce *et al*, 1989). However, "our ability to identify the minimum environmental capital stock is limited" (Elkin *et al*, 1991:2). Irrespective of this limitation, Elkin *et al* (1991) believe a change of direction needs to occur in our present levels of consumption. The ability to identify this change imposes a limitation which ultimately could indicate a viable minimum capital stock. The concept of critical load is central to this deduction. As Elkin *et al* (1991:2) phrase it: "[critical loads] are based on the environments capacity to absorb pollution. . .in wildlife conservation we can attempt to identify the minimum levels of habitat that must be conserved to maintain a species diversity". Another method to determine critical load for maintaining a minimum or constant natural capital stock, is that of the precautionary principle. The precautionary principle dictates that if there is scientific doubt, then the benefit of the doubt is given to the planet or resource (Elkin *et al*, 1991; Friends of the Earth, 1995; Hewitt, 1995).

With these characteristics in mind, and as discussed in the spatial dimension characteristic, issues of sustainability should be addressed as near to the source of environmental problems as possible. As argued, this is at the urban settlement level.

3.3. LOCALISING SUSTAINABILITY TO THE URBAN AREAS

Urban areas by their very nature are complex. Apart from their physical characteristics that create a visible fabric of infrastructure, explicit and implicit (if not intrinsic) relationships exist in urban areas. These are influenced through human-built form interaction, as well as human-human interaction within the urban environment (Lynch, 1990; Shirvani, 1985). Addressing sustainability spatially within an urban environment will inherently be complex. Issues of urban sustainability are manifold and strategies aimed at achieving sustainability within the urban environment will also be manifold. Furthermore, no single strategy will be the same for any two areas, since each urban environment is set within a landscape varying according to criteria that dictate its form. Such criteria include location, demography, topography, economic variables and social variables.

Realising the limitations set by tracing all rational relationships (if not irrational) within an urban environment, the goal of achieving sustainability at a local level seems far-fetched. After all, policies for sustainability can only be implemented if a reductionistic approach of cause-effect relationships can be applied. Even at a simplified level, internal and external dimensions of urban sustainability can be noted. Just consider the metabolism and ecological footprint of urban areas. Owens (1992:79) interestingly states that "sustainable urban development is arguably a contradiction in terms. By definition, urban areas require the resources of a wider environment for their survival".

Accepting this statement would require a radical approach towards restructuring society and its economy. Furthermore, such a strategy would need to be holistic, encapsulating an urban area's ecological footprint.

Anti-urban sentiments have surfaced (consider the Gaia philosophy). Utopian ideals of decentralised patterns of quasi-self-sufficient, small-scale communities have manifested themselves (consider the extension of Kibbutzims and Moshavs). However, at the present rate of social, political and economic will, these seem remote and it is anticipated that current patterns of urbanisation will continue. Debates have often emerged over the "correct" urban form: Compact Cities or Decentralised Sprawled Cities. (This debate is discussed and analysed in Chapter Six). Owen (1992) convincingly argues that given current development patterns, demographic characteristics, economic and social nuances, urban areas are here to stay.

To consider sustainability in its entirety is an ambitious task, and beyond the scope of this dissertation. Rather, as mentioned earlier, sustainability can be achieved in various ways, each one addressing one aspect that could encourage the sustainable use of resources or promote a sustainable lifestyle. A plethora of strategies has been developed which could improve the sustainability of cities. Many of these have developed from policy initiatives. For example, separating waste at home, for easier recycling. Another example could be the use of car pools to reduce the number of private vehicles on the road. Furthermore, the need to save water has encouraged people to collect rain water for gardening purposes. In some cities grey water infrastructure has been laid where this water is used for gardening purposes only. Other initiatives to help reduce the city's ecological footprint include urban agriculture policies that encourage people to plant food-yielding plants in their gardens. Some municipalities and communities have even gone further in temporarily using undeveloped land within the city for agricultural purposes. Other initiatives include the use of lead free petrol to eliminate carbon emissions. All these initiatives have a variety of implications and ultimately influence lifestyles and cities, through the provision of new infrastructure and facilities and even by zoning areas differently to accommodate urban agriculture.

These initiatives are all a part of the sustainability jigsaw as they originate from general sustainability principles. Since sustainability principles embrace almost every aspect of human life, those which may be relevant to urban areas are outlined in the next section.

3.4 PRINCIPLES OF SUSTAINABILITY

3.4.1. General Principles of Sustainability

Equity, constant natural capital stock, basic needs, time and space are considered as the primary principles of sustainability (UNCED, 1992, WCED, 1990, Elkin *et al*, 1991).

The remaining principles can be applied to urban areas. They are a synthesis of an extensive literature review, and in some cases have been adopted as policies by some urban areas (such as Curitiba, Brazil; Portland, Oregon) for the attainment of sustainable urban development.

The Brundtland Report made a number of recommendations for the attainment of sustainability. In its chapter on urban pressures (WCED, 1987) the most notable include (but are not exclusive to the Brundtland Report):

- Government support of the informal sector. Brundtland argues that this sector "improves the economy by mobilising untapped resources, contributing to capital formation, and stimulating employment. It is not capital- or technology-intensive, nor energy-intensive. . .Moreover, informal sector workers are flexible in responding to local needs and demands" (WCED, 1987:51). In Namibia, the National Development Plan 1 (NDP1) explicitly states that the informal sector must be in partnership with government and included in the delivery of housing (NDP1, 1995; UCT, 1996). It is therefore essential to consider informal sector inclusion into the promotion of urban sustainability for a number of reasons. Firstly, the informal sector will be a major player in the shaping of urban form in the Namibian context. Secondly, by its very nature, the informal sector can be sustainable in its activities. Thirdly, by including the informal sector and adopting appropriate standards, we are fulfilling a primary principle of sustainability, namely attainment of basic needs appropriate to the development context and not exceeding ecological limits. Furthermore, including the informal sector in the development context, enhances public participation and embraces the principle of inclusiveness and equity in through decision making.
- Plan and guide physical urban expansion. This is central to the urban sustainability debate, because as will be shown in Chapter Nine, the type of urban form directly influences sustainability. It is therefore important to guide development and not to be lead by development into speculative and haphazard planning, which will have major equity, social, economic and environmental implications.

- Use of low-cost technologies. The use of low cost technologies, especially in the supply of housing, could have economic benefits for the home owner. Moreover, they tend to make housing more accessible. Low-cost technologies are also considered to be environment friendly.
- Public participation. Effective public participation reduces ineffective planning which often leads to wasted resources which is unsustainable. Public participation encourages people to define what they need and how they intend to contribute. Public opinion also plays a critical role in improving urban conditions.

The OECD (1991:10) summarises its principles for attaining sustainability as the "need for:

- developing long-term strategies for the management of the urban environment in the context of sustainable global development;
- adopting a more cross-sectoral approach to the planning of development proposals. . .;
- facilitating co-operation and co-ordination within the public sector, and between the public and private sectors and local communities;
- setting and enforcing minimum environmental standards;
- increasing the use of renewable resources and fostering low-waste and recycling processes; and
- encouraging and building on local initiatives and community involvement. . .".

The ICLEI (1995) adopts similar principles of sustainability, but they are fundamentally based on the primary principles mentioned above, and are linked to the concept of social, economic and environmental sustainability. The following statement by the ICLEI (1995:32) encapsulates its principles: "Sustainability is about improving standards of living within the carrying capacity of the natural environment. It is not about economic growth, but is about social equity and cultural development".

Since this dissertation emphasises urban form, which is both policy and design driven, the design principles for sustainability are outlined below.

3.4.2. Sustainable Design Principles

Sustainable design principles are inherent in the Shallow Green approach mentioned in Chapter Two. Sustainable design is a concept that recognises that humans are an integral part of nature, and that just as we respond to nature, so does nature to us. A balance needs to be achieved where we can make our lifestyles more comfortable by recognising this relationship with nature. The philosophical base to this is that of conservation, and applying conservation to every-day life.

The Hanover Principles, developed for EXPO 2000, lay a model for sustainable design, and these principles, together with the policy principles mentioned above, form the basic

sustainability demands of this dissertation. The Hannover Principles, adopted by the International Union of Architects, can be summarised as follows:

- Insist on the right of humanity and nature to co-exist in a healthy, supportive, diverse and sustainable condition.
- Recognise interdependence. The elements of human design interact with and depend on the natural world, with broad and diverse implications at every scale. Expand design considerations to recognise even distant effects.
- Respect relationships between spirit and matter. Consider all aspects of human settlement, including community, dwelling, industry and trade, in terms of existing and evolving connections between spiritual and material consciousness.
- Accept responsibility for the consequences of design decisions upon human well-being, the viability of natural systems and their right to co-exist.
- Create safe objectives of long-term value. Do not burden future generations with requirements for maintenance or vigilant administration of potential danger due to the careless creation of products, processes or standards.
- Eliminate the concept of waste. Evaluate and optimise the full life-cycle of products and processes, to approach the state of natural systems in which there is no waste.
- Rely on natural energy flows. Human designs should, like the living world, derive their creative forces from perpetual solar income. Incorporate this energy efficiently and safely for responsible use.
- Understand the limitations of design. No human creation lasts forever and design does not solve all problems. Those who create and plan should practise humility in the face of nature. Treat nature as a model and mentor, not an inconvenience to be evaded or controlled.
- Seek constant improvements by sharing knowledge. Encourage direct and open communication between colleagues, patrons, manufacturers, and users to link long-term sustainability considerations with ethical responsibility, and re-establish the integral relationship between natural processes and human activity".
  (in USDoI, 1993:5).

In addition to these, a further principle should be adopted, that of learning from past plans and designs and being open to other cultures. Quite often, planners, urban designers and policy makers have ignored the past for modern technological fix-its, which in many circumstances have failed. By adhering to this principle, an improvement of lifestyles can occur through the implementation of re-found humanising principles inherent in past designs. This principle is supported in the works of Lynch (1990), Lynch (1985), Shirvani (1985), Etzion (1996), Fathy (1996), El-Deen Hamed (1996), Barnhett (1982), Kain (1981), Pressman (1981), Griffiths (1968), Bitan & Potchter (1995) and Sherlock (1991), who have all made use of and referred to pre-modern planning and design principles.

With these principles it is hoped that environmental, economic and social sustainability are placed at the core of practices and professional responsibilities. Furthermore, it is also

hoped that these principles will enhance the sustainability of the built environment. By adapting our paths of urban development to promote sustainable development, we can improve the quality of life of urban dwellers.

3.5. HOLISTIC CONCEPT OF SUSTAINABILITY

Due to the complex nature of cities, implying that the achievement of sustainability in urban areas is just as complex, clarification of the word sustainability is necessary. As discussed earlier, sustainability can be achieved in a number of ways. Here it becomes important to note that sustainability can be applied to three broad contexts also dictating the urban environment, namely economic, social and natural (environmental).

Each context can be regarded as a system, and as Barbier (1987:104) puts forward, each system "has its own unique set of human ascribed goals:
[Natural] systems goals:
- genetic diversity
- resilience
- biological productivity

Economic system goals:
- satisfying basic needs (reducing poverty)
- equity enhancing
- increasing useful goods and services

Social system goals:
- cultural diversity
- institutional sustainability
- social justice
- participation".

These goals ought to be fundamental to any development. Although within the urban environment it becomes difficult to achieve natural system goals, since they are not the direct and primary concern of urban areas, urban areas can be involved in maintaining these goals indirectly, by becoming aware of their ecological footprints and aiming to reduce them. Methods in achieving this goal will vary between settlements, because they are set in different environments which have varying degrees of agricultural and biological productivity. For example, the curtailment of urban sprawl into highly productive marginal lands in fertile tropical and subtropical areas would have a greater impact on the goals of biological productivity than those settlements in barren desert environments. The issues of sustainability therefore assume different sets of criteria. For example, the curtailment of urban sprawl from a sustainability perspective would include more social and economic goals, with environmental goals aimed at reducing green house gases and urban heat islands.

Although Barbier (1987) uses the three systems for economic evaluation, it would be misleading to consider the goals of natural systems as such. There are many more goals, notably of a more practical nature, such as the reduction of green-house gases, the attainment of fresher air and the reduction of pollution.

From this it becomes evident that sustainable urban development tries to attain these goals, and others as well, through direct and indirect means. This means that sustainability can be applied from three fronts (social, economic and environmental).

Economic sustainability realises that economic growth is inherently unsustainable. A change is needed in the current economic focus and sustainable economic development should be strived for. Implicit in this concept of sustainable development, is the linking of social criteria. That is, as Pearce *et al* (1989:29) state that "development implies change leading to improvement or progress...[meaning that] real development is normative or value laden" and implies that "economic development has something to do with achieving a set of social goals...which may change over time". Linked to economic development is an advancement in the utility (regarded as satisfaction or well-being), the preservation of existing freedoms and advances in freedom (where freedom is related to poverty, ignorance and squalor), and self esteem and self respect, which are all social in nature (Pearce *et al*, 1989). Economic development as a notion of sustainability implies quality where standards of living are improved.

Social sustainability tries to incorporate aspects such as social justice, equity and cultural support, so that "sustainable development requires that economic development is managed to use the talents and resources of local communities and to be supportive of community life and power. The benefits of that development need to be distributed equitably and sustained in the long term. . . Social justice will necessarily have to be based on economic sustainability, and economic sustainability requires environmental sustainability, as all raw materials and energy sources come ultimately from the natural world" (Hewitt, 1995:34).

Environmental sustainability means maintaining the natural capital and considering the carrying capacity of the natural environment (Hewitt, 1995; Goodland & Tillman, 1995).

As noted, environmental, social and economic sustainability are not mutually exclusive. This is especially true to the urban context, because urban areas cannot manage their problems by merely exporting them physically. Urban areas need to begin to internalising their externalities. For example, changes to ecological footprints need to occur through changes in lifestyle and consumption patterns.

Needless to say, environmental sustainability needs to be considered as a position of dynamic equilibrium. Constant adjustments and even trade-offs between the three fronts of sustainability will occur, and even within the three fronts (Barbier, 1987; Hewitt, 1995).

Furthermore, although this dissertation is calling for the attainment of sustainability at a local level, namely the urban environment, it must be realised that sustainability cannot be attained or maintained purely at the local level (Hewitt, 1995). The sustainable development of the urban environment has particular ramifications concerning the way urban areas view the impacts of their activities. Since "urban areas can never be regarded as self-contained entities, as they need to interact economically, socially and environmentally with other areas as an integral dimension of their vitality and growth" (OECD, 1991:36) the policies for sustainability will not only impact on the local environment, but also on the regional, national and international environment. As discussed earlier, it is therefore important to implement change at a local level, especially when it will have a multiplier effect. As Hewitt (1995) maintains, local actions should be complementary to national and international action. "Each local authority can strive towards sustainability in those areas which it does control, co-operate with those around to affect wider concerns and press hard for national and international action" (Hewitt, 1995:35).

In Namibia it is hoped that this will be realised through the implementation of a Coastal Zone Management Plan (CZMP) in the Erongo region, which includes recommendations for the adoption of a sustainable urban form and the implementation of sustainable urban development.

3.6. SUSTAINABLE CITIES

The debate between compact and sprawl settlements in Chapter Six, will concede that environmentally sound development can assume almost any urban form depending upon the context. However, the chapter also advocates through the debate between sprawl and compaction, that compaction provides social, economic and environmental benefits. Yanarella & Levine (1993:301) agree with this statement by stating that "while our studies have indicated that sustainable cities have been and are likely to be compact cities, we have also concluded that compactness in and of itself is not a definitive indicator of sustainability". Therefore, if our sustainable cities are likely to be compact (and this is a broad term itself) there must be operative principles guiding the design and governance of sustainable cities.

Their are various methods to achieve sustainable cities. However, these are based on the principles of sustainability mentioned earlier as well as basic principles of urban form and urban design which will be mentioned in chapters 5 and 7 respectively. Ultimately, the sustainable city will be based on the ability of such settlements to strive for social and ecological sustainability.

To pre-empt the discussion to follow, the sustainable city will have features of high population densities, human-scaled architecture, social heterogeneity, aesthetic richness and diversity of design.

At an elementary level, the city should be structured and organised so that it meets man's:

- physical needs (food, water, shelter, sanitation, transportation, work, recreation, etc.);
- love for nature (sunshine, fresh air, trees parks, etc.);
- need for social life and social care (where civic wealth is adequately distributed so as to reduce poverty); and
- need to develop and grow. (Dantzig & Saaty, 1973).

Walmsley & Botten (1994) predict that by the year 2000, 50% of the world population will be living in cities. The main input of this statistic is the current rates of urbanisation. In most countries, if not all, the development of nations is linked to the growth of cities. As major centres of consumption, production and communication, cities are the focal points for pollution, crowding, poverty, disease and oppression. These all have economic, social and natural environmental implications.

In order to reduce the adverse effects of these implications, cities need to chart their path of development. Realising that they are not closed systems and cannot sustain themselves within closed boundaries, a number of options avail themselves to cities. The most viable is that of alignment with the basic principles of sustainability. Cities need to realise that they are part of an ecosystem and have to consider their relationships with biophysical and socio-economic elements. However, there are many relationships, and it would be exhausting if not impossible to trace these relationships. Furthermore, since change cannot occur overnight, sound management and planning is needed to ensure appropriate systems of governance, resource use, transport, physical planning, etc. (Walmsley & Botten, 1994).

In general sustainable cities embrace the basic principles of sustainability, that are applied to specific urban themes such as resource use, housing, finance, governance, urban environment and health, employment and transport. For example, in many rapidly urbanising towns and cities, informal housing and squatting is occurring. By involving people in self-help schemes, a change in lifestyle can occur from one based on scavenging for resources to one based on recycling. Further down the line, products can be recycled from which shelters can be built. Through a process of capacity building and a partnership with government, houses can be built using appropriate technologies and employment can be created. Local authorities should also site areas for development close to public transport routes since urban transport is essential for supporting basic needs. Holistic planning is encouraged. Thereby a resource seen to be a burden on urban societies, the squatters, have been internalised into a local economy producing benefits. They, in turn,

have internalised some products rendered redundant by the city dwellers. Sustainable use of resources has therefore occurred.

Ultimately all urban dwellers should be encouraged to:

- improve the quality of human life;
- respect and care for community life;
- change personal attitudes and practices;
- maintain vitality and diversity;
- minimise the use of non-renewable resources; and
- keep within the earth's carrying capacity and localise this concept to the urban area.

Cities such as Curitiba (Brazil), Portland (Oregon) and Singapore have taken the sustainability route with many resultant benefits. In general, the approach adopted from a physical perspective, has been that of "maximum integration of urban functions and social classes, to give people incentives to live near their work and city services" (Hulley, 1994:5) and through the urban form getting people to economise on energy, while still improving the quality of life. In many respects this was achieved by managing urban growth and through the provision of attainable guidelines relevant to that society. Furthermore, people were given access to key economic and environmental resources and empowered to participate as active decision-makers in the use and management of resources.

The performance of the city can ultimately be evaluated by considering aspects such as balance, fit, harmony, vitality, access, sense and legibility. Most of these are discussed in Chapter Seven. In this respect, the sustainable city can be achieved through design, since many of the aspects mentioned can have a design element.

3.7. CONCLUSION

The path to economic development, social equity and better social well-being as well as environmental enhancement and conservation, is attainable through sustainability. The adoption of various principles could provide a framework for achieving such benefits. These principles can be adopted at any spatial scale, but as argued are best achieved at the local level. By "thinking globally and acting locally" a number of world issues can be addressed. However, this requires political will and the acceptance of local people. Since the scope of sustainability is endless, so are the means in attaining them. One such mean is to translate the principles of sustainability through design. By designing settlements in a particular way, sustainability can be promoted, since quite often our environments determine our actions, and this is discussed in chapters 4, 5 and 7.

Chapter 4 will illustrate how the sustainability debate can be advocated in decision-making, and explicitly try to implement some basic principles of sustainability such as equity, equality and public participation. In illustrating the various methodologies this dissertation has adopted and recommends as best equipped to relay the message of this dissertation, some ground work is covered for attaining sustainability in design, which will ultimately influence the urban form of a settlement.

Chapter 5 presents the argument that humans and their environments have an intricate and complex relationship. At times these relationships are explicitly manifested, but most of the time they are implicit. In retrospect, sustainability once manifested in urban form, will start off a new relationship and possibly a new urban form.

Chapter 7 briefly illustrates how the built environment can be interpreted. In so doing, and realising how environments can enhance lifestyles, it becomes apparent that issues of sustainability are implicit in many built biophysical relationships.

This chapter, has therefore presented the tenets of sustainability, which in due course will be noted in many of the design principles this dissertation presents.

3.8. SUMMARY AND MAJOR FINDINGS

Chapter three has provided a simple but useful description of what sustainability is and what it entails. The following points are the main findings of this chapter realised so far.

1. A number of definitions exist that try to define sustainability and sustainable development. The major characteristics they predominantly have in common are those of equity, constant natural capital stock, the ability to fulfil basic needs and the dimension of space and time.
2. A spatial scale is of great importance when dealing with issues of sustainability. Spatial scales can enable the quantification of impacts and adoption of manageable strategies.
3. Most environmental problems emanate from cities. As major centres of production, communication and consumption, and with almost 50% of the world population in them, issues of sustainability can be addressed close to where the problems emanate. With unprecedented pressures from urbanisation it is important to identify the issues that lead to unsustainability before they manifest themselves.
4. Strategies aimed at achieving sustainability are manifold and can be spatial and aspatial in nature. Aspatial strategies consist of policies that aim at addressing maladjustments in consumption patterns and general lifestyles. Spatial strategies aim at attaining physical change.
5. Physical change can be achieved through aspatial policies as well, but are inherently spatially directed. Density policies and transport taxes are examples of such aspatial policies. However, it is from direct physical changes that issues of sustainability can be addressed. Design therefore has a major role to play in achieving sustainability.
6. Sustainable design is inherent in the Shallow Green approach, which recognises that humans are an integral part of nature. Just as we respond to nature, so does nature to us.
7. Sustainable design must recognise social, economic and natural environmental implications. In such a holistic manner relationships between the built environment and human environment; human environment and natural environment; and natural environment and built environment can be made as beneficial as possible.
8. Finally, all the principles mentioned manifest themselves some way or another in design and ultimately in urban form.

"The body and the mind are shaped by the adaptive responses that man makes to the physicochemical, social, behavioural and even historical stimuli they impinge on him. . . Man makes himself in the very act of responding to his environment - through an uninterrupted series of feedback processes. . . For this reason, environmental planning plays a key role in enabling human-beings to actualise their potentialities. Human potentialities, whether physical or mental, can be realised only to the extent that circumstances are favourable to their existential manifestations."

(Dr. Rene Dubos, 1972:178)

CHAPTER FOUR : PROCEDURAL THEORIES OF INTEGRATION

4.1. INTRODUCTION

There is no single process for design. As Shirvani (1985:105) states, "design method/process has always been a problematic and sensitive subject for designers", since all designers use methods and processes they are comfortable with. Quite often designers use intuition to develop a plan, and here the art of design is emphasised. "Others emphasise various systematic processes and take a philosophical approach to design" (Shirvani, 1985:105).

Although intuition was used to draw up the proposition of appropriate designs for desert environments, a philosophical approach was adopted in order to develop the argument. This chapter therefore deals with procedural theories. It is important to consider methodologies, because design is a methodology in its own right. Design, "when applied to public policy, can help solve some of the problems of mis-allocated resources [and] misused land" (Barnett, 1982:7). The best way to attain sustainability is through the use of a process and a final plan. Getting to the plan solves part of the sustainability issue, since it interprets the environment which ultimately produces a viable design.

The Rational Comprehensive Method will be discussed first. In this discussion, it will become evident how the Rational Comprehensive Method led to the attainment of certain design/planning principles. The dissertation sheds light on certain design principles that could enhance the liveability[3] and sustainability of the built environment, but it does not intend these principles to be used as blue-prints. In this respect the blue-print approach to planning and design is discussed, since it is quite often a product of the Rational Comprehensive Method. In line with certain principles of sustainability, such as equity and equality in decision making that ensure public participation, the principles transcending from the Rational Comprehensive Method are fed into a philosophical framework of Integrated Environmental Management (IEM). The basic principles of IEM are outlined and the process is illustrated. This is done to illustrate that the process of decision-making, in recognition of impacts on the environment, cannot be done through a linear process.

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[3]Liveability is a term used which covers a range of local environmental characteristics, such as townscape quality, health, safety and a perception of security. Planning can influence liveability through the use of urban design, the development control system and urban form (Bentley *et al*, 1985).

This leads to a concept of how the principles should be viewed and a possible procedural process is recommended.

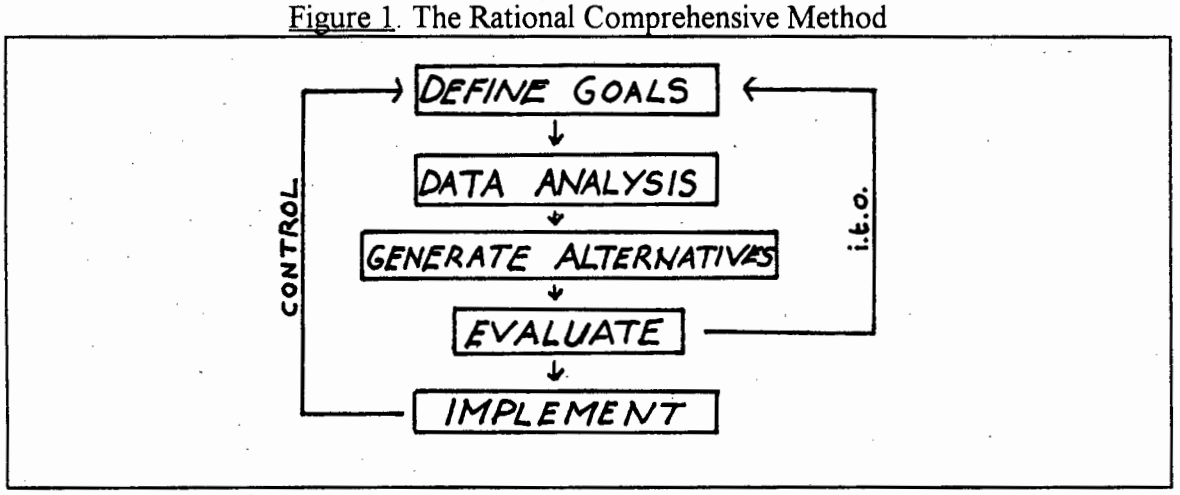
Finally, as an encapsulating meta-theory of this dissertation, decision-making is discussed and a model of decision-making is presented. This section highlights the presumption that our decisions are shaped by our environments (socio-economic, political, cultural and biophysical).

4.2. RATIONAL COMPREHENSIVE METHOD

In the absence of a public forum to determine goals and objectives, the Rational Comprehensive Method has been used in developing planning and design principles. Comprehensive planning assumes that the planner understands the needs and interests of those affected by his/her plans. The plan is therefore considered to reflect the needs of the affected community.

The Rational Comprehensive Method tries to predict a future outcome. In this respect the rational comprehensive planner attempts, in a holistic manner (looking at all elements which might affect a decision) to consider all possible alternatives for future developments. The process is goal-directed and therefore focuses on a determined end-state. "It is a goal directed approach" (Camhis, 1979:61). Figure 1 gives the author's adaptation of the Rational Comprehensive Method. In essence, the planner's focus is on the best method to use in achieving his/her goals. Goal consensus is assumed. Decisions are evaluated on whether or not they achieve these goals. Being linear, the method can overlook diversity through the assumption of consensus. Its directness is often associated with blue-print planning.

Figure 1. The Rational Comprehensive Method



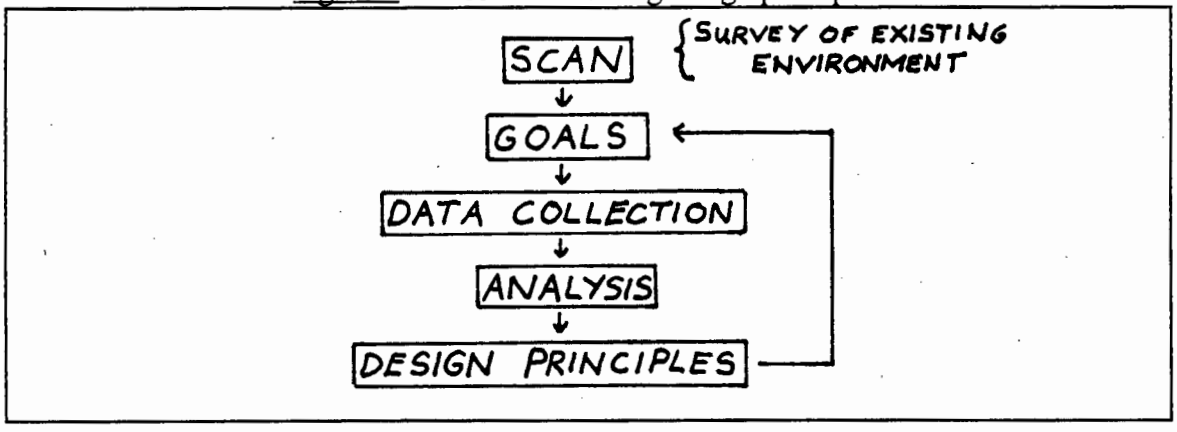
(Source: Adapted by author)

From this brief description, many disadvantages of the methodology can be noted. These can be listed as follows:

- the future cannot be predicted;
- planners cannot assume consensus in goal attainment without public involvement;
- all issues cannot be considered in decision-making and human capacity for problem solving is limited, and therefore an absolute barrier to rational choice;
- decisions are made in a complex environment; and
- the method is limited in terms of public participation and generation of alternatives.

Nevertheless, for a number of reasons, the methodology was used in this dissertation to attain basic design principles. Firstly, circumstances of this dissertation did not lend themselves to an elaborate exploration of community goals, needs and perceptions. Where possible, these were reflected in the goals based on literature researched. Secondly, circumstances did not present themselves for a detailed evaluation of the planning/design principles used in this dissertation. Thirdly, and probably most importantly, the dissertation presents itself as a proposition. Fourth, the planning/design principles are not intended as an end to the planning process. Rather, they are principles to facilitate discussion and, if appropriate, to be regarded as non-static guidelines which could be considered in the drawing up of proposals. Finally, it was believed that the process lent itself to an effect methodology that would rationalise the discourse where possible. The process adopted in attaining the design principles is illustrated in Figure 2.

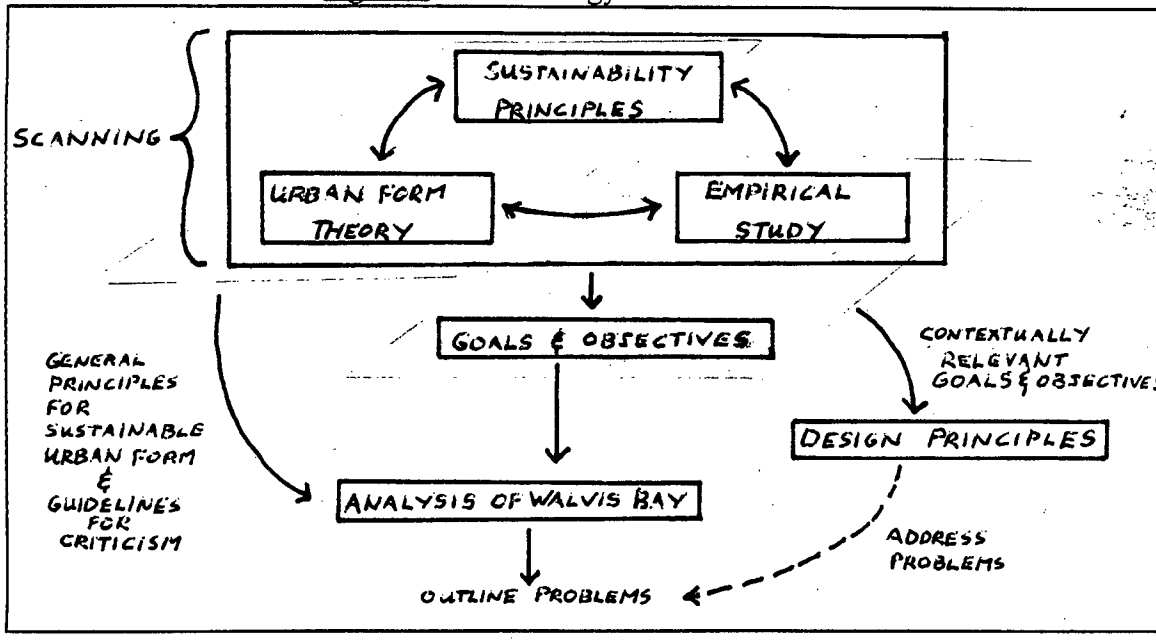
Figure 2: Process in attaining design principles



In order to anticipate problems, the built environment was scanned to see if any maladjustments could be noted. There is no doubt that this could be regarded as a subjective step, since some predetermined concept or set of criteria to judge against was considered. To reduce this subjective nature of scanning and to focus it, an analysis of urban form theories and urban design principles was conducted. In so doing, the scanning process adopted a proactive (creative) rather than reactive (curative) process where strengths and weaknesses were identified. The scanning step was not linear and included a

cyclical process. Figure 3 illustrates the process of this dissertation and shows that the theories and the empirical evidence are constantly assessed against each other. Figure 3 also illustrates how the argument was developed.

Figure 3: Methodology of the dissertation



The aim of the process is to explore the possibility of a sustainable urban form in desert environments. This led to the proposition that specific design principles are appropriate in a desert environment. This set the goals, which, as part of this dissertation's ambit, are to effectuate a sustainable urban form through physical planning and design considerations that the planning system can control. The objectives of these goals would inherently be the planning/design principles.

Effectively, the goals and objectives were determined through the scanning function, based on the proposition's precept that if urban forms could be made sustainable, their characteristics should be identified. These therefore formed the goals. In essence, the goals were based on theoretical perspectives of empirical evaluations. Ideally, the goals and objectives should be refined and structured through public participation at this step. Public participation in the early stages of the process can eliminate "angry reactions that hinder the design's progress. Such early participation may also provide the designer with additional insights into the plan" (Shirvani, 1985:112).

Within this process of goal setting the goals are broad statements of intent, and the objectives the mechanisms in achieving the goals (ultimately the planning and design principles). Policies (or design policies), in this dissertation, are the means to attain the objectives.

Data was collected in terms of the goals and objectives. This involved research on urban form in desert environments. This research was based on direct observations, theoretical literature review and empirical literature review as well as personal interviews with Namibian officials.

The data was then analysed, and the goals were applied to environmental constraints. Relationships between the built and natural environment were also sought in this analysis. These were predominantly based on empirical evidence from the literature review.

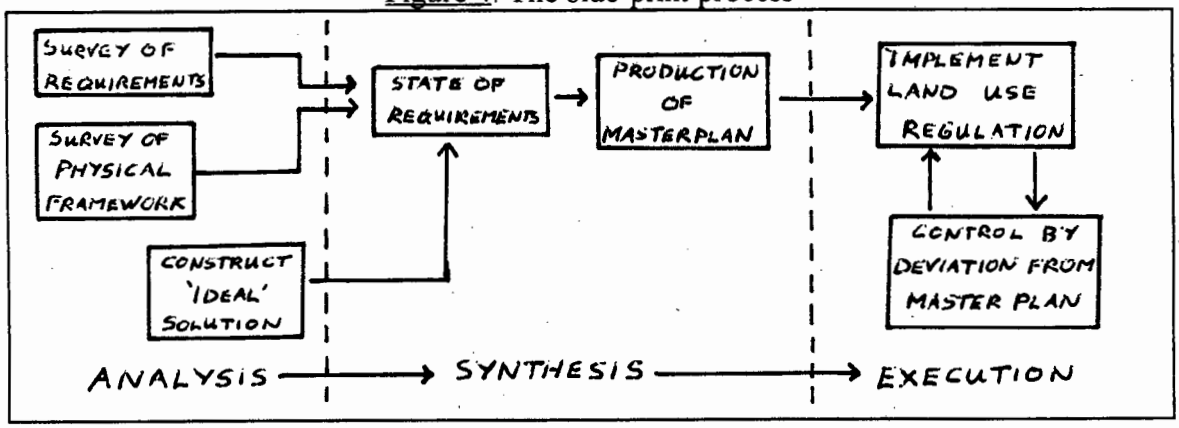
The generation of alternatives and their evaluation would normally follow in the Rational Comprehensive Method. However, following the analysis, design principles were empirically deduced from case studies and furthermore induced in terms of the goals and objectives set. Since these planning and design principles are not considered as "end products" of the planning system, the rational comprehensive process was stopped at this point.

Instead of continuing the process as a goal-directed approach, it is envisaged that the process be problem-directed. In this respect the planning/design principles will be considered as non-static guidelines, which will facilitate the planning process further.

4.3. BLUE-PRINT PLANNING

Had the planning process continued, it would have provided a static product that could be associated with a blue-print. The blue-print approach relies on technical standards and quantitative data, so that all actions are oriented or aimed at a product. It therefore has an image of what the future state should be. Its process is geared towards a predetermined state, and therefore assumes a high level of confidence in attaining the "ends". In order to do so the process must have a high level of control, thereby assuming consensus. The Blue-print process is illustrated in Figure 4.

Figure 4: The blue-print process



(Source: Prinsloo, 1976)

The criticisms of the approach can be listed as follows:

- its linear and product oriented characteristics make it applicable to cases of complete certainty;
- it is inflexible and unable to adjust to changes, whether policy or value formulated;
- it tends to promote a preconceived solution to a poorly defined set of problems;
- future impacts are not looked at in depth, and no monitoring or review procedures are allowed;
- public participation is minimal;
- it is not adaptive, for it does not allow experimentation and innovation;
- no alternative policy plans are examined;
- the approach is lacking in any sophisticated use of techniques, and where such techniques are used they are used in the most simplistic manner where the outcomes are inappropriate;
- the process does not enable people with the experience to learn from and improve upon, because its gained knowledge is not shared easily;
- the decision makers have inherent preconceived ideals which are often imposed upon other people (Muller, 1992).

Such a process would have been contrary to what is envisaged. The planning/design principles should therefore not be seen as end products, but as means in addressing certain issues.

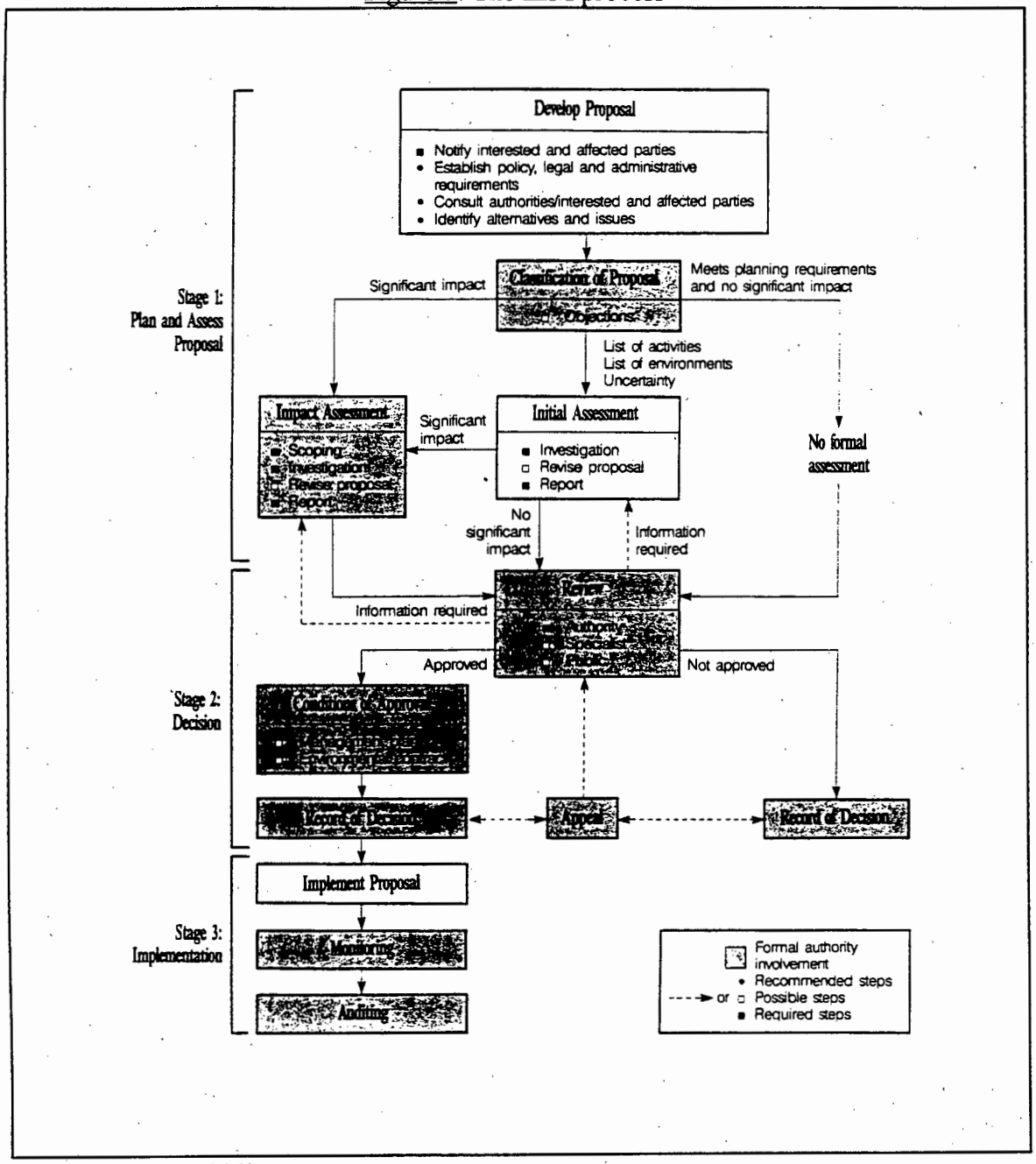
4.4. AN INTEGRATED PHILOSOPHY

An approach was therefore sought that would promote a process of public participation and encourage active citizen involvement in shared decision making. The approach sought would also consider the impact of developments and monitor and review such developments, so that the consequences could be understood, thereby supporting a process of continual knowledge through awareness.

In this respect it was believed that the Integrated Environmental Management (IEM) process could form the underlying philosophy in the attainment of solutions. The IEM process is illustrated in Figure 5. It is believed that since IEM seeks "to resolve or mitigate any negative impacts and to enhance positive aspects of development proposals" (DEA, 1992:5), the design principles could be seen as such proposals. Furthermore, since the design principles have social, economic and biophysical implications, and IEM seeks to integrate these environmental assets into a manageable solution, the IEM process as a philosophy could enhance the consideration of the design principles into a planning system that is integrative in its approach and responsive to the needs of its community. IEM is seen as a philosophy, since procedures adopted should be relevant to the context and therefore will vary in process.

Since the aim is to seek the sustainability of settlements through physical planning and design, its achievement is based on implementation that is both process- and design-driven, with a design resulting from a process. It is therefore anticipated that the planning/design principles will facilitate public participation in the "develop proposal" stage of IEM.

Figure 5: The IEM process



(Source: DEA, 1992)

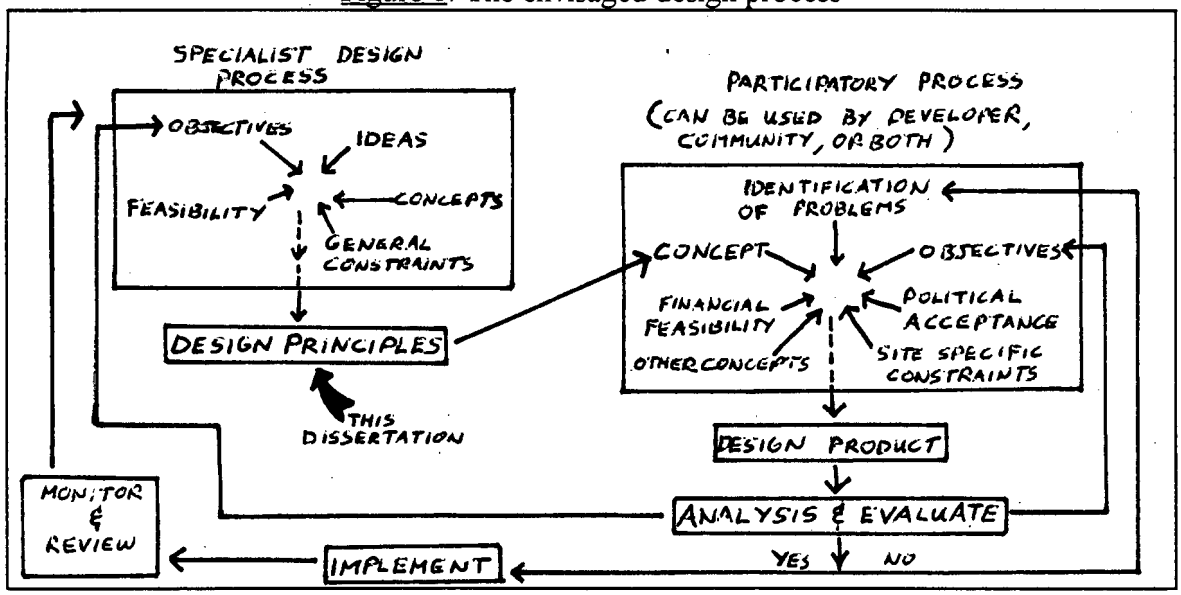
A few of the basic principles of the IEM process include, *inter alia*:

- informed decision making;
- a broad meaning given to the term environment;
- an open participatory approach in the planning process;
- due consideration of alternatives; and
- the opportunity for public and specialist input in the decision making process (DEA, 1992:5).

This dissertation supports these basic principles, and inherent in many of them are - sustainability principles such as equity and equality. Since many of these principles are strived for, it is believed that by aligning the planning process to the philosophy of IEM, tangible solutions can be found in urban environmental issues.

The envisaged process in terms of attaining design principles based on the IEM principles and philosophy is illustrated in Figure 6. This process recognises that planning and design should not be seen as separate activities. It also recognises the sequential nature of planning and design, especially in decision making.

Figure 6: The envisaged design process



This design process is iterative and enables communities and other professionals to become involved in the development of design principles that may be appropriate to their specific site and context. The process also illustrates the status of this dissertation. Note that the design principles being used as guidelines, act as concepts in the initiation of a final design product, thus facilitating discussion. In the specialist design process, the objectives (such as the orientation of roads in terms of prevailing wind patterns) are broadly defined.

The objectives in the participatory design process are defined through a participatory process more tuned to the local context. Communities may have alternative goals and issues they wish to resolve and these may in themselves have design elements a developer may wish to consider. It is therefore important that communities be involved in the development of goals and objectives. It may even be found that the local environmental parameters in a specific local area are different, thus requiring alternative design details. However, in this light the design principles provide some guidance as to what should be looked for. The final analysis and evaluation step permits the planning authority to strategically evaluate the design proposals and, in terms of development control systems, consider their applicability. It is envisaged that the participatory design process will be used on various scales. Thus developers and communities can decide to what degree participation will occur and how it will occur.

This dissertation will illustrate that a number of aspects influence urban forms in desert environments. The need to align them into a path of sustainability will result in the synthesis of a number of design/planning principle and policies that could help in the attainment of sustainability. However, these principles are just that. They will need to be adapted according to local circumstances and this is envisaged through the participatory design process as outlined in Figure 6.

4.5. THE CONSCIOUS USE OF METHODOLOGY

Since it might be inappropriate and wasteful, if not unsustainable, to impose changes on existing urban forms, a two-pronged approach is necessary. The first is based on existing settlements where the development control system could direct developments. The second refers to new developments, where change can be initiated through the adoption of a planning system entailing the use of a specific methodology.

Irrespective of the approach, design must begin with the current situation. Furthermore, the change that is achieved depends upon the way the issues are tackled. As will be mentioned in Chapter 5, planning theory of urban form highlights the fact that urban form can be consciously modified by planning authorities. This modification comes about through a conscious use of methodology. Different methodologies are used in a number of situations, depending on what is ultimately envisaged and who is involved in the planning process. For this reason, the envisaged planning process is outlined in Figure 6. The way decisions are made in this process may be determined by the process itself, but in essence decisions are made on how the discourse is presented and how the problem is identified and made relevant to the decision makers. A brief overview on decision models is highlighted in the next section. The section on decision models will also link up with the discussion on planning theory of urban form. By noting the way decisions are made and how they are influenced, it is possible to control a discourse and initiate change if need be. In this respect, although it may appear to be a hidden agenda, this discourse could be

captured by decision makers and planners to promote sustainability. How this can be done within the realm of decision making is beyond the ambit of this dissertation, although it is hoped that the design principles resulting from this dissertation will facilitate further action.

4.6. DECISION MODELS

In later chapters it will become evident that a number of players shape urban form. Being a part of Planning Theory (discussed in Chapter 5), urban form results from the decisions made by such players. It will also be noted that urban decisions are not made by a single homogenous group, with the possible exclusion of planning authorities who may have a better comprehensive view than other urban shapers. However, even within the planning authority, decision making is fragmented and pluralistic. In many areas, planning authorities tend to follow pluralistic currents and try to make sense of urban form by comprehensively viewing the overall evolving spatial structure. A method of doing this is to define the influencing factors that affect decision makers.

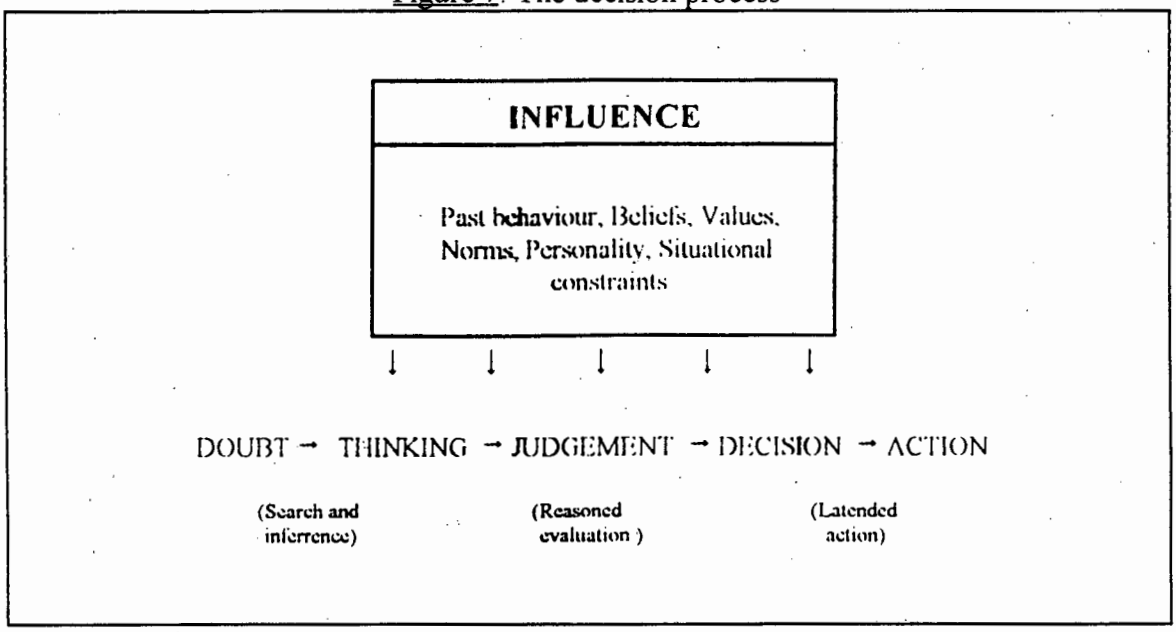
Clearly, the spatial structure revolves around people's decisions and in order to understand the spatial structure, it would be essential to realise how people make decisions. Of the many decision-making theories, Parkin's (1994) urban infrastructure decision-making process, provides insight for the purpose of this dissertation. In the chapter on sustainability, it is mentioned that an awareness of sustainability needs to occur and that such an awareness could be kindled by promoting change of the urban structure. As the dissertation will illustrate, urban form is structured by a variety of influencing factors. It may be argued that the adoption of this discourse will serve the interests of a specific group. This dissertation affirms the precept that a change in urban form will benefit society as a whole. No hidden agenda exists to proliferate the ideology of one group above another group, except for the adoption of a new worldview that recognises the limits to growth and importance of achieving sustainability, especially within the urban context. In order to capture the sustainability debate, it is essential to capture the discourse within the decision making stage.

As Rees (1995) argues, sustainability means nothing if people are not informed, or deliberately misinformed on certain issues. As Rees (1995) points out sustainability is not only a technical issue, but involves a process of decision-making as well. He therefore states that "planners have an unprecedented opportunity to practice their procedural skills as educators, as facilitators and as mediators between politicians and citizens in shaping the sustainability agenda" (Rees, 1995:356). The role for planners has therefore been set, in that they should aid the sustainability debate through planning processes. The way planners communicate the message of sustainability is crucial. For this reason, Parkin's (1994) decision models are discussed, because by understanding how decisions are made, planners can understand which issues to emphasise.

Parkin (1994) promulgates that urban infrastructure decisions have largely been conducted within a Weberian or Marxist framework. "The Marxists have sought to describe how structural forces shape the provision of infrastructure to serve the interests of capitalism. The Weberians have, on the other hand, concentrated their attention on the roles of 'urban managers' such as planners, real estate agents, and private developers within an environment of increasing social rationalisation" (Parkin, 1994:203). Parkin (1994:203) goes on to say that "engineers, economists, planners and public managers associated with the detail of infrastructure allocation continued their professional duties directed, as ever, by a technocratic consciousness confident of its central role in modernity and unaware of its ideological constructs". Parkin (1994) argues that the ability to solve problems goes beyond having just pure facts and using technical techniques in solving them. Harper & Stein (1992) studiously analysed the various planning methodologies, and uncovered that they were based on normative values, thus having ethical implications. Parkin (1994) supports this by stating that although professionals use technocratic criteria to conduct their duties, they must realise that their constructs of technocratic ideals do have an underlying ideological construct. Implicit in any theory, is a motive that rationalises the use of that theory and shapes the way a decision is reached. This needs to be made explicit, and by illustrating how decisions are made, it is possible to attain change within the future that is sustainable.

Decisions are often made at two levels: the individual level and the organisational level. Each level has its own decision process (Parkin, 1994). Figure 7 illustrates how decisions are made at an individual level.

Figure 7: The decision process



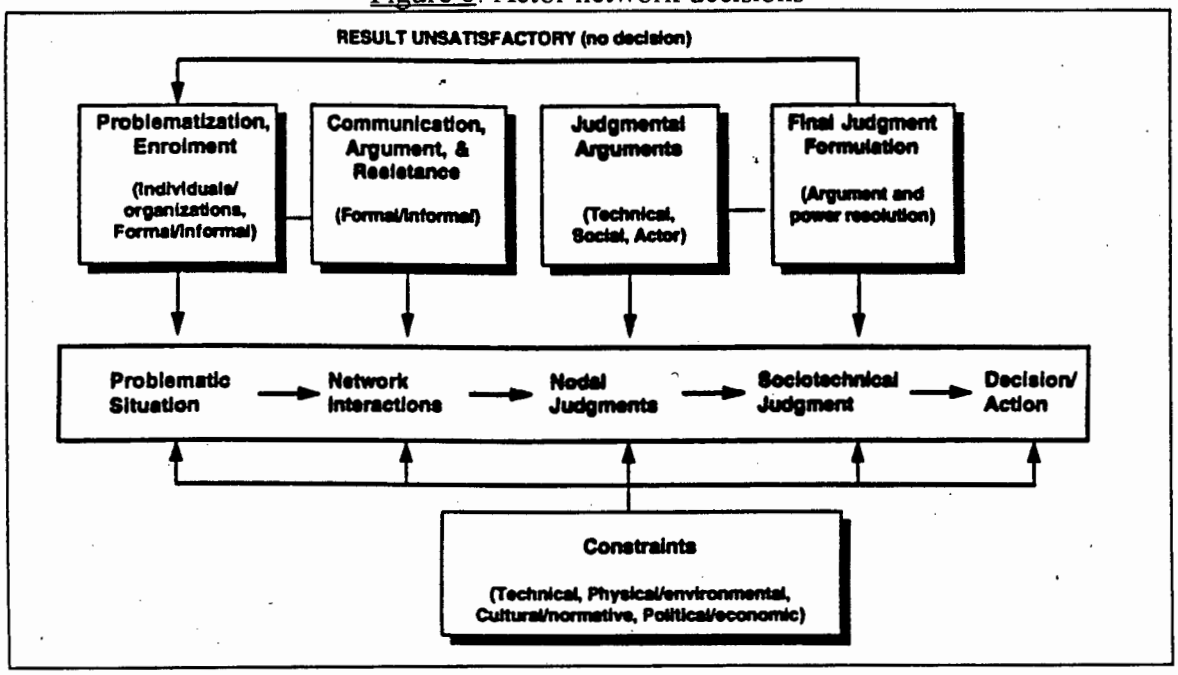
(Source: Parkin, 1994)

Action at the individual level results from a conscious judgmental process. Therefore, the model used for deliberation "is one which assumes a cognitive process directed by rational objectives" (Parkin, 1994:204). Depending on how heterogeneous a society is, people draw different conclusions, because their decisions are influenced by a variety of constraints. Unless the constraints are similar, it will be difficult to provide a single solution to a number of individuals. However, aspects that influence a community, although rationalised individually, are decided through a decision process that is synthesised through interaction.

Decision making within any organisation is a complex task and is influenced at various levels by various policies and persons. Decision models of this kind combine three processes. Parkin (1994) describes the three processes as:
- the rational goal-directed process used in analytical and evaluation studies[4],
- decisions as result of organisational processes, and
- decisions as a result of organisational politics.

Since decisions are solved by both individuals and organisations, the decision process is best reflected through Parkin's actor network decision process as illustrated in Figure 8.

Figure 8: Actor network decisions



(Source: Parkin, 1994)

[4]An example of a goal-directed process is given in the next section.

Perceptions are often created within the personal domain and it is only through interaction with other actors that a person can evaluate his/her personal stance and where necessary (with new information/data) adopt a more informed opinion. "Data generated from network dialogues form a pool of cues for individual judgement" (Parkin, 1994:207). Quite often the cues used depend upon a person's interests and where necessary are manipulated to fit into an actor's argument/discourse.

Parkin (1994:210) contends that "the power to define the problem is often more important than the power to implement the solution". Not all groups agree on environmental and development priorities, resulting in conflict. In order to reduce conflict, Parkin (1994) argues that, the way a discourse is presented, influences the outcome. Parkin (1994:208) suggests that "the better the fit between the final argument[5] and dominant social values, the less power will be needed to adapt the structure to the imperatives of action". Since many of the design principles and policies mentioned are technically responsive, the social and economic benefits that could arise from their adoption should be illustrated to society. Communities should therefore be involved in decision-making and should be presented with all the relevant information. This in itself enhances the principles of equity and equality inherent in the concept of sustainability. The design principles and policies should be made relevant to the communities if success is to be attained. However, it cannot be expected that a community will replicate the entire principle or policy. That is why the principles and policies need to be flexible in their adoption, yet robust in attaining specific objectives.

It is hoped that the design process as envisaged by this dissertation will use the design principles as influencing aspects that may alter the parameters that influence decision making. The design principles, though facilitating discussion, could therefore help capture the discourse and making it relevant to people's needs, thereby giving sustainability greater leverage in decision making.

4.7. CONCLUSION

This dissertation advocates, a change in urban form through the implementation of specific design principles. A specific urban form is envisaged, one that is sustainable providing social, economic and environmental benefits to its citizens. It is believed that change through the adoption of principles needs to be supported by a planning system. This system, being a planning process, must recognise that we learn from past designs, plans and decisions, and that success is achieved if people are involved in the planning process.

[5]That is the discourse adopted.

IEM therefore formed the philosophical base of the planning process. Involvement in the planning process entails decision making and in order to understand what influences decision making, Parkin's model was discussed. The decision model allows us to realise that decisions are influenced by the environment in which people find themselves. In defining the environment, thereby defining what could influence decisions, discourses that highlight specific issues could be adopted. Whether the discourse gains attention depends upon how they respond to social currents. This means, that in order for sustainability to be achieved through design principles they must be relevant to the people. This can only be attained if people are involved in the planning process.

The planning and design principles discussed in Chapter 8, should therefore be considered as facilitating guidelines that still need to be processed and refined by communities and developers, since they are not prescriptive measures.

4.8. SUMMARY AND MAJOR FINDINGS

Chapter 4 has discussed various planning methodologies. The importance in understanding these methodologies is that each method is capable of producing a design, but that each design is only developed through the rationale employed. Quite often, the rationale is to produce an ideal design that de-emphasises the role of public participation. Processes characterising such a rational are extremely linear and similar to the blue print approach. What is achieved therefore, can best be determined through a process; conscious decision is already made in attaining some construct. The following points have been noted in this part of the discussion.

1. Certain planning methodologies have inherent principles of sustainability and are able to enhance them further; public participation being such a principle.
2. Designs can be achieved through the adoption of a variety of methodologies, but their success depends on the ability of the methodologies to scan the environment in a holistic manner and synthesise key issues from it, understand societal needs and reflect societal, economic and natural environmental realities and public concerns in design. Success of a design depends on the methodology used. Methodologies that reflect societal currents tend to have greater success.
3. Decision making is inherent in planning and iterative in nature. Many factors influence decisions and these factors are constantly changing.
4. The manner in which an issue is presented and made relevant to a community's needs, can influence decision making drastically. It is therefore important to make the discourse as relevant as possible to people's needs.
5. Designs should not be seen as static, since the variables used define their characteristics. A change in variables could therefore result in a different design. However, certain environmental variables remain constant. It is predominantly human variables that change.
6. Planning processes should always be seen as learning processes. This facilitates discussion, new ideas and concepts and reduces tension. It also illustrates that there are no right solutions to development, and if there are, they depend upon the variables and how they were defined.

"Today's city is not an accident. Its form is usually unintentional, but it is no accident."

(Barnett, 1982:10)

CHAPTER FIVE : URBAN FORM THEORY

5.1. INTRODUCTION

Urban form is a visible physical attribute of cities. Social constructs, economic forces and environmental factors manifest themselves in urban form. Urban form is therefore a product moulded by many manifestations which change over time. In many instances, this product begins to influence our lives. With a greater understanding of the forces that shape our settlements and the unique characteristics they create, we can begin to analyse what works and what doesn't. Strengths, weaknesses, opportunities and constraints can be identified. By building on what we already have, we can begin to develop a sustainable settlement.

Concepts such as urbanity and urban form are discussed in this chapter, and issues are presented to illustrate the intrinsic nature of urban form.

From the discussion on urban form, it will become clear that many aspects shape a city and that they all have implications on sustainability. Basic concepts of urban form are presented as well as performance dimensions which tend to improve the quality of urban environments. Models of settlement form are briefly highlighted so that basic concepts can be understood when Walvis Bay is analysed in Chapter 9. These basic concepts and principles will form the basis for planning and designing sustainable settlements.

However, before these are discussed, the importance of understanding urban form is highlighted.

5.2. IMPORTANCE OF URBAN FORM

The term urban form is given a broad meaning in the following discussion, so as to encompass a number of scales. From the discussion, it will become evident that urban form has implications at a local and city-scale level. For example the discussion illustrates that at a local level (that is at the neighbourhood unit and even at street level), buildings and spaces may form roads to give an area a special quality. Furthermore, the grouping and type of buildings influence movement patterns, energy requirements, and the possibility for adaptation and change. Perceptual and aesthetic stimulation that buildings and spaces offer are all reflected in urban form at the local level.

At a city-scale level, the shape of the city provides opportunities for access and the distribution of resources. Unique shapes and characteristics develop out of city growth. These play a major role in hindering or advancing urban functions and activities in general, as well as choices and opportunities at the city level (Hamnett, 1973:50). As Lynch puts it: "The pattern of urban development critically affects a surprising number of problems, by reason of the spacing of buildings, the location of activities, the disposition of lines of circulation" (Lynch, 1961:79).

However, urban form also has regional and national implications especially on the physical environment. For example, at the regional and national scale, urban form has implications in terms of settlement and population distributions. Furthermore, urban form at these scales is of major concern in terms of the extent of built-up area. Consider the megalopolis of east-coast America where from Boston through New York down to Philadelphia, one continuous built environment is almost formed. Population and settlement distribution and the ratio between built and non-built environment transcending through urban form are important to consider in relation to other resources such as amenity, access, open space and areas for conservation.

Urban form influences the natural, social and economic environment, and these in turn influence urban form. Behaviours, relationships and functions are influenced through the intrinsic relationship between these environmental elements. Ultimately, "the built environment changes and grows in response to man's preferences and activities and the demands he makes" (Hamnett, 1973:51). The discussion to follow will also illustrate that "if environment or urban form does not wholly meet our requirements then changes are clearly necessary. Frequently, however, such changes require social and political changes, and this points to one major limitation of changes in the urban form. Although many social problems have physical or spatial manifestations, changes in the physical environment alone will achieve little" (Hamnett, 1973:51). The ability to achieve sustainability through urban form therefore, does not just depend on changes in urban form, but also on political and social reform which should ultimately, through the adoption of policies, be implemented through design.

Lynch (1961:79) argues that we must begin by "evaluating the range of possible alternatives of form, on the arbitrary assumption that the metropolis can be moulded as desired. For it is as necessary to learn what is desirable as to study what is possible; realistic action without purpose can be as useless as idealism without power. Even the range of what is possible may sometimes be extended by fresh knowledge of what is desirable". Once we understand physical urban forms, social processes and urban functions, as well as the role of culture and historical differences we will begin to understand appropriateness.

Finally, it will be emphasised throughout the discussion to follow that there is no single universal aesthetic form or good urban form, since this would entail idealism and a disregard for pluralism and change, which are strongly manifested in the history of settlements. Nevertheless, "though there may be no overriding universal spatial or physical aesthetic of urban form, this is not to say, however, that there is no aesthetic whatsoever" (Hamnett, 1973:52).

5.3. URBANITY

The term urban is difficult to define precisely. This difficulty arises from elaborating on concepts (such as population, character and function) often associated with so-called urban areas. Various empirical studies suggest that defining urban areas by means of fixed resident populations is unrealistic. This is validated by research which indicates that fixing population numbers as defining aspects of what is urban is based on arbitrary administrative decision making, which has no universal applicability (Carter, 1985). High population densities are also not indicative of urbanity. Consider, for example, the settlement patterns created by apartheid planning, in the former Bophuthatswana in South Africa or the communal areas in Namibia, where people were concentrated in rural areas. Carter (1985) demonstrates the point of population density by citing Australia (regarded as being highly urbanised) and India (not highly urbanised but having high population densities) as examples. Nevertheless, what is indicative of population, is that the process of urbanisation involves "the multiplication of points of population concentration and the increase of the size of individual concentrations" (Carter, 1985:17). Following from this, an urban area may be characterised by some degree of population concentration irrespective of size. Rather, technological, economic and sociological indices attributing to the process of concentration need to be considered.

Urban areas have also been identified by their visual impression (i.e. buildings and streets). Once again Carter (1985) illustrates that through the ages, towns have changed in form and structure. Agricultural reform created nucleated settlements of agricultural populations, which changed radically with industrialisation. Arguably the advent of the automobile also distorted the concept of urbanity. Transcending from this is the realisation that what is urban, is dynamic in character and will therefore change with time. (The visual impression will be discussed in more detail later). However, a possible trademark that could be linked to urbanity is that of function. Central Place Theory offers some relief by defining settlements according to their functions. However, determining the minimum number of functions necessary to make an area urban also seems to be arbitrary. "It might well be argued that by the latter half of the twentieth century the distinction between urban and rural, town and country, is in any case unreal" (Carter, 1985:20).

Since it is difficult to define urbanity by means of population, visual character and functional criteria, it might be possible to attain a working definition by suggesting what the causes of urbanisation are. A positivistic approach is therefore used in this discussion to define what urban/urbanity is. This implies that by identifying what causes so-called urban areas, we are able to understand what the effect is. A possible flaw in this approach is that society can only determine what it can understand. Therefore, we already have to some degree defined urban, and are now just trying to validate our perceptions. Accepting this as a flaw, let us nevertheless continue to define urban in this manner. The hypothesis in this case: urban areas are a result of urbanisation. Therefore, what are the causes of urbanisation and what is the final result? The causes of urbanisation of the twentieth century will only be outlined.

Economic development can be regarded as a primary cause of urbanisation. This often relates "to the movement of people out of agricultural communities into other and generally larger non-agricultural communities. This concept gives primary recognition to the differential ordering of occupations. . .within a given territorial space" (Carter, 1985:27).

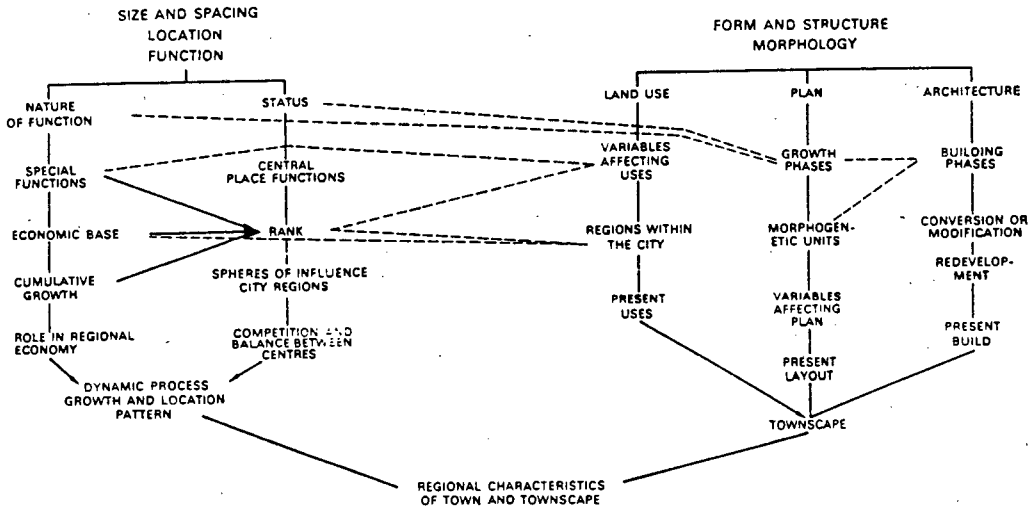
The agglomeration of economies can be considered as another cause of urbanisation. That is, various functions locate close to one another because they attract each other economically, providing greater economies of scale. These two points add to the claims by Berry and Lampard (reported in Carter, 1985:28) that "city growth is simply the concentration of differentiated but functionally integrated specialisms in rational locales".

Political and social change can be regarded as other reasons for urbanisation. That is, for example, political influences that mobilise people into urbanisation through the creation of nationalistic ideologies. These ideologies aim at achieving industrialisation, which is best achieved through urbanisation, and people are mobilised for urbanisation through nationalism. Socially, towns exert a pull on rural people to aim at attaining products and standards presented by a new capitalistic lifestyle (Carter, 1985).

The definition of what is urban does, however, go beyond the analysis of urbanisation. Carter (1985) proposes that urban areas have two further defining features. They are location and form. These two features are revealed through scale where the ability to interpret the urban feature is revealed through the intake of more knowledge. Carter (1985) explains this by comparing the ability to look at a Map with actually being in the streets, where our perceptual capacities are enhanced by a third dimension of height and a fourth dimension of time inherited in the built fabric.

Location is influenced by function and the status of that function. Form[6] produces a scene transmitted through three variables: layout, land-use and architectural style. The relationship between these three variables and the function of the area create a unique urban form (Carter, 1985; Knox, 1995). However, as Moudon (1986) notes, form follows function and function is not dictated by form. Yet, in certain instances function has followed form, especially when typologies are influenced by mass production. (Typology is a concept where a group of objects have some identical characteristics). It can be argued that the first typology is concerned with nature, that is, nature dictates form. A second typology is influenced by mass production and, form dictates function. Human aspects can be noted in a third typology. That is, man makes forms and adapts previous forms to suit his functions (Boden, 1992). This dissertation will illustrate that sustainability can best be achieved through the interpretation of the first and third typologies. The characteristics of towns or urban areas can be summed up in Figure 9.

Figure 9: Characteristics of a town.



A diagram of the content of urban geography as it was conceived in the 1960's. The broken lines indicate some, though clearly not all, of the connections between the various aspects of study. They have been inserted as a rational representation of the complex way in which all the aspects that can be studied interact with each other. In all of these aspects three approaches can be identified: 1 Aggregate, locational analysis; 2 Disaggregated behavioural analysis; 3 Welfare analysis.

(Source: Carter, 1985)

[6]The study of urban form is known as urban morphology.

Ultimately it can be argued that urban shaping elements are threefold: cultural, functional and visible physical objects. These elements therefore demonstrate what urban is. They have spatial and aspatial aspects influencing the form of urban areas.

Due to its complexity there are limitations in defining what urban is; nevertheless a working definition is essential. In this dissertation urban is those areas of human settlements which have a functional and physical relationship. From the brief outline above, it would follow that urban areas are shaped by economic, political and socio-cultural forces which, together with population sizes and densities, create a dynamic visual character that has a variety of functions. In further examining what urban is, the internal characteristics (form) give additional clues. Noticeably, most concepts of urban form are empirically inductive and not theoretically deductive.

5.4. URBAN MORPHOLOGY

The following section is dedicated to a discussion on urban morphology. Morphology is discussed to give some indication as to basic elements that give rise to specific urban characteristics. Furthermore, the purpose of evaluating urban morphology (or urban form/ pattern/ shape as it is commonly referred to) is to identify basic urban elements that could be applied in tandem with sustainability to certain urban areas, in this case Walvis Bay. By combining certain urban form features and sustainability, appropriate changes, if necessary, can be applied to such urban areas.

Knox (1995) attributes morphology to building style, building form, building function, plot and street layout and environmental quality. These features are influenced by economic and cultural criteria, as well as architectural styles and planning fashions. However, morphology is not static. Morphogenesis (process that creates and reshapes the physical fabric and urban form), as Knox (1995) notes can be attributed to a number of reasons. Firstly, new urban fabrics and modifications (i.e. subdivision of land and changes to built features) change morphology. Secondly, outward extensions of a town as well as internal reorganisation as a result of growth change the urban form. Thirdly, change occurs at different spatial scales. Fourth, internal organisation of older city areas create mixed land uses. Finally, as Short (1984) argues, change in morphology also depends on building trends, property development initiatives and property speculation.

Furthermore, Knox (1995) states that morphogenesis, with time, is also influenced by the evolution of norms and the aesthetics of power, space and design. Moreover, the influence of transport on urban form needs to be considered, because as Knox (1995), Carter (1985), Short (1984) and Hartshorn (1992) note, land use and transport are interrelated. Technological developments in transport have had a drastic influence on the physical structure of urban areas.

Lynch (1990) asserts[7], the spatial phenomenon of urban areas can be explained through three theoretical branches. Yet, these three branches do impose themselves on each other and, as will become evident, cannot be viewed as inseparable, because they are interconnected. These three theoretical branches are discussed below.

5.4.1. Planning Theory

Lynch (1990) refers to the first theory, which applies decisions about urban development through an understanding of political and economic enterprises, as planning theory. The interests of various individuals and groups and their processes of decision-making are fragmented and pluralistic. This sets the rate and quality of urban growth in terms of the many actions, often value-laden, of individuals or groups. In most instances local authorities, depending on their role in urban development, that is whether they are proactive or reactive to development, often provide a supporting function setting the quality of settlements (i.e. building codes and zoning).

The role individuals or groups play in moulding urban form is important to note for a number of reasons. Firstly, development, though guided by local authorities, is not directed and comprehensively understood by the major players (i.e. developers). Urban form is therefore difficult to recognise. This leads on to the second reason. Planning authorities are best equipped to view the urban form in a comprehensive manner, considering that it is dynamic and ever evolving. Urban form can therefore be consciously modified by planning authorities who have greater cumulative power than the plethora of developers. From this follows the question as to which theory would be best suited to permitting conscious, comprehensive planned modifications to urban form, realising that urban form is continuously evolving. This is discussed in Chapter 4. Thirdly, it is important to recognise the way individuals make decisions. Decisions are based on knowledge, and knowledge is based on many facets, such as intuitive perception, culture, societal values, worldview, and education. (Decision making was discussed in Chapter 4). It would therefore follow that the way the urban environment is presented depends on how the information is presented for decision making. This is important to consider in order to make people aware of a particular urban form.

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[7]Lynch (1990) is referenced extensively, because Kevin Lynch is considered a leading investigator of urban form. His books The *Image of the City* (1975) and *Good City Form* (1990) are considered as authoritative texts on the subject matter.

5.4.2. Functional Theory

The second branch of theory according to Lynch (1990) is based on function. It is argued here that urban form can be explained through functions and activities. As Lynch (1990) points out, many of these theories are based on how authors conceive the city.

5.4.2.1. The Historical Process

One dominant view of urban form theory is to consider the city as a historical process. Each city is considered different, with a variety of influencing factors (such as climate, economics and political structure) which through individual events create a particular form. Urban form is therefore created through the "interplay of continuity and change" (Lynch, 1990:328). As Lynch (1990) correctly points out, these theories have little predictive power, since they are historical accounts, and can only argue/illustrate what is. However, their value is that the quality of an environment can be analysed, since certain environments have stood the test of time. In this so-called test two principles of urban design, in terms of city form, are emphasised. They are uniqueness and viability. It is from this strand of theories (the historical process of functional theory) that most evaluations or analyses of towns come about, and is predominantly related to the art of city making.

5.4.2.2. The Ecological View

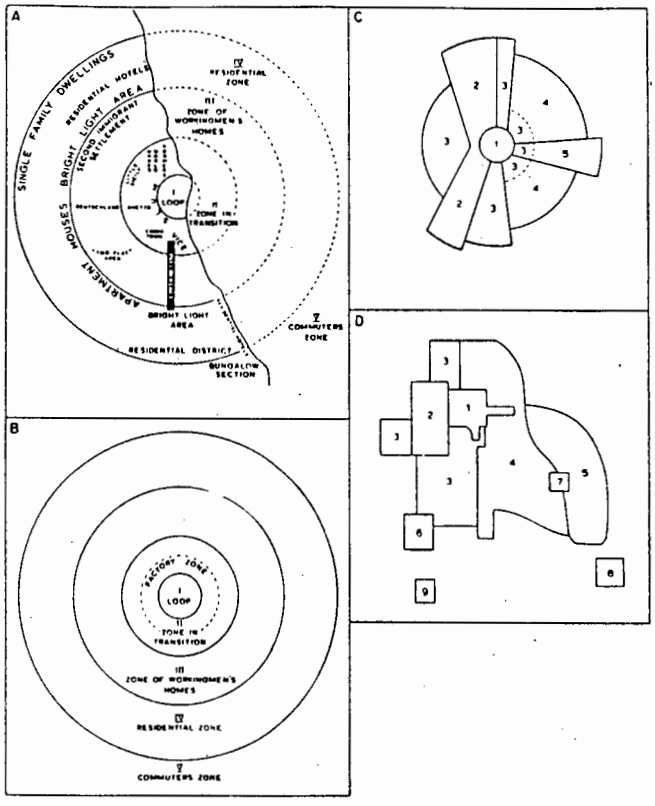
From the Chicago school of thought people such as Ernest Burgess and Robert Park, advocated the ecological view of urban form. Their position that the city structure was to be viewed from a human ecological perspective became dominant. The urban area, in this tradition, was zoned into economic and social classes and people were categorised into land units. Burgess' Concentric Zone Model had a profound impact on explaining the city form and stimulating further debate and theories. Burgess' model was followed by Hoyt, who introduced the Sector Model. This was followed by Harris and Ullman's Multiple Nuclei Model (See Figure 10).

In all three instances urban form was influenced by where people lived and worked, transport patterns, and a constant dynamic system of invasion and succession causing the city/urban area to expand continuously (Carter, 1985; Lynch, 1990).

These ecological views are primarily based on empirical description and are quantitative in that they are highly dependent on statistics (Lynch, 1990). Theories in this line, although explaining dynamic events, do, however, perpetuate the status-quo because the conditions for change tend to be set. These theories are useful in explaining social phenomena such as ethnicity and the aspiration to rise in income class, as well as to correlate work-residence distributions, not to mention other socio-economic distributions that may be relevant in

determining equitable distributions of spatial resources (Lynch, 1990). The theories do, however, fall short in explaining environmental quality.

Figure 10: Human ecology models of urban form



The concentric zone scheme of urban land-use. *After E. W. Burgess (1925)*. **A** indicates Burgess's detailed interpretation of Chicago while **B** is his generalization for all rapidly growing industrial cities.
C: The sector scheme of *H. Hoyt (1939)*: **1**: CBD; **2**: wholesaling and light manufacture; **3**: low-class residential; **4**: middle-class residential; **5**: high-class residential. **D**: The multiple nuclei scheme of *C. D. Harris and E. L. Ullman (1945)*. The areas numbered are as in **C** with the addition of: **6**: heavy manufacturing; **7**: outlying business district; **8**: residential suburb; **9**: industrial suburbs.

(Source: Carter, 1984)

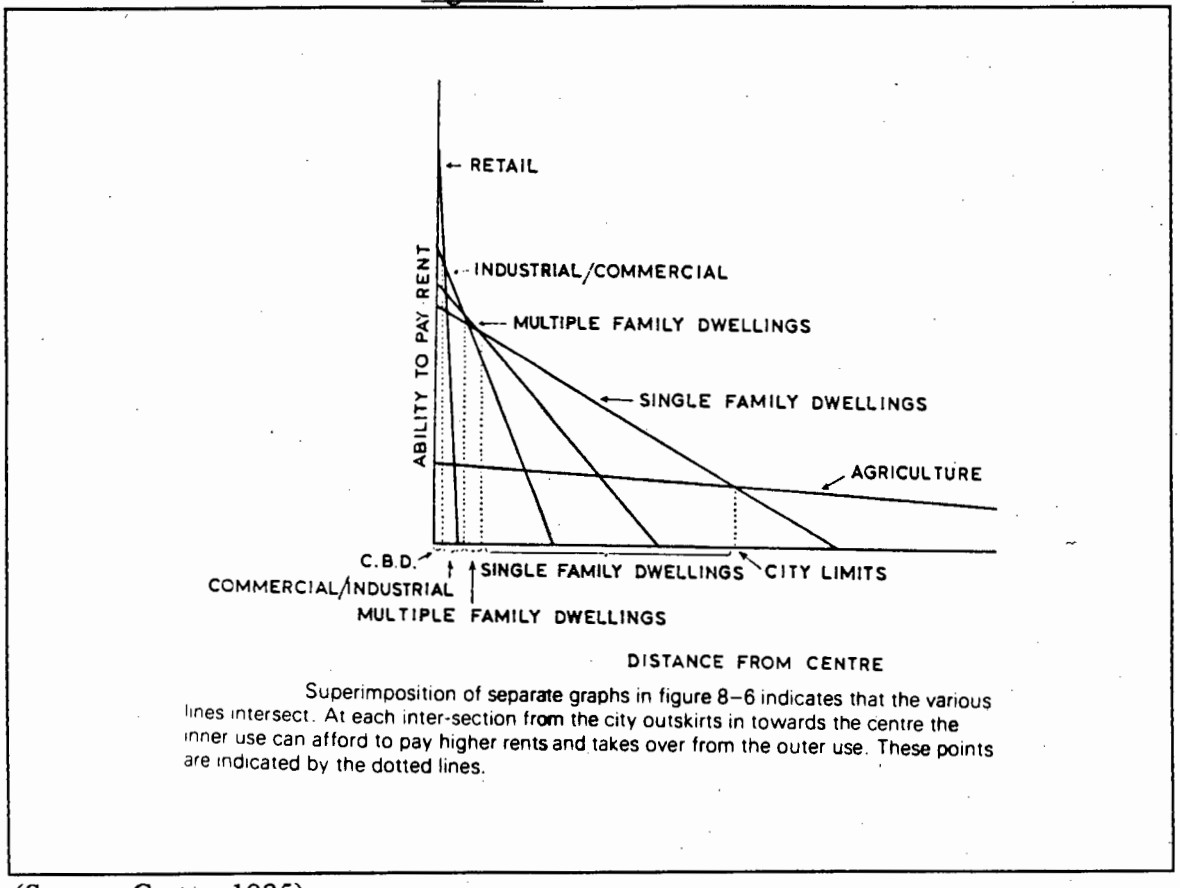
5.4.2.3. Spatial Economics

Another branch of functional theory is based on spatial economics, where the foci have predominantly been on industrial location and transportation costs, to mention two. Urban areas are viewed as "patterns of activity in space which facilitate the production, distribution and consumption of material goods" (Lynch, 1990:331). The idea is that space imposes further costs in addition to the basic factors of production, and that space is a resource in its own right. Von Thunen, Christaller and Hurd have all been proponents of this branch and have all developed their own theories in this regard. Their analyses try to determine optimal efficient locations, ensuing greater economies of scale. Through the

interpretation of certain past industrial/urban locations, the theories try to generate models which could demonstrate or indicate the best positions for the location of industries or urban centres (Lynch, 1990; Carter, 1985).

Most of these models have successfully explained regional patterns of urban settlements, but are rather insufficient in explaining internal urban patterns. Exceptions that try to illustrate the relationship between access and rent can, however, be associated with these models. For example, Hurd as a proponent of Bid Rent Curves (see Figure 11), demonstrates that the highest bidder gets the best location and goes on to explain how each land use manifests itself within the city, based on its propensity to pay rent (Carter, 1985). Ultimately, spatial theories also neglect socio-economic attributes of urban form, but successfully illustrate the value of economic efficiency in urban planning.

Figure 11: Bid rent curves



(Source: Carter, 1985)

Theories of agglomeration (proponents being Perroux and Friedman) and frictional models (Weber and Losch) have also been used to illustrate urban form. Lynch (1990) suggests that these theories regard the city as force fields, where concepts used in physics are also used to explain urban form. Models of this strand of thought have been applied to

determine, for example, population distributions and their relationship to traffic flows. In certain instances they have illustrated how changes in traffic can influence land use patterns and vice-versa. These ultimately influence urban form. Interaction between people (communication) is central to these theories. "Interaction between persons is conceived as the dominant justification for a city. Implicitly, the best settlement is the one in which interaction is at its maximum" (Lynch, 1990:335). These theories, although narrowly based on communication as a concept and a number of mathematical and value based assumptions, do highlight an important element of human settlements; that of interaction and communication.

5.4.2.4. System of Linked Decisions

Individuals, firms and agencies all make a plethora of decisions that interact to create urban environments. Urban form is argued to be shaped by diverse goals and resources that are manipulated through the "cumulative product of repeated decisions" (Lynch, 1990:336) made by people and are "continuously influenced by each others' actions" (*ibid.*).

The city is therefore considered to be a complex system of linked decisions. This forms another group of functional theories, where urban form is linked to human decisions and is shaped by them. The way decisions are made tend to be complex and at times (if not always) irrational. As Parkin (1994) explains by example, decisions are often made in terms of how information is presented, or the discourse adopted (refer to Chapter 4 for a the discussion on decision models).

Computer simulation models have also been used to explain human behaviour and city growth, and to take into account the cumulative effect of synthesised decisions. A good example to illustrate a computer simulation model is the game SimCity. This package permits you to create a city and respond to the various needs of a simulated community as it grows and develops. Lynch (1990) states that such models and theories have a number of limitations: they require high levels of abstraction, are value-based and rely on standardised quantifiable data. The models of these theories tend to construct themselves as the model progresses and are therefore considered to be dynamic, since they never reach the same equilibrium point. This could prove to be a major asset of simulated models. Ultimately, these models illustrate how decisions change as the situation changes (Lynch, 1990). Lynch also believes that their value in explaining urban form lies in the belief that urban form is manipulated through plural decisions and that decisions are based on values.

5.4.2.5. Conflict in Urban Form

The contribution of Engels, Gordon, Harvey, Lefebvre and Stretton to urban form illustrates the role of conflict in settlement form. "City form is the residue and the sign of conflict, and also something which is shaped and used to wage it" (Lynch, 1990). Lynch stresses that conflict has had a major influence on urban form. For example, Lynch (1990) illustrates how city fortifications influenced the shape and density of a city. City design was also used to enable better control of people, resulting in structured urban areas. By way of example, the creation of large boulevards by Hausman in Paris prevented people from erecting barricades across the streets. It also permitted armies and cavalries to move more freely.

In Israel, plans for new settlements have to be approved by a military council which assesses the town's ability to protect its citizens. The Israeli defence force is also allowed to lay down certain standards, such as the maximum/minimum distance between certain buildings and land uses. "Security principles were expressed architecturally, where guidelines were established for the maximum distance between buildings, the layout of buildings and streets and their minimum distance from places of concealment such as wades and woods" (Troen, 1992:94). In South Africa, the layout of many traditionally black areas was not only designed for economy and rapid erection, but it can be argued for the effective control of the residents. Conflict has therefore influenced urban form and design through the need to consider strategic and defensive concerns. In Israel, if topography interfered with security design, it had to give way (Troen, 1992).

Marxists would argue that space is being controlled by capitalists to perpetuate their rule through the spatial rationalisation of the status-quo. As Lynch (1990:341) states: "It is a physical means for expropriating the social surplus".

As a branch of functional theory, conflict theories explain certain features of city design and subsequently urban form. Furthermore, they clearly demonstrate the role of urban form and planning in maintaining control. Finally, they indicate that urban form is dynamic and susceptible to conflict.

5.4.3. Normative Theory

Lynch (1990) refers to the third branch as normative theory. This branch of theory deals with the "generalisable connections between human values and settlement form" (Lynch, 1990:37). Lynch argues that functional theories and planning theories all depend on values. He criticises functional theory for not dealing successfully with continuous change, for he believes that incremental actions lead in some progressive direction. Lynch also points out that environmental quality is not well represented in planning theories and functional theories, with the exception of the historical view. He ultimately emphasises

that assumptions about function and process are hidden in normative theories. Harper & Stein (1992) also believe that many planning actions have a normative base which should be made explicit, especially to the planning profession. Lynch also illustrates that behind policies, symbols, buildings and land use, there are underlying values. He does this by listing a variety of national and local policies that have a common basis. A variety of values (strong values, wishful values and hidden values) are said to exist by Lynch (1990). Each set of values ultimately has varying degrees of influence in manifesting itself in urban form.

Strong values explicitly manifest themselves in city form because they can be achieved through practice. Examples of strong values include, *inter alia*, increasing access, reducing pollution and improving defence. Wishful values, so called because they are difficult to shape the city according to their ends, are often cited. They include objectives such as improving equity, increasing amenity, preventing ecological disruption and conserving material and energy resources. Weak values are difficult to manifest through city form and where they can be manifested, are difficult to detect or measure. Examples include: increasing choice and diversity, reducing crime and increasing social integration. Hidden values are less articulated due to hidden agendas. Examples include making a profit and maintaining political control (Lynch, 1990). From this it can be deduced that economics, sociology, psychology, ecology and politics all influence urban form, but societal values underlie these and therefore have an inherent effect on urban form.

Harper & Stein (1992) illustrate how certain normative ethical theories underlie all planning procedures and methodologies.

5.4.3.1. Values expressed through plans emphasising quality of life

Societal values often emphasis quality of life. A number of architects, planners and sociologists tried to create urban forms that would enhance the quality of life, through a set of values they believed were important for society. This section of the dissertation discusses the urban forms created by such people, and the inherent normative theories will be emphasised. Many of the plans can be regarded as eccentric in design, but others have had a profound influence on urban form, where their concepts are still being applied to this day.

The proponents' proposals for the ideal city/urban form displayed values based on their perception of society. Ideal cities were influenced by utopian ideals, where the modern city was fantasised in form and how society would be. Quite often utopian ideals were primarily concerned with social relationships and little attention was given to the spatial environment. "The environment was primarily a setting - either a pleasant background or a symbolic expression of the perfection of the new society" (Lynch, 1990:58).

The environment began to play a prominent role in the late nineteenth and early twentieth centuries, when works on utopian city ideals in the form of Morris' *News From Nowhere*, Ebenezer Howard's *Garden City*, Frank Lloyd Wright's *Broadacre City*, Le Corbusier's *Radiant City* and Soleri's *Babel II* (the last two being futurist Utopians) came to light.

Morris tried to integrate physical and social systems together from a socialist perspective. Howard and Wright focused on small balanced communities, whose members are in direct relation to the natural environment and to each other. (Refer to Chapter 6 for a discussion on Garden Cities). Le Corbusier and Soleri moved away from a "supportive physical background for a communitarian society. . .and followed a different line of thought" (Lynch, 1990:59). Their focus was on the physical rather than the social environment and promoted a technocratic solution to environmental problems. Le Corbusier with his *Pilotis*[8] designed structures, believed that by raising street levels and buildings, land on the ground could be kept free for nature. Soleri proposed futuristic compact cities that would stand in wilderness sites, thus reducing man's impact on the environment (Lynch, 1990).

Many of these plans for model cities, where society could be restructured according to certain societal values, were idealistic and fanciful. The plans of futurist utopians and their concepts that man and his habitat are separate entities, are frightening. Nevertheless, some of the models proposed did have an impact on settlement planning with varying degrees of success. For example, Howard and Le Corbusier had a strong influence on physical planning practice, especially in the first half of the twentieth century. The works of Geddes, Abbecrombie, Radburn and Howard influenced urban form in Southern Africa, England, Europe, Israel, Australia, New Zealand, Canada and the United States (Efrat, 1993; Troen, 1988; Auster, 1989; Bunker, 1988; Freestone, 1986; Hegcock & Yiftachel, 1994; Freestone & Hutchings, 1993; Home, 1990; Newman, 1993; Lynch, 1990). Many of these plans incorporated environmental quality in their designs, with a major emphasis on social planning. Normative values were therefore inherent in the concepts and had a profound impact on urban form around the world. The idealism in these plans, can be regarded as an expression of human need and desire for a better environment. What transcends from the above review on the variety of models of cities, is the need for identity, community control, self-sufficiency, equity, health and a relationship with nature. These concepts need to be re-emphasised in an urban form that is grounded in reality.

[8]Pilotis are pillars which raise a building from the ground.

5.4.3.2. Normative values expressed through perceptions

a). Cosmic theories

By tracing the history of cities, it can be noted that the form of the city was linked to how people perceived their environment. Perceptions were based on values (whether socio-economic, cultural or political) and these values had an effect on the shaping of urban areas.

From Sumeria, Egypt, Greece, the Roman Empire or Aztec Empire, religion as a founding element of many cities had a profound influence on the physical form of the city. Settlements were designed so that they linked humans to the universe and the gods. People's senses were played with so that the built environment had symbolic meaning and psychological influence, relaying messages of power, beauty and control. Space was divided to mirror organisation and hierarchical power. "The use of site and form to symbolise and reinforce power has been carried through Western civilisation and survives today" (Lynch, 1990:75).

These settlements are explained under the concept of cosmic theories, since the cities were designed to please the gods. The city designs of these theories demonstrate a number of important urban form concepts, for example, the use of symmetry, balance, elevation and lines of procession. Inevitably, they influence urban design and townscape by illustrating how power, order and control, amongst others, can be achieved through design. "Behind these concepts lie certain primary values: order, stability, dominance, a close and enduring fit between action and form" (Lynch, 1990:79). Lynch (1990) convincingly argues that these concepts of the past are still relevant today, even though we don't perceive the built environment in the same way as our ancestors. The context has changed, but the play with space does affect our actions.

b). City as a Machine

The concept of the city as a machine is considered by Lynch (1990) as another normative theory. Here Lynch states that the "typical aim was to allocate land and resources quickly and to provide well distributed access to them" (Lynch, 1990:82). Basic forms were used by the Greeks and Romans to 'get on with life'. Greek colonies used the *per strigas* layout, whereas the Romans used the *cardo* and *decumanus* cross, respectively for laying out their settlements or military camps. The Roman plan underlies the layout of the centres of many European cities.

The need to establish settlements fast and with little fuss can also be noted from the Spanish Emperor's directives in 1573 on how to build new towns in the newly conquered lands (Morris, 1994). "The laws gave rules for site selection, the layout of an orderly

square grid of streets and blocks, their orientation, the form of the central plaza..." (Lynch, 1990:83).

Zionist planning in Israel also used principles of the Roman camps, where settlements could be established overnight in hostile areas (Troen, 1992).

Planning today expresses elements of the machine model through practices such as zoning and land subdivision (Lynch, 1990). It could also be argued that Blueprint planning is associated to the machine model as well.

c). The organic model

The city as an organism is the third model of normative theory. The organic model is based on the concept that the city has differentiated parts which work together and influence each other. Form and function are linked. Mumford, Geddes, Olmsted, Howard and Perry all implemented various aspects of organic theory. "Organic theory was central to the English new towns, the greenbelt towns in the United States, and indeed to most modern new towns throughout the world" (Lynch, 1990:90).

The major concept behind the organic model is the criterion of autonomous social units that are spatially defined into communities. Each part has its own form and function that is ultimately fused together with other parts. Diversity is therefore fused into a complex relationship in order to achieve balance. Community units are created in such a way and each unit builds into another. Each unit is supposed to function within a dynamic equilibrium. If growth occurs, it is meant to be in the form of a new unit and so on.

Organic planning, open space systems, bounded units, greenbelts and radial patterns are physical forms of the organic models. Nostalgia for small communities and the rural countryside is a strong motivation in the organic models. Neo-classical planning of modern settlements is also following this trend. The normative values inherent in this theory are community, continuity, health, security, intimate scale and a closeness to the environment (Lynch, 1990). Lynch (1990:94), argues that the theory "still rules town designs and public policy about cities: in the form of policy rhetoric, if not otherwise".

Strong criticism is directed at the model for a number of reasons. Firstly, the idea of a hierarchy of units instils a degree of social organisation by means of control. This notion is considered dangerous, even though the concept is difficult to implement because it is almost impossible to prevent human interaction. Secondly, flexibility and choice are also hindered by the organic model in that each unit is supposed to be in equilibrium and static, which requires boundaries to be fixed. This is rarely maintained, because thresholds do not always occur at the same place. The city can therefore not be given a single optimum size.

Thirdly, communities are not autonomous and do not fit neatly into each other. Furthermore, change is occurring constantly.

5.4.4. Review of the Discussion on Urban Morphology Theory

From the above discussion it follows that there is no general relationship between the form of a place and values. What transcends is that the relationship between urban form and humans is complex and that urban form and human character are not mutually exclusive. Urban form gains its character from humans; their aspirations and values are reflected in the built form.

Realising the importance of values in shaping the built environment, it is important to note that urban form may reflect a specific culture/society, but it does not have universal applicability. However, empirical evidence in the literature review indicates that a change in society cannot be achieved through urban form or through a change in physical setting. Medieval cities still operate today, but that does not imply people continue a medieval lifestyle. Neither does a change in society pre-empt a radical change in urban form. For example, the same medieval cities still exist and have not been abandoned. Rather, "social and physical patterns have inertia, and they work on each other over a lapse of time and through an intervening variable, that is, through the actions and attitudes of persons" (Lynch, 1990:102). Nevertheless, physical change can induce social change, but it depends upon the cumulative effect of incremental changes on individuals. By influencing quality of life, change occurs.

The above discussion on urban form illustrates that change occurs in small steps. These steps take place at various speeds, and rate of change depends on people's perceptions of quality of life. "Single actions spring from multiple values and have plural consequences" (Lynch, 1990:106). Furthermore, the changing context of any problem causes values and consequences to shift with time. This produces a complex yet interesting built form. Moreover, urban form can be linked to physical solutions based on performance standards.

An understanding of these theories has led to the consideration that urban form has major implications on the quality of life. In certain theories quality of life dictates urban form and the urban form therefore reflects human needs directly. In the chapters to follow, the underlying theories of urban form are uncovered. This should lead to an understanding as to why certain settlements have a specific form. It might thus be possible to induce change where needed, by building arguments on what was. However, in order to understand these forms, the elements of a town (discussed in section 5.6 and 7.2) also need to be understood.

Urban forms need to function and be relevant to societal currents. The theories have all tried to explain what influenced urban forms and *vice-versa*. However, for urban forms to

be effective, they must have some indices by which their performance can be evaluated. As a part of this dissertation's proposition, it is important to identify these performance criteria so that, in this case, Walvis Bay can be analysed, and from which recommendations for a more sustainable form can be made. The next section discusses the performance criteria inherent in the theories mentioned above.

5.5. PERFORMANCE DIMENSIONS

The way an environment performs illustrates whether it is successful or not. Performance standards are linked to values. "The quality of a place is due to the joint effect of the place and the society which occupies it" (Lynch, 1990:111). Even without an elaborate analysis of urban form we have some idea as to what works and what doesn't. Empirical research in the literature reviewed does indicate that basic urban form principles exist. A shortfall does, however, manifest itself through the arrogant belief that there is a single good urban form which has universal applicability if the basic principles are adhered to. Some consonance does exist to prevent us from falling into this trap, in that the brief analysis of the various theories of urban form outlined previously, illustrate the dynamic and pluralistic nature of settlements. Furthermore, the realisation that the surrounding environmental context changes, as do human values, ensures that urban form will vary between societies, time and location, therefore eliminating the myth of a universally applicable good urban form.

The principles enhancing urban form should therefore not be seen as static performance standards but, as Lynch (1990) correctly points out, as performance dimensions. Standards imply rigidity whereas dimensions permit greater flexibility and indicate that situations change according to the dimension adopted. Ultimately, what can be achieved is an urban form that is appropriate to its environment.

Vitality, sense, fit, access and control are considered to be the five basic dimensions which urban planning should consider as performance indices for urban form. On top of these lie two further meta-criteria of efficiency and justice (Lynch, 1990).

Vitality is the ability of urban form to support urban life and contribute to the survival of the species. The urban environment is therefore seen as a support function. Therefore a logical deduction could be that the more vital a settlement, the greater the quality of life it can maintain. Sustainability could be seen as central to the dimension of vitality.

Sense is the ability of an urban area to be clearly perceived, mentally differentiated and "structured in time and space by its residents. . .and connects with their values and concepts" (Lynch, 1990:118). The urban form should therefore be legible to its users and appropriate to their needs and abilities, while at the same time reflecting that society.

The ability of the built environment (spaces, channels and equipment) to support people's activities can be regarded as an environment's degree of fit. The urban form should therefore be able to support human activities.

Access is the ability of people to reach resources, services and other people with relative ease, in such a way that it does not hinder their development and quality of life. Access does not only refer to vehicular access, but can also be visual and perceptual. Quality and diversity of an urban settlement is therefore important.

The ability of people to use their environment and care for it illustrates that they are able to control access to spaces and activities. One should therefore consider whether design promotes the concept of community control.

These five dimensions all refer to the quality of a settlement. Together with the criteria of efficiency (that is, the ability to maintain a settlement and for it to work with minimum social and economic cost) and justice[9] (where a settlement is able to balance costs and benefits appropriately) they can be closely associated with sustainable urban form, meeting most of the principles of sustainability mentioned in Chapter 3. These dimensions will be applied in chapter 10, where a brief analysis of Walvis Bay's form will be given.

5.6. MODELS OF SETTLEMENT FORM

Every city/town has a general overall shape. This shape is influenced by a number of factors, which individually produce a distinct pattern. However, city form is not influenced by a single factor, even though it may play a dominant role, and therefore resulting urban forms should be seen as a combination of the various models outlined below. It would be labourious to go through all the models proposed by Lynch (1990) and most of them are beyond the ambit of this dissertation. For example Central Place Patterns refers to shopping and the characteristics associated with it. There is no doubt that retail centres influence the spatial patterns of cities. Literature by Cervero (1989), Nelson (1958), and Davies (1984) to name a few support this view, but understanding the relationships

[9]If justice is to refer to equity, then equity can be achieved in three ways in urban form. The first is to apply a minimum standard or threshold for everyone. The second method of attaining equity could be by focusing on key resources such as those that ensure access, vitality, territorial control and resources such as land. Finally, equity can be gained by focusing on the least favoured group, where change must at least improve that group's situation. This is based on Rawls' Difference Principle. This dissertation sets forth that a final outcome to urban change should at least benefit the least favoured group, but asserts that this can only be achieved through the manipulation of the previous two methods. Furthermore, it should be mentioned that these methods are value derived and that other methods of achieving equity do exist, such as those which ascribe to Nozickian negative rights theory.

between shopping and spatial patterns requires an in depth analysis of that specific phenomenon (Münster, 1994). A brief discussion will therefore only revolve around certain models of direct relevance to this dissertation and which will help with the analysis of the Walvis Bay townscape.

Lynch (1990:454) gives a simple, yet comprehensive, outline of settlement form models:

1. General patterns
   - The star
   - Satellite cities
   - The linear city
   - The rectangular grid city
   - Other grid forms
   - The baroque axial network
   - The lacework
   - The inward city
   - The nested city
   - Current imaginings
2. Central place patterns
   - Patterns of centres
   - Specialised and all purpose centres
   - Linear centres
   - Neighbourhood centres
   - The shopping centre
   - Mobile centres
3. Texture
   - Cells
   - Sprawl and compaction
   - Segregation and mix
   - Perceived spatial textures
   - Housing types
     - -High slabs
     - -Towers in the green
     - -Dense walk-ups
     - -Ground-access walk-ups
     - -Courtyard houses
     - -Attached houses
     - -Free-standing houses
   - Housing innovations
   - Systems and self-help
4. Circulation
   - Modal choice
   - Circulation patterns

- Modal separations
- Managing travel distance
- Channel prototypes

5. Open space patterns
- Distribution of open space
- Map shapes
- Open space classes
    - -Regional parks
    - -Urban parks
    - -Squares of plazas
    - -Linear parks
    - -Playgrounds and play fields
    - -Wastelands and adventure playgrounds

6. Temporal organisation
- Management of growth rate
- Strategies of development and renewal
- Permanence
- The timing of use.

This comprehensive list does indicate that no real single urban form exists. The urban form of many settlements today is a combination of these various models.

The discussion to follow, in combination with urban form theories will, also illustrate how urban settlements work and in what form and with what effect or consequence.

5.6.1. General Patterns

5.6.1.1. Star Shape (see Figure 12a)

Settlements take the form of a star with a dominant centre in the middle and radial transport patterns leading to the centre. Open spaces can be found between the development/ transport corridors. Densities decrease from the centre outwards. The star shape can develop in tandem with a ring shape, especially when development occurs around a loop road built around the outskirts of an expanding city (Spreiregen, 1965; Lynch, 1990; Carter, 1985). Old fortified cities are good examples of ring developments, where new roads followed the old walls of the city.

5.6.1.2. Satellite City (see Figure 12b)

Similar to the idea of a star city, it involves a core city surrounded by a constellation of other smaller cities, or satellites. These satellites are separated from the core city by greenbelts (Spreiregen, 1965; Lynch, 1990). Howard's Garden Cities exhibit the model,

and today, though refined in certain instances, its principles are welded into neighbourhood concepts.

5.6.1.3. Linear City (see Figure 12c)

Linear shapes are usually a result of topographical constraints restricting growth, but can also be associated with transport spines (Spreiregen, undated; Lynch, 1990). Linear shapes are also associated with the first signs of urban sprawl, allowing people to move out of the concentrated city areas, though still attached to the city through transport corridors.

5.6.1.4 Grid City (see Figure 12d)

A grid city consists of a rectangular set of roads. "Ideally, the form has no necessary boundaries and no central points" (Lynch, 1990:378). Change and growth can occur anywhere.

5.6.1.5. Baroque Axial Network (see Figure 12e)

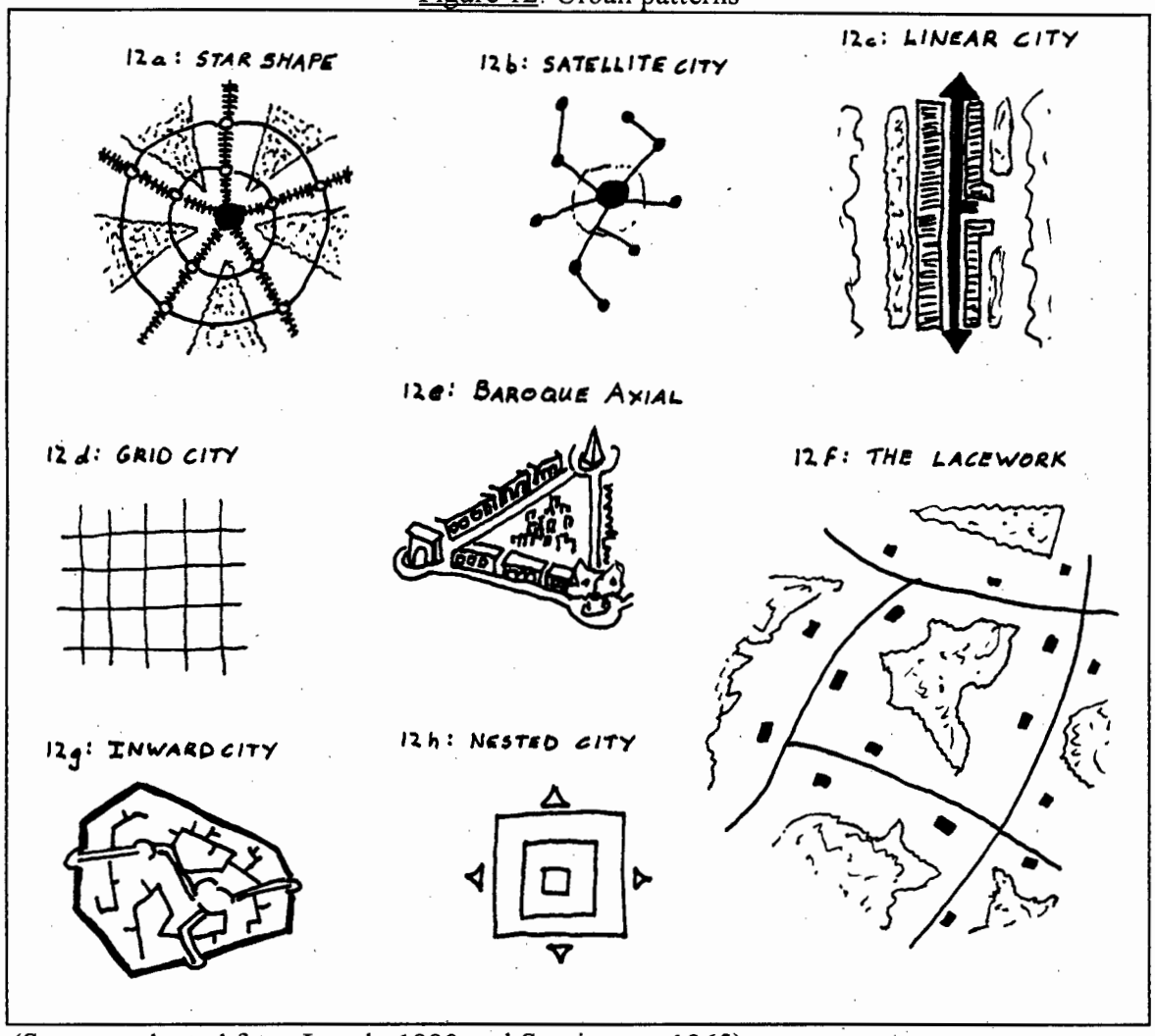
"The structure consists of a set of symbolically important and visually dominant nodal points, distributed over an urban area on commanding points of ground. Pairs of these are connected by arterials, which are designed as visual approaches to the nodes and to have a continuous, harmonious character of land and building facade. These arterial frontages are likely to be occupied by upper social groups, and prestigious or crowd dependent activities. Thus an irregular triangular network of special quality covers the urban area" (Lynch, 1990:380). The patterns created tend to be memorable. It emphasises power, but does so through the minimum amount of control. Although considered inappropriate for modern heavy traffic (due to the irregular nature of intersections), it is considered a proven device for planning areas and allowing people to develop at will within a framework (Lynch, 1990).

5.6.1.6. The Lacework (see Figure 12 f)

Open spaces can be found in low-density settlement areas. Superblocks encrusted with built features surround an open space. Although permitting natural areas within the city, amenity and access are reduced due to the urban sprawl such a plan promotes. If the natural areas in the centre of these superblocks are to be farmed, the unit of land may be too small to be economically viable, especially if modern technology is used. Only small-scale agricultural farming for immediate household consumption would be viable. Furthermore, the natural areas surrounded by built environments, cannot be considered as appropriate for the maintenance of viable ecological communities. This is because islands are created which prevent species from interacting with other communities, to list but one of the problems associated with Island Biogeography Theory and Minimum Viable

Population Theory. MacArthur & Wilson (1967), Diamond (1975) and Soule (1986) are recommended texts for further reading on these theories in the field of Conservation Biology. These theories should not be discarded by physical and land-use planners, since they hold important concepts in maintaining ecological balances through planning measures.

Figure 12: Urban patterns



(Source: adapted from Lynch, 1990 and Spreiregen, 1965)

5.6.1.7. The Inward City (see Figure 12g)

Based on the Medieval Islamic City, every built element in the settlement is contained, from the whole city down to the house. Tight configurations of roads exist. Public open space is reduced to the street and market area (Lynch, 1990).

5.6.1.8. The Nested City (see Figure 12h)

Similar to the Islamic city, it offers more structure. "The city is conceived as one ring within the other, box within box. . . the important streets are the circumferentials and not the radials" (Lynch, 1990:385).

5.6.1.9. Megaform

These forms originate from the futuristic ideas of certain designers. Here elements of a city, such as roads and utilities, are integrated into a structure where open spaces are reduced to the roof tops. In these forms, the primary element of the design is to control the environment and create a new societal system. It is highly dependent on technology, and social, psychological and environmental problems are not fully explored.

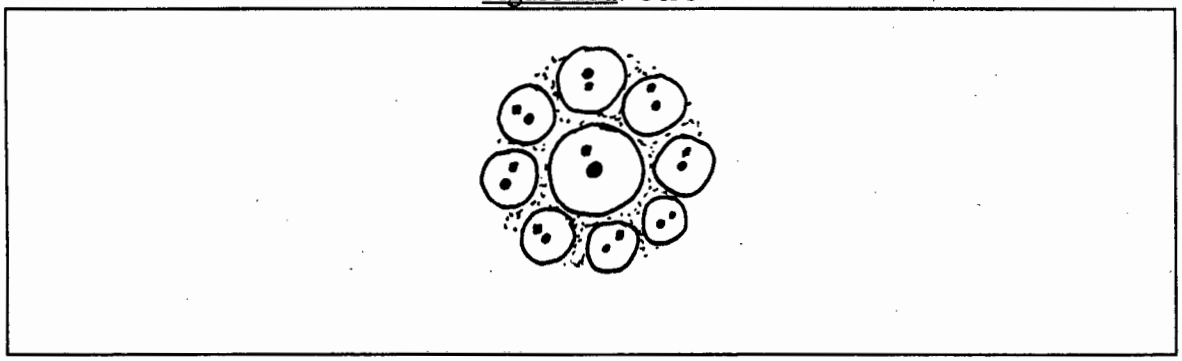
The above-mentioned models refer to the general form of a city. Models that refer to density and texture of a city are now explained further.

5.6.2. Models Referring to Densities and Texture

5.6.2.1. Cells (see Figure 13a)

The city in this model is made up of distinct units that are meant to be self-contained to some degree. Each unit can be planned appropriately according to its specific needs. Perry adapted the model, with limited success, and applied it to his Neighbourhood Unit Plan. His unit was focused on a school that was meant to be the focal point of the community. According to him other needs could be planned for, according to this focus. A common belief is that cellular planning will promote a stronger community, especially within the residential environment (Lynch, 1990). Current planning still uses the idea of a neighbourhood unit, where issues such as security, identity, community and even social organisation are emphasised.

Figure 13a: Cells



5.6.2.2. Sprawl and Compaction

Sprawled settlements are characterised by large erven. Buildings are separated from each other by the large spaces between them. Compact settlements have smaller erven and are characterised by higher densities, allowing buildings to be attached. Sprawled settlements and compact settlements are discussed further in Chapter 6.

5.6.2.3. Segregation and Mix

Research by a number of planning authorities such as Jacobs (1961), Spreiregen (1963), Jacobs (1985), Lynch (1975) and Lynch (1990) have illustrated how land-use planning favours sharp distinction. A look at our cities illustrates this from basic lay-person observation. Our cities are divided into a commercial centre, a residential area, an industrial area and so on. Zoning is an example of such sharp distinction. Although segregation reduces conflict and nuisance, and promotes certain property values, a mix could increase accessibility, promote communication and provide better services. Extremities of segregation also create conflict; sterile environments add stress and reduce access. A balance therefore needs to be found.

In Namibia, as a result of the past apartheid policy; class, ethnic and racial segregation is visible. This is often regarded as large scale segregation which leads to gross inequality. However, small scale segregation (and this does not imply the perpetuation of apartheid or racist policy) could reduce conflict and "promote neighbourhood interaction and solidarity" (Lynch, 1990:405).

A healthy balance between mix and segregation could enhance access and promote the formation of communities. Furthermore, it could enhance vitality and vibrance of an urban area.

5.6.2.4. Characteristic Spatial Texture

Spaces and built features of a settlement create a texture. Texture is the degree of mixture of fine and course elements. For example, "a suburban area with small houses on small plots has a fine grain and a uniform texture. With small houses on varying size lots, you could still have a fine grain but an uneven texture. In the city, large blocks with buildings of varying sizes could be described as having a course and an uneven texture (see Plate 4, in Chapter 10). If the buildings are uniform in size, they could be described as having a course grain but a uniform texture" (Spreiregen, 1963:55). The relationship between built and open features as well as the characteristics of built features, influence texture. Spatial texture characteristics do not necessarily have to be shaped by built features. That is, natural features such as rivers and trees and their relationship with the built environment can influence urban form.

Lynch defines texture further, by stating that there are three types of texture. A close texture, where buildings seem amalgamated and continuous. These settlements are often said to be of a human scale. Classic European cities are good examples of such close textures. Close textures are even considered to be perceptually secure and legible. Isolated buildings within a sprawled environment of massive spaces are said to have streets that have no form[10] and the buildings are eclectically arranged in the townscape, creating no sense of place due to limited unbounded spaces[11]. These arrangements form the second texture. Here, the city is considered illegible, isolated, cold and insecure. The third texture uses natural features to provide continuity and buildings are considered as single objects within the natural features. Places and spaces are created by the relationship between the natural environment and built environment (Lynch, 1990).

5.6.2.5. Housing Type

As noted in the previous section, the built environment has an influence on the way a city looks. Texture can also be given by housing types as noted in Spreiregen's quote above. Since the residential environment is a major feature of any built form, a variety of housing types that could be suited to Namibia will be discussed. Housing types can be ground access walk-ups, courtyard houses, attached houses and free-standing houses (see Figure 14). Each type has a coverage, height and typology implication which creates a texture. The definition of texture mentioned above should suffice. The housing types will therefore be discussed with relevance to their characteristics only, since endless combinations of type and plot sizes exist which all give different textures.

Ground access walk-ups: A mix of apartments (and even alternative uses) with a moderate coverage and building height, which all have a street entrances, can be provided through such a configuration. Examples include a mix of two story row houses with a three-story walk-up apartment. Such designs can use urban land economically. The housing type is said to be of a human scale, providing the opportunity for a vibrant community to exist through the mixing of family units and land uses.

Courtyard houses: are a way of achieving high-density single-family houses. Each housing unit is designed around a central courtyard providing light, air and shelter. The type of housing is "relatively inexpensive and workable and particularly applicable to warm, dry [and] sunny climate[s]" (Lynch, 1990:414). In due course it will be noted that this typology is well suited to Walvis Bay.

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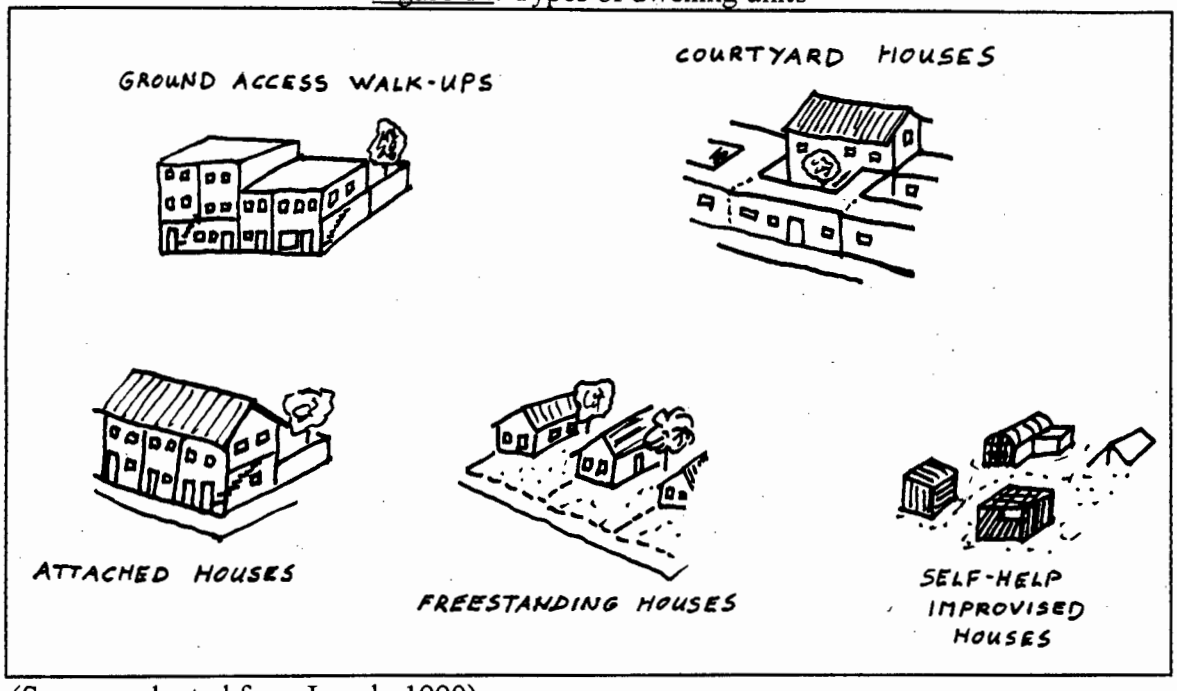
[10]In a close texture, roads are defined through buildings, i.e. the spaces between buildings.

[11]Psychologically, it is believed that people require constant senses of enclosure and openness, and that too much of either could lead to psychological disorders.

Figure 14: Types of dwelling units



(Source: adapted from Lynch, 1990)

Attached houses: Row houses, duplexes and garden apartments at moderate densities and low heights are examples of attached houses. "Compact and inexpensive relative to other types, they still provide the desired qualities of direct access, unit identity and private open space" (Lynch, 1990:415). Intimate scale is retained and differentiation of private and public space does occur.

Free-standing houses: where the house is surrounded by private space, are the most common form of housing stock found.

Self-help housing: A variety of housing options are available which could be used in creating a specific urban form. Yet, they have predominantly related to formal dwelling units. Informal dwellings created through the self-help process are also a housing option which can influence urban form. Since self-help housing is a major form of housing provision in many developing countries, more attention will be focused here on self-help housing in the Namibian context.

In the context of urbanisation in Namibia, support for self-help housing is essential. The following reasons can be cited:

Firstly, agreement can be found with Lynch's (1990:418) statement that "the best housing is made by, or under the direct supervision of the ultimate user, and that the labour and ingenuity of the dweller is a vast, unused resource for housing construction". Drakakis-

Smith (1981) also illustrates the power and untapped resources of the informal sector and the effectiveness of self-help housing.

Secondly, in Namibia, the NDP1 advocates that through the "Build Together Programme", self-help housing should be promoted and encouraged.

Thirdly, self-help housing is sustainable in that it encourages the recycling of materials and it permits people to develop according to their needs (and within their means). Furthermore, people are involved in a participatory manner in housing delivery and decision making. They are also influential in creating an appropriate built environment according to their needs and requirements and obtain employment. Namibia has taken a positive step in accepting self-help housing, and there is no doubt that this will create a new urban form. In Namibia, public policy is being directed towards supporting local enterprises, encouraging small contractors, and providing cheap land, cheap small-scale building materials, basic services and capacity enhancement programmes. (NDP1, 1995; BTP, 1994; UCT, 1996).

Self-help housing can create a simple and varied urban texture, consisting of individual buildings. Moderate densities can be achieved by permitting high-coverage low buildings. The form of the city would result from the "pattern and character of the street and utility systems, from the nature of the building materials and simple building elements" (Lynch, 1990:418). Self-help housing does not need to consist of individual houses. Prototypes in the form of row houses or courtyard houses could be developed on a self-help basis. Similar concepts are being applied in Latin America. Although more complicated and requiring more input from the authorities, the outcome could imply an urban form that is more socially and economically sustainable, while also being sustainable in terms of energy efficiency, and ultimately resulting in a design that considers nature. Chapter 8 discusses design principles that could be used in attaining sustainability.

5.6.3. Conclusion on Urban Form Models

Urban form models in terms of pattern and texture have been discussed. It becomes evident that settlements are shaped by a number of these models. However, as noted by Lynch's (1990) outline of urban form models, other models exist as well.

Models of urban form also relate to transport modes. Most modern cities are designed with the car in mind, thus reducing human scale which is vital in ensuring equity. Density, urban texture and form are all influenced by the various types of circulatory patterns used. Radburn planning and the use of superblocks, amongst others, all have created settlement forms designed primarily with circulation in mind. The mode of transport also influences the urban form. Suburbanisation, for example, flourished with the advent of the private motor vehicle. Unfortunately, those who did not have private means of transport were

disadvantaged. Their mobility patterns were and are severely influenced, denying them access to a number of facilities, services and utilities (Münster, 1994).

The need for open spaces and the type of open spaces in terms of their function also influence city patterns. Lynch (1990) discusses this in further detail and along with Spreiregen (1963) is recommended for further reading.

Lynch (1990) also argues that the management of growth, the strategies used for development and renewal and the timing of implementation of certain projects all influence city design and have an effect on spatial patterns. These are important aspects to consider. For example, the inability of many local authorities in Namibia and South Africa to provide areas for low-income housing before the onslaught of rapid urbanisation resulted in land invasion, squatting and informal densification of existing urban areas. This illustrates that growth was not managed well and development strategies were inappropriate, or implemented too late. New urban patterns that are in stark contrast to the existing settlement have resulted from this.

All these models need to be considered when analysing existing settlements and determining the appropriate physical form of new settlements or developments.

5.7. CONCLUSION

This chapter set out to define what is urban and what the characteristics of urban areas are. In so doing, urbanisation was discussed as a process leading to urbanity. In turn urban morphology was explained in terms of theories which try to pin-point the rational behind certain spatial configurations. From this it was noted that settlements are a combination of a number of influencing factors. Therefore, the theories were interwoven.

Given these theories, it was discovered that urban forms have specific qualities. Urban forms in many instances form a symbiosis with quality of life. Performance dimensions were therefore sought, which could help in the analysis of urban form. More importantly, these dimensions should be reflected in settlements, and if reflected in design, could enhance the liveability of settlements.

Urban form models were then discussed and these provided visible characteristics that could be identified in all settlements.

In general, the discussion on morphology (settlement form) above has illustrated that a variety of factors influence urban form. An awareness of these will permit a more comprehensive analysis of existing towns. Moreover, the discussion has illustrated how urban settlements work and in what form and with what effect or consequence.

Furthermore, it leads to a realisation of what works and what does not, whether the urban forms are apt, flexible and robust[12]. Only once all the urban form models with their strengths and weaknesses are considered, can appropriateness be determined, and once environmental, social, economic and cultural circumstances are understood as well. The discussion has also illustrated that there is no correct form or correct elements of form with universal applicability, but dimensions and practices exist that could enhance the quality of urban environments.

Furthermore, as will be noted in Chapter 6 and 8, the concepts and theories outlined here, have major implications for sustainability. The need to embark on a path of sustainability will illustrate that a new urban form will arise, but may not necessarily be distinct from other urban form models. Inevitably, the built environment will become a melting pot of various elements, where the context has changed to include sustainability. Moreover, this does not imply that all settlements will change physically. Rather social, cultural or behavioural facets may change depending upon how that society sees fit to change. Nor does it imply that all urban forms at present are unsustainable, or that sustainability has a particular urban form. Change will occur at different scales (temporal and physical), and in the particular context of this dissertation can be achieved in Walvis Bay through the adoption of certain urban form design performance characteristics.

The next chapter emphasises the importance of urban form reflected in this discussion. This section should also be seen as the base for the discussions on sustainable cities, because an understanding of the models of city form, will strengthen the discussion between Compact Cities and Sprawl Cities in Chapter 6.

[12]Flexibility is the ability of a settlement to adapt and change according to new circumstances. Robustness is the ability of a settlement to withstand negative change and if necessary recuperate to its original form if appropriate.

5.8. SUMMARY AND MAJOR FINDINGS

This chapter has provided a theoretical base for urban settlements. By understanding what makes an area urban, what its causes are and what theories are available in explaining certain urban forms, and finally what models such urban forms can physically assume, we can begin to draw upon certain characteristics that give urban areas specific qualities. The following points have transcended from this chapter:

1. Urban form has a variety of environmental implications at different scales. At a street level it influences people's lives directly, in that it creates the habitat in which most people live. At a local level it influences the way resources are distributed at a city level. At a regional level it influences population distributions, thereby influencing national development plans and resource distribution. It furthermore influences the physical environment through direct consumption of land and through indirect consumption in terms of the settlement's ecological footprint.
2. The built environment reflects man. Human values are therefore reflected in urban form. However, this relationship is complex and is at times not easily identified. Since it reflects human values, and human values are not universally the same, a particular urban form does not have universal applicability.
3. Form predominantly follows function, but with holistic planning mechanisms settlements can develop with both form and function in tandem. In fact, they are reflected in each other.
4. If urban forms do not meet our requirements changes need to be made.
5. Urban settlements cannot be characterised by one particular branch of urban form theory. Even though a settlement may primarily be explained by one particular urban form theory, these theories are interwoven and thus evident in almost all urban settlements.
6. Planning authorities are best equipped to view the urban form in a comprehensive manner.
7. Since urban forms influence people physically, mentally and financially, quality of life is inherent in urban form.
8. Urban forms can be analysed in terms of their performance. Performance indicators such as vitality, sense, fit, access, control, efficiency and justice allow us to determine the appropriateness of settlements.
9. The performance dimensions are closely aligned to the principles of sustainability and, if implemented, could enhance urban environments.
10. Urban forms can take on a number of spatial characteristics. In many instances these spatial characteristics are influenced by urban form theories.
11. Residential areas form a major component of urban settlements. Therefore, the type of housing configuration has a major impact on a town's form.

"The inferno of the living is not something that will be; if there is one, it is what is already here, the inferno where we live every day, that we form by being together. There are two ways to escape suffering it. The first is easy for many: accept the inferno and become such a part of it that you no longer see it. The second is risky and demands constant vigilance and apprehension: seek and learn to recognise who and what in the midst of the inferno, are not inferno, then make them endure, give them space."

(Italo Calvino, 1974)

CHAPTER SIX : COMPACT CITY OR SPRAWL CITY ?

6.1. INTRODUCTION

In the section on urban morphology it was noted that a variety of urban forms exist. The various shapes urban areas take on depend upon influencing factors such as transport considerations, topographical constraints, societal values. This section aims to illustrate that the physical shape of a city, whether it is compact or sprawled, can have significant implications in terms of sustainability. This section will be discussed in abstract and by discussing sprawl and compaction, the forces determining urban form mentioned earlier are explained once again.

In many cities around the world the debate for sustainability in terms of urban form revolves around the issue of compaction or sprawl. They are two diverse polarities, each one has its advantages and disadvantages, and ultimately, the one which receives greater political and social attention in terms of peoples lifestyles and the abilities for society to change, will dictate a clear commitment. Nevertheless, this dissertation will illustrate that greater benefits can be associated with a compact settlement than that of a sprawled settlement. So what are compaction and sprawl ?

6.2. URBAN SPRAWL

Urban sprawl is often associated with a visual image of a settlement, that on approach seems to fill the entire horizon with a built environment continuing for miles. Images of Los Angeles come to mind, where the urban environment is almost undisturbed for over 100 kilometres. Closer to home, the image of the Witwatersrand also illustrates urban sprawl, where one could travel from Carletonville on the West Rand to Springs on the East Rand without a break in built features.

6.2.1 Causes of Urban Sprawl

Clearly, a number of criteria give rise to urban sprawl. A close constellation of settlements creating a satellite pattern in the past has now become one big mass due to population growth in each centre, to the extent that urban development from both settlements begins to meet. The advent of the private motor vehicle has also contributed to urban sprawl, since more people commute between work and home, where the latter is a rural setting. Nevertheless, it is predominantly socio-economic pressures that accelerate urban sprawl. A list of such pressures includes: overall increase in population; movement of people from

out-lying rural areas to the city requiring the city to provide new areas; densities in the inner city having either reached threshold or having become too crowded; decay of residential areas around the city core forcing those who can afford to move out of the city or urban renewal and gentrification of these areas forcing the poor out. The list also includes affluence, which permits residents in the inner city to move to the suburbs and residents in the suburbs to move to larger homes on larger plots. The relocation of industry influences urban sprawl because people prefer to live closer to work. The development of extensive highway systems combined with the multi-car family can also be cited as a cause of urban sprawl, as well as congestion in the city, the need for more accessible sites, and the development of shopping centres. Even poor planning, poor development control and land speculation, can be regarded as causes of urban sprawl (Carter, 1985; Cervero, 1987; Lynch, 1990; Münster, 1994, Breheny, 1992; Dantzig & Saaty, 1973).

Apartheid planning can also be regarded as a cause of urban sprawl, where large tracts of land were used as buffers between black and white and coloured and Indian areas. Black areas were also sited at a distance from the outskirts of so-called white settlements. Infilling, whether anticipated or through illegal squatting, did occur, bringing these settlements which were supposed to develop individually, closer together and reducing the myth of separate development through organic models (Johnston, 1984; Davies, 1981; McCarthy & Smit, 1984; Smith, 1992; Münster, 1994).

Affluence and self-interest in terms of lifestyle, where people want to have beach-front homes on large properties so that neighbours won't disturb them, has also given rise to urban sprawl along the coast and other natural features, such as lakes. Mountains might be next, as everybody tries to get away. However, each time we move, we set a trend.

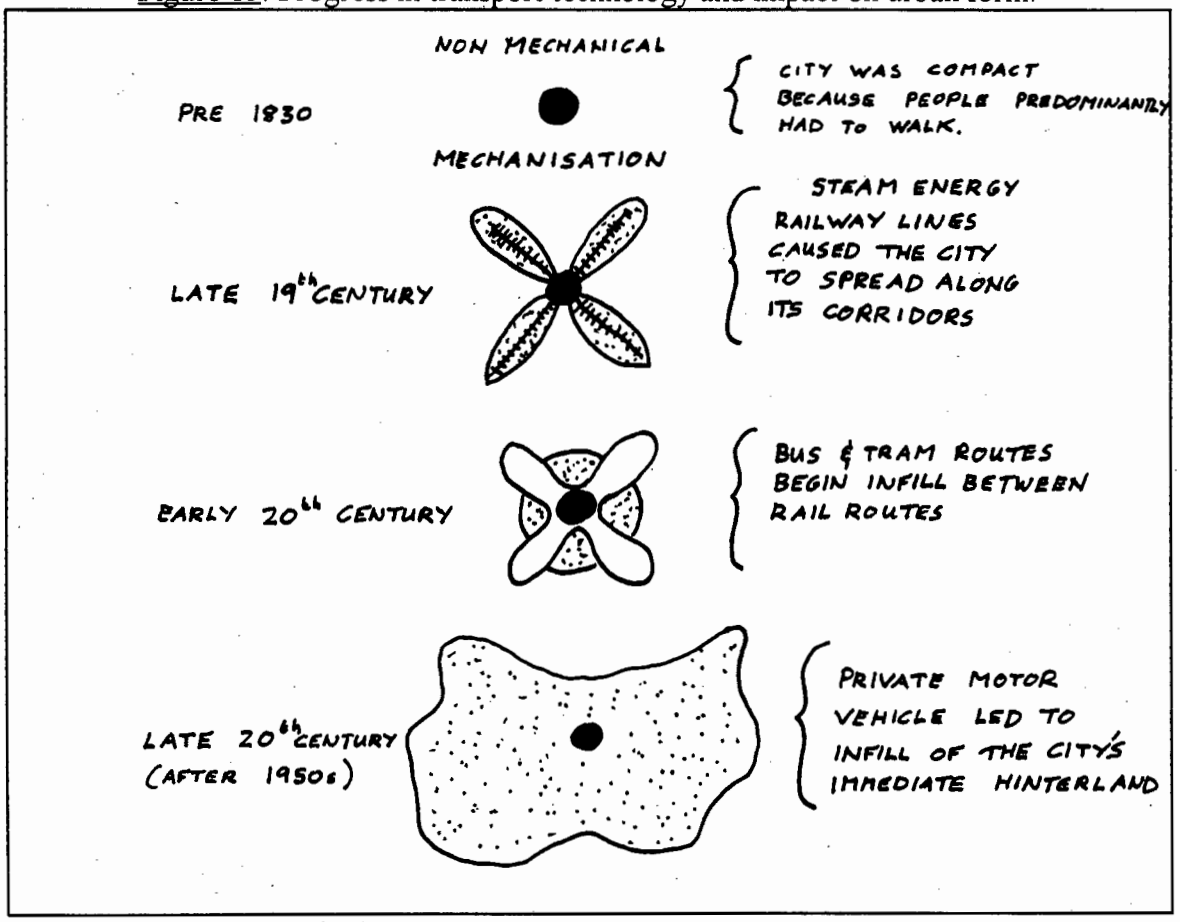
This is not a radical Marxist critic of Western society, but an honest realisation of equity, since a lifestyle that places so many demands on a world that is limited is unsustainable. Furthermore, within a limited world, how can such a Western lifestyle be seen as an ideal and strived for by many developing nations, when there is no space, unless the Kalahari, Siberia, and Antarctica are considered. This may seem flippant, but it's not. It has been estimated that if everyone in South Africa were to have a piece of property on the coast he/she would only have about 3 cm of coastline.

The Namibian coastline is also threatened by coastal urban sprawl. Areas such as Wlotzkasbaken with plots ranging in size from 3000 m^2 to 11000 m^2 encourage urban sprawl. Settlements such as Henties Bay where the Municipality "does not have a policy which relates to housing, but is most likely to encourage expansion, as long as it does not contravene the town planning scheme, and the market demand for such housing exists" (UCT, 1996:110) encourages urban sprawl, especially when affluent holiday seekers and retirees seek homes at the coast where stands in the order of 600 m^2 to 900 m^2 are

available (UCT, 1996). Swakopmund is expanding in two directions: along the Swakop River Basin course and along the coastline to the north. These developments with erven larger than 600 m^2 are contributing to the town's sprawl. Furthermore, Swakopmund's present structure of large erven and wide streets, low densities, large buffer zones and very generous planning standards, as well as the inappropriate location of certain municipal facilities, all contribute to urban sprawl (UCT, 1996).

Walvis Bay is no exception to urban sprawl. In fact, Walvis Bay epitomises urban sprawl. It is not a megalopolis, but a medium-sized town with a population of about 45000 people (UCT, 1996). Its layout is sprawled and planning standards which far exceed expected utilisation. A comprehensive critique on Walvis Bay is given in Chapter 10.

Figure 15: Progress in transport technology and impact on urban form.



(Source: adapted by author)

The causes of urban sprawl are many and interrelated. As can be noted from a brief empirical study of the settlements in the Erongo region in Namibia (reported in the UCT (1996) document), as well as from the brief theoretical discussion on the models of urban

form, sprawl form is varied with no particular form, but with the characteristics of spread and continuity of a built environment. As a recap of urban form, transport (various transport modes influenced the sprawl of the city as can be conceptualised in Figure 15), economic (priority has been predominantly given to allowing greenfield growth rather than redevelopment and renewal of present urban areas, except when apartheid was physically implemented[13]) and cultural aspects (the importance given to space which was seen and is still seen as an endless resource) can be seen as dominant forces that shaped the Southern African city. These dominant forces have also influenced settlement planning in Australia (Newman, 1993).

6.2.2. Consequences of Urban Sprawl

The most visible consequence of urban sprawl is the consumption of land. Due to low-density free-standing houses on large plots of land, which could have been used for other purposes, land is consumed predominantly for the residential environment. This leads onto another two problems of urban sprawl summed up by Dantzig & Saaty's (1973:7) statement, that "the more sprawl there is, the more the residential, commercial, recreational and shopping functions are zoned apart from each other, the greater will be the energy expended in getting people and materials back and forth between them".

The implications are as follows. Sprawl encourages further sprawl through the zoning of different land uses which drift further apart. This is because the low-density development characteristic of sprawled settlements is such that retail, commercial and educational uses require a minimum threshold to survive. The range of these uses is increased with the effect that greater isolation arises between them. Furthermore, extreme zoning regulations also cause settlements to spread out, since mixing of uses is not permitted. The second problem associated with sprawl is the wasteful use of energy. Daily commuting is required in sprawled settlements, where as people could have easily walked home if the settlement was arranged differently. This consumes energy.

Ultimately the consequences of sprawl can be explained in terms of costs. These are: capital costs, operating costs, social costs, environmental costs, functional costs and opportunity costs.

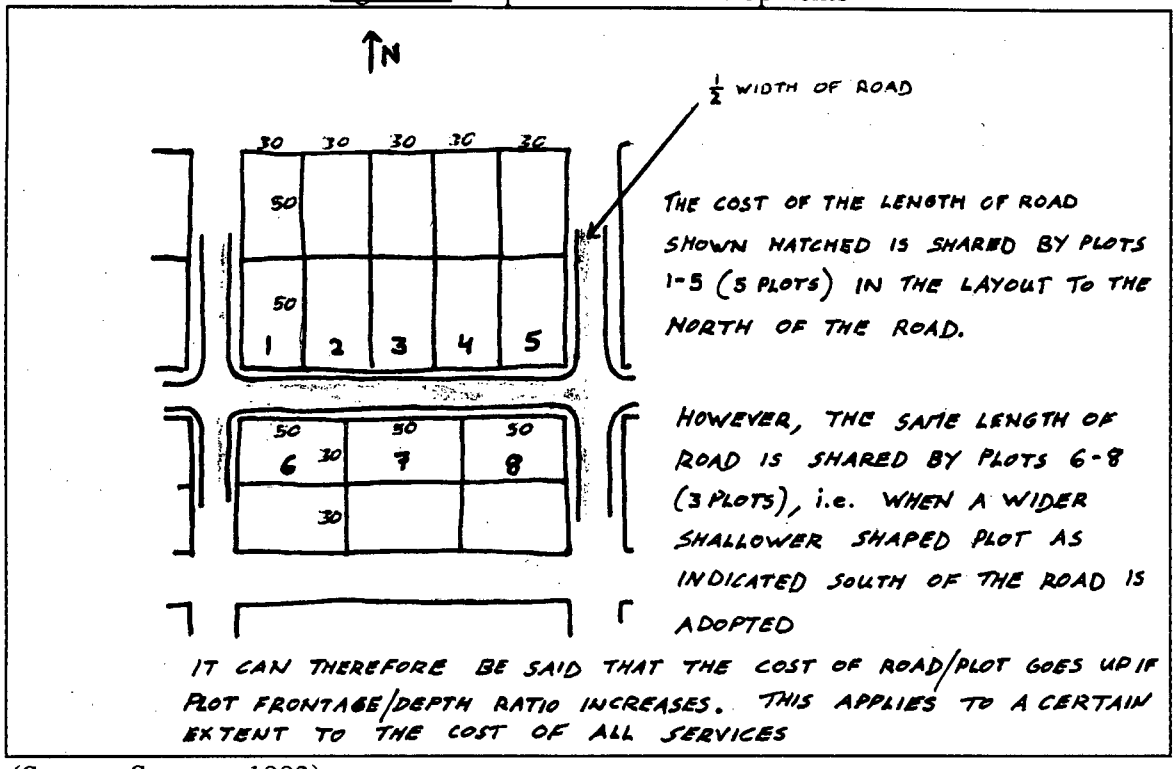
6.2.2.1. Capital Costs

Financial costs incurred in the design, planning, construction or instalment of investments can be referred to as capital costs. The provision of bulk infrastructure (roads, sewer

[13]District Six and Sophia Town (now Triomf) are good examples of redevelopment inner city areas based on apartheid policies.

mains, water mains, pump stations, electricity cables etc.) increases the capital costs of developing sprawled settlements because these services need to be provided over a larger area due to low densities. The reasons for high cost of low density infrastructure can be narrowed down to two. Firstly, increased distances between single dwellings generate unnecessary reticulation costs. (See Figure 16). Secondly, peripheral developments require longer infrastructure linkages to existing utility mains (Samson, 1993).

Figure 16: Capital costs of developments



(Source: Samson, 1993)

The findings of an empirical analysis on urban sprawl in terms of capital cost was reported by Behrens & Watson (1992). The findings illustrated that "the cost of sewerage and sewage treatment in low-density development was double, and the cost of water supply triple, than that of higher density development" (Behrens & Watson, 1992:14). Behrens & Watson (1992:15) also report that "the unit cost of constructing a two-storey walk-up apartment was almost a third of a detached dwelling. In fact, dwelling construction accounted for the bulk of the capital cost savings observed in the comparison between low-density and high-density developments". Internal servicing costs are also increased, because the need to transfer building materials to a construction site raises the cost of a development. The need to survey land also increases the cost of such developments.

6.2.2.2. Operating Costs

Higher administrative, maintenance and running costs are also incurred in sprawled settlement developments. Extra road frontage due to large plots, means that people have to pay more for services. (See Figure 16). However, operating costs go beyond road frontage. Densities are also important to consider. Behrens & Watson (1992) report that low densities generate higher costs due to distance, equipment and labour implications, especially for road-based services. "It requires more fuel, more police vehicles and more working hours to patrol a sprawled development than a compact one" (*ibid.*:15).

The need for extra materials also incurs costs as they need more storage space. Storage costs of public works facilities increase and more land is required. Operating costs of engineering infrastructure also increase in sprawled settlements (Samson, 1993).

6.2.2.3. Social Costs

Travel costs, endowment costs, loss of amenity, loss of access and household preferences for particular forms of urban development can be regarded as indicators of social cost, where social costs "refer to the impact that various patterns of investment and urban - growth have upon different communities" (Behrens & Watson, 1992).

In sprawled settlements people are more often required to travel to work, recreation and other amenities. This means that a travel cost (measured in terms of income spent on travel and time spent travelling) is incurred. "Car travel in high-density environments, is half that of low-density environments" (Behrens & Watson, 1992:16).

Conditions of establishment[14] are imposed on new developments with regard to the essential services and facilities the municipality provides to such a development. They are considered to be in the interest of sound local government, control and in the interests of the future residents of a township. Endowment is one such condition of establishment. "The purpose of an endowment condition is to obtain a contribution from the developer towards the local authority's provision of amenities in the township to be established which will enhance the price of erven in the township" (Van Wyk, 1994:4). Inevitably, these costs are borne by individuals in the form of rates, taxes or purchases. These are considered to be a substantial amount for large developments. However, it has been argued that these costs are not fully recuperated by the development *per se*, but in fact by the whole community. This could be argued as unjust and inequitable, especially for

[14]Conditions of establishment are A-type conditions subject to which the township is declared an approved township. Conditions of establishment are imposed on the developer. Non-compliance will delay the approval of the township.

poorer groups, because the exploits of the rich are being subsidised by everyone, rather than subsidising poor communities more appropriately. "Suburban developments are generally not confronted with the full cost of infrastructure linkage and land consumption. . . Instead costs have tended to be recovered within broader rating structures, representing an effective subsidisation of these developments" (Behrens & Watson, 1992:17).

Behrens & Watson (1992:6) consider another social cost in the form of household preferences. That is "in cases where the residential choices of households are not catered for, it can be argued that some form of cost is imposed". Free-standing houses are often provided in sprawled developments, implying that those who would prefer courtyard houses or flats, cannot do so and are forced to pay the rent or buy free-standing houses. Newman (1993:295) notes that the "mismatch of housing type and household need is increasing. Low-density houses on the fringe for a standard family are increasingly irrelevant to the market but their inertia continues". Ultimately, "the high-density planned community offers a more stimulating environment than the low-density sprawled community" (Behrens & Watson, 1992:16) and offers more choice.

Another social cost of sprawl is that it engenders social isolation due to low densities. Issues of safety and security are closely related to social isolation, since isolation makes people more vulnerable. Furthermore, the need to create more streets to accommodate private vehicular traffic may create unsafe areas for pedestrians and children. Moreover, urban sprawl discourages a sense of community and encourages segregation.

Finally, amenity and access are reduced through urban sprawl. Firstly, since urban sprawl often entails low densities, it becomes non-viable to provide public transport to these areas, therefore hindering access to those who cannot drive or who do not own private vehicles. Accessibility levels are therefore significantly reduced due to urban sprawl (Münster, 1994). Empirical evidence also illustrates that "at low densities it is observed that only high-income groups can afford either the cost of private transport or expensive public transit fares" (Behrens & Watson, 1992:16). Low-income groups who cannot afford these transport costs, however, have to bear them or otherwise resort to walking, which consumes and reduces quality time[15]. Secondly, amenity of certain services is reduced due to distance, since many services cannot afford to locate in areas of low densities, because of threshold considerations and zoning implications. This increases functional costs because low densities are inefficient for market thresholds (Lynch, 1990; Behrens & Watson, 1992; Münster, 1994; Schuurman, 1985; Bowlby, 1978; Bowlby,

[15]Quality time lost due to walking can be regarded as an unfortunate opportunity loss, because the time lost in walking could have been used as quality time at home with the children, or otherwise to study, relax, etc.

1985). Behrens & Watson (1992:16) also state that "access for low-income groups increases only at higher densities".

6.2.2.4. Environmental Costs

Urban patterns of development incur costs on the natural environment. Urban sprawl consumes land, which could have been left in its natural state. Loss of animal habitats and species diversity can be associated with urban sprawl. "In terms of land consumption. . . area developed by the high-density planned community was half that of the low-density sprawl community" (Behrens & Watson, 1992:17). Furthermore, the relationship between urban sprawl and air pollution has been correlated (Dantzig & Saaty, 1973; Strahler & Strahler, 1973). "High-density planned community produced 45% less air pollution than the low-density sprawl community. The major source of air pollution was found to be vehicular emission" (Behrens & Watson, 1992:17).

6.2.2.5. Functional Costs

In the section on urban form models, the impacts of certain forms were analysed. Issues such as traffic congestion, the facilitation or inhibition of economic productivity and opportunity, the efficient or wasteful utilisation of land and the degree to which it affects energy consumption were discussed in term of urban form. Urban sprawl is considered to be counter-productive in most of these issues, and therefore incurs a functional cost. For example, the inability to provide public transport means that people have to travel by car. This increases congestion during peak periods, creating functional problems on the transportation (road) network. Sprawl also influences energy use, in that cumulative benefits of compaction in terms of energy efficiency are lost. Behrens & Watson (1992:19) relate that "high-density developments consume 44% less energy than low-density developments" and petrol consumption increases with low densities because low density sprawled cities increase trip length and trip volume and duration, in order to satisfy daily household needs.

Compact settlements are also argued to be more efficient and economically productive. Excessive travel times are reduced. Apart from reduced distances and decreased production costs, labour concentration is argued to be better because people are less tired from shorter travel distances and because of the concept of more personal quality time (Domanski, 1979).

6.2.2.6. Opportunity Cost

Opportunity cost is the cost of an alternative investment or opportunity foregone in terms of the present investment or choice. Since opportunity cost is closely linked to need, it would be important to assess the need for a particular development. The discussion on

urban form models has illustrated the conditions that shaped certain forms, and needs and values were implicitly implied in these characteristics. In relation to urban sprawl, one example will suffice[16]. As mentioned earlier social costs are being incurred in terms of household preferences not being catered for. This could also be considered an opportunity cost in that choice is limited and an alternative lifestyle that reflects the needs of the user is not available. These resources, the free-standing homes, have been allocated inappropriately, since it can be assumed that they do not suit the lifestyle of many people. Furthermore, in low-cost settlements, these people subdivide their land illegally, because they have no direct need for the extra land, but can generate income by letting the extra space to homeless people (see Plates 8 and 9). This was not the intention with which that property was acquired. If there was a variety of housing types, people could be given a choice and find something appropriate to their needs. Furthermore, the capital cost in terms of running infrastructure, could be reduced with higher density compact settlements and these costs could be better spent in upgrading existing infrastructure.

Figure 17 gives an overview of the waste and negative consequences of urban sprawl, from an economic dimension. Unfortunately, the need for change and the adoption of sustainability is at present best conceptualised from an economic perspective alone. However, sustainability from a social perspective is gaining momentum, especially in Namibia and South Africa, due to the need to address past social imbalances. Unfortunately, environmental dimension is relatively weak, but is gaining momentum.

Until now, only the negative consequences of urban sprawl have been discussed. However, some positive aspects can be associated with urban sprawl, and surprisingly they do have sound concepts of sustainability. As Steiner (1994:14) remarks: "Sprawl is like cholesterol. There is bad sprawl and good sprawl. Its effects depend on the designers, planners, developers, and public officials involved. And as with cholesterol, moderation is [the] key".

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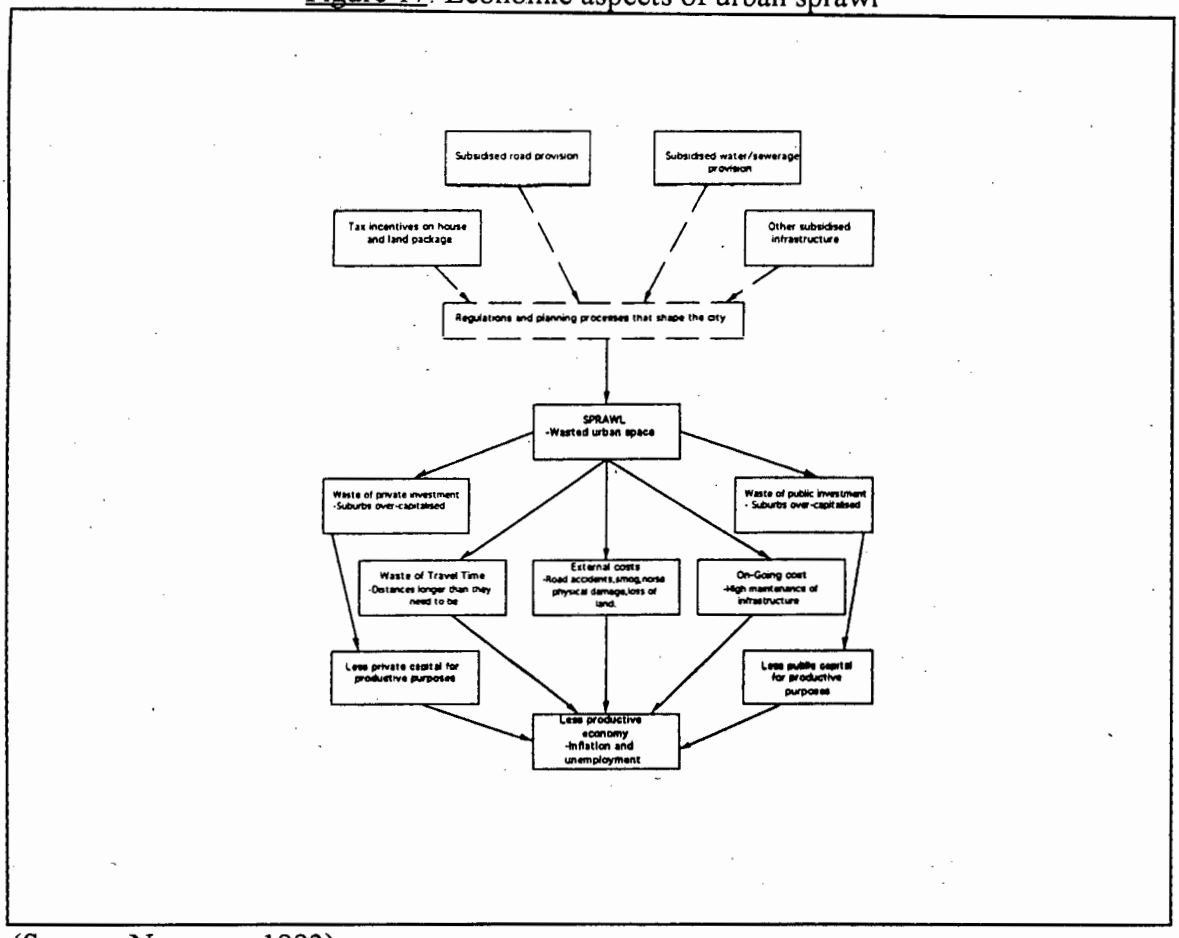
[16]The example chosen is hypothetical, but reflects an underlying equity and sustainability principle, in that people should be given a choice. At a more practical level, it implies that the delivery of low-cost housing should not be on a homogenous basis, since even this group is made up of divergent interests. A minimum standard of 300m^2 plots, adopted in Namibia, may therefore not be appropriate for everyone. Other housing arrangements exist, as described earlier, and would require less land.

Figure 17: Economic aspects of urban sprawl



(Source: Newman, 1993)

6.2.3. Some advantages (?) of urban sprawl and their criticisms

Steiner (1994) argues that there is benign sprawl and this is predominantly linked to the concept of sustainability. His argument can be interpreted as follows. Firstly, urban sprawl permits the qualities of the environment to be immediate. That is, the best of two worlds (urban and rural) can be achieved, permitting nature to be at your doorstep.

Though not mentioned by Steiner (1994), the following is nevertheless linked to the concept of an immediate environment. Urban sprawl permits people to have large properties on which people are encouraged to grow personal crops in so-called perma-culture gardens. Undoubtedly, if crops were grown, greater global sustainability in terms of agricultural production could be achieved. Households would grow what they needed and consume what they needed with no waste, as organic matter could be reused for compost, and water recycled etc.. This concept is also based on the premise that modern

technology permits people to work from home, thus reducing travel to and from work. Furthermore, modern communication may even lend itself to other civic functions such as education at home and home entertainment and this would reduce the need for travel. The concept also argues that if people have more private open space, they would not need a lot of public open space.

These concepts place a lot of emphasis on modern technology and assume that the householders have the ability or the means to work from home, and the money to afford high-tech equipment. The reality is far from this, since the concept is based on affluence and certain Western ideals. It is inappropriate and beyond the means of many countries, including developed countries. Not all environments lend themselves to perma-culture of such as scale. Considering Namibia's harsh environment, garden agriculture of such a magnitude may not be sustainable unless grey water and even brown water is used. Changes in lifestyle are needed, and as mentioned earlier, these change slowly. The spatial arrangement of such settlements could take the form of the Lacework, but as discussed in the models of urban form, it has inherent problems, such as those associated with minimum viable populations.

Secondly, and this is his main argument, it is not the immediate effect of urban sprawl that should be of concern, but the quality, equality and environmental sensitivity in which such developments are made and maintained. That is, urban sprawl can be sustainable if architectural images appropriate to the environments are advocated and constructed, if water and energy conserving techniques are employed in such sprawl developments and native vegetation is used for landscaping purposes. Steiner's (1994) argument is clearly based on quality, especially for the individual or family unit and this is where it falls short. All the elements he talks about can be achieved in compact settlements as well (see the next section) and provide greater social benefits, as can be noted in the critique on urban sprawl in terms of costs.

Steiner (1994:15) states that sprawled settlements are "not the result of bad planning, but of rational zoning, and subdivision laws and ordinances. These laws and ordinances more or less institutionalised the designs conceived". He furthermore states that the designs were "bastardised" for the automobile. Realising that the adopted standards are inappropriate and too car-oriented, Steiner's (1994:16) concern is the reality that we have such settlements, and that we need some "fundamental rethinking of our patterns of development, although that doesn't mean throwing out the old pattern entirely". Change needs to occur, and these changes should begin within the existing settlements, as mentioned above. He advocates densification through infill. However, he believes that sprawl in certain areas such as along transport corridors might be good. This could possibly allow diversity, so that some people could adopt a new lifestyle. However, linear sprawl cannot be advocated everywhere. For example, it would be inappropriate to develop along lines of corridors which run parallel to the coast. The KwaZulu-Natal south

coast with its transport corridor has almost created a continuous built environment along the entire coast, resulting in the loss of certain vegetation species. In Namibia Damara tern colonies and lichen fields could be destroyed, not to mention the unique qualities of the landscape itself, as well as the impact it would have on the waterfront area (UCT, 1996). This would need to be considered in a coastal zone management plan for the Erongo region.

Ultimately, design must include quality and specific performance targets for sustainability. This is where sprawl can be good. However, as discussed, lifestyles need to change and this may be a slow process, especially if political and social will does not exist. Architects, designers and planners can slowly begin to modify past practices, and should try to advocate a new dispensation with new practices. Furthermore, it should be mentioned that many proponents of urban sprawl do, advocate the rational and complete use of the ground, since waste is regarded as senseless. Yet, some proponents believe that sprawl in itself permits land to be used more flexibly, with greater adaptability potential in the future, for example through infill (Lynch, 1990).

Inevitably, as Steiner (1994) advocates, "the issue is not whether a settlement should be dispersed or not - but whether it is ecologically sound. Both high and low-density settlements are possible, and probably desirable, if done with quality, equity, and environmental sensitivity". The truth of this statement is accepted, but as the critique has shown so far, old practices are perpetuating, and as empirical evidence suggests (as reported by Behrens & Watson: 1992), and the discussion on urban form suggests, high density settlements through the compact city idea are probably more appropriate to human needs and sustainability principles.

"The unthinkable is starting to be thought. In some places we are running out of space. And not only running out of space, also out of air (fresh air) and fresh water. The thoughtlessness of our approach to housing, the squandering of valuable virgin land and the social stress that distances and inaccessibility impose on individuals is now emerging as a major problem in our...life" (Australian Prime Minister Keating, quoted in Newman, 1993:285).

6.3. CHALLENGES OF A COMPACT CITY

When one mentions a compact city, people often visualise a high-density settlement closely resembling Manhattan Island (New York) or Hillbrow (Johannesburg). High-rise buildings, sunless streets, an exhausted bird singing in a tree half dead and gangsters running around terrorising honest citizens are badly portrayed concepts of high-density settlements. In fact, this is an extreme form of high density not advocated and is seen as a problem in its own right. High-rise is not recommended, rather three-storey walk-ups, with a texture that is fine, yet diverse. High-density also implies single-family dwellings, in

row-house, courtyard and ground access walk-up residential units, and even free-standing residential units on small erven. Compact city formation also implies a mixing of appropriate land uses, and not perpetuating sterile zoning regulations or invoking chaotic mixing of incompatible land uses. It seeks to find a balance that will add and promote diversity, promote accessibility and equity, as well as the concepts of legibility, fit, efficiency, sense, vitality, control and sustainability.

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The awareness of the problems of urban sprawl discussed in the previous section lay testament to the need for a compact city. The issues have indicated that sprawl is economically inefficient (high infrastructure and transport costs, time and land wastage, housing mismatch), environmentally unsustainable (greenhouse gasses, photochemical smog, loss of habitats and species), socially inequitable (unfair subsidisation, the inequality of being car-less, inequality in location, with the poor located on the outskirts of settlements in Namibia and South Africa especially, far from work and other opportunities) and that these settlements are becoming unliveable (in that community and neighbourhood interaction is lessened, urban vitality[17] lost and public safety jeopardised).

6.3.1. Historical Precedence for the Compact City

6.3.1.1. The Garden City

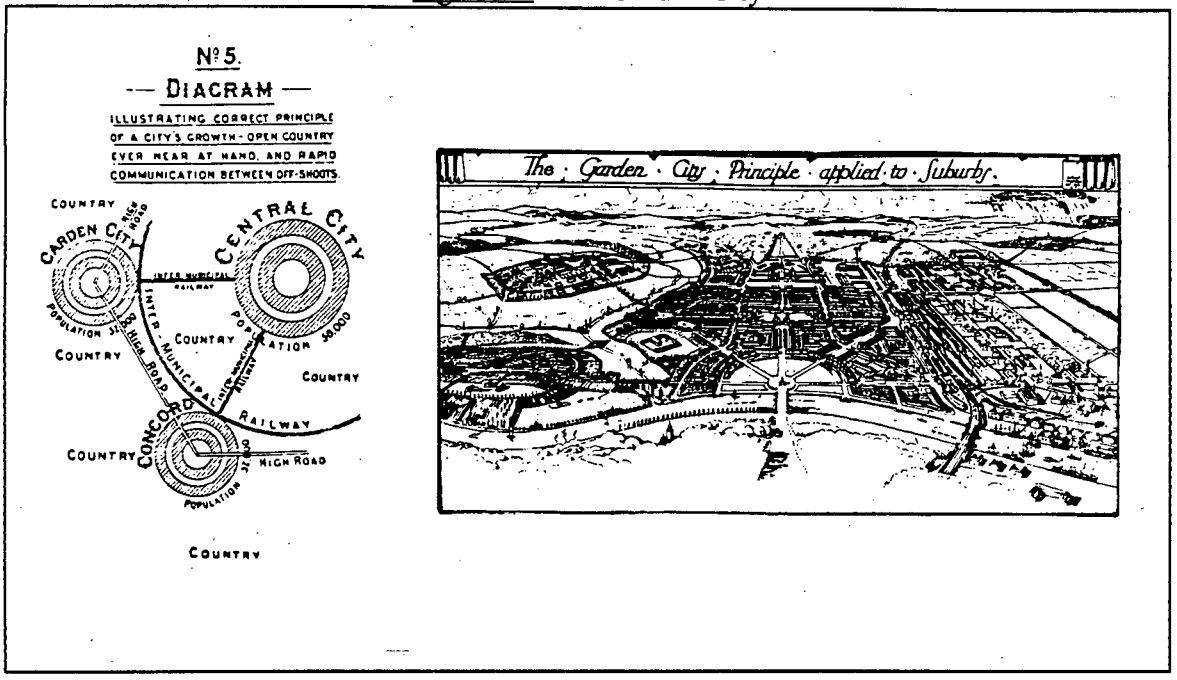
The Garden City has its origin in England c.1898, when its proponent Ebenezer Howard proposed a settlement that would have its own industry, where people could live and work close by. (See Figure 18). This settlement would be a self-contained unit and would be encircled by an agricultural greenbelt. The major concern of the settlement would be with the maintenance of certain minimum standards of layout. Howard's goals "were to open up the urban setting, to screen off ugly work areas, to bring people and green spaces together, and to eliminate the need for long distance transportation" (Dantzig & Saaty, 1973). The Garden City was envisaged to have a stable population and if growth occurred new Garden Cities would be created, so that a constellation of settlements would dot the landscape. Three assumptions form the basis for Garden Cities:

- the settlement would accommodate 30 000 people who would live and work in the same place;
- people prefer small towns close to nature to big cities; and
- a decentralised social order would be self-sufficient.

[17]Vitality and culture of the city is reduced as public spaces are dominated by cars rather than people.

These assumptions proved to be incorrect. To date, the only "true" Garden City based on these ideals and assumptions is Letchworth (England), established by Howard. Garden Cities, as originated by him, did not proliferate due to their obvious flaws.

Figure 18: The Garden City



(Source: Freestone, 1986)

Although "the garden city movement started as a social movement. . . its greatest success was as a planning movement" (Freestone, 1986:62). It helped articulate ideas regarding shape, structure and size of settlements and had a great impact on environmental ideals. Pertinent ideas, such as limiting population and area, multi-nucleation, satellite centres, greenbelts and agricultural backdrops, arose from the garden city idea. Certain elements from Howard's Garden City were adapted and implemented at different scales, giving a foundation to the Compact City. These elements are evident in the concepts of greenbelts, decentralised cities and satellite cities.

The greenbelt concept (undeveloped land forming a belt surrounds an urban area[18]) has been implemented on various scales. The footnote mentions that it can be implemented at

[18]The city of Curitiba, Brazil, regarded as a model sustainable city, is surround by a greenbelt. A greenbelt strives to contain development within the boundary it sets, so as to prevent urban sprawl. "In Curitiba's case the green ring has been largely defined by a ring road, often with open country to one side and city on the other" (Hulley, 1994:3). For over twenty years, Curitiba has been successful in maintaining development within the city limits delineated by the greenbelt.

a city/regional scale. At a neighbourhood level, attractive bedroom communities have been developed, where rigidly zoned neighbourhoods are surrounded by open spaces. A good example of the implementation of greenbelt planning is Radburn (New Jersey) or Pinelands in Cape Town. Developers of new housing estates are also adopting greenbelts through a concept called clustering. This is where "clumps of relatively high-density housing are set in open spaces. . . Clusters are urged on communities as a way of preserving the landscape while permitting development, on developers as a way of saving cost, and on homeowners as a new way to live" (Lynch, 1990:404). All these have the underlying concept of a greenbelt containing development and augmenting urban sprawl.

The concept of decentralised cities also has its origin in the Garden City. Frank Lloyd Wright displayed his model of a decentralised city, called Broadacres. Wright's goal was to open up the city and bring rural values to it. A nostalgia for country living led to the belief that its perceived qualities were suitable for city life as well. Nowadays, this nostalgia is linked with a romantic notion of what rural life was and developers are marketing developments based on so-called traditional values. Rancho Santa Margarita in Orange County (California) or Needwood in Midrand are good examples of so-called neo-traditional towns and urban villages. However, Till (1993) explains that these neo-traditional towns are inventions created by corporate planners. They attempt "to validate the establishment of residential communities through ambiguous, yet familiar, historical symbols. Yet the identities constructed for neo-traditional towns and urban villages make sense only in relation to the 'other'. In southern Orange County, corporate planners present their master-planned communities as 'distant' from the suburbs and cities located in Los Angeles and in northern Orange County according to a scale of temporal, geographic, and social values. Implicit to neo-traditionalism is a geography of otherness. This geography reinforces existing social and spatial divisions, promotes reactionary and exclusionary territorial identities, and legitimises the status quo" (Till, 1993:709). The discussion on urban form has highlighted the fact that many urban forms have an underlying normative theory which can be used to explain urban form. Till (1993) illustrates this further and although he refers to the local level, it can be associated with the concept of decentralised cities. The key aim is to augment urban sprawl, resulting in suburbanisation.

A satellite city is another spin-off from the Garden City idea. Here, smaller centres (each different) are located around a larger central city. The central city, or core city, has the commercial, cultural and administrative functions. These functions are not repeated in the satellite cities and the satellite cities are expected to be centred around another function. People are expected to live and work in the same satellite. Urban growth is supposed to take place in newly formed satellites. The concept of the satellite city is exemplified through the city of Columbia (Maryland) as well as the New Towns in Britain (Dantzig & Saaty, 1973). The assumptions made by Howard, as these here, are also not grounded in reality. Dantzig & Saaty (1973) point out that satellites cannot be seen as individual entities, that do not replicate the core city and are not interdependent on each other.

Dantzig & Saaty (1973) illustrate this point through the analogy of cellular biology, by stating that if cells are separated from the main cell (parent) they will replicate the parent and, when clustered, the cells become interdependent because they each specialise in a specific function.

Garden Cities, greenbelts, decentralised cities and satellite cities, and their modifications through the proponents of the Garden City idea, such as Geddes, Olmstead, Abercrombie, Perry and Radburn, all implement urban forms that can be described as Organic Models of Normative Theories explaining urban form or as Cellular Models of settlement form based on urban texture. Both these models have been discussed in Chapter 5.

The garden city movement had a profound effect all over the world, especially within the former British dominions, and variants of it, in terms of scale, are still applied to this day.

6.3.1.2. Le Corbusier

Le Corbusier's Radiant City provided another vision for a centralised high-density settlement. High-rise structures surrounded by wide open parks were the visual image Le Corbusier envisaged. The ideas incorporated in the Radiant City resulted in urban renewal projects, where "the dense fabric of the inner city was demolished and replaced by high-rise apartment blocks" (Behrens & Watson, 1992:9). These large towering blocks created social problems and, where possible, they were demolished.

6.3.1.3. Jane Jacobs

The economic boom after the Second World War led to an increase in living standards. The rise in living standards "coupled with an increase in car ownership established a bias for motor vehicular friendly environments, and clearly this was best served in the outer areas of the city" (Münster, 1994:26). This resulted in massive suburbanisation. Behrens & Watson (1992) illustrate that as the city centres began to decline as a result of decentralisation and suburbanisation, so did the tax base. Effective segregation of income groups was occurring and the intricate fabric of the old city was dismantled. They continue to state that it was in this context that planners began the low-density/high-density debate. From this Jane Jacobs emerged as an influential critic of suburban sprawl.

According to Jacobs (1961), cities are being murdered by orderly planning. Jacobs (1961) goes on to state that an important condition for a lively city "is the need. . . for a more intricate and close-grained diversity of use that give each other constant mutual support, both economically and socially". She lists four conditions for the reconstruction of the city:

- need for mixed primary use;
- need for small blocks;

- need for aged buildings (so as to provide variety); and
- need for concentration of people.

Jacobs (1961) therefore emphasises, medium-rise, high-density urban forms, with a mix of land uses. These, she argues, would provide better living environments and would prove to be more efficient, economically and functionally.

She stressed the need to break away from rigid cellular planning, which manifested itself in rigid zoning practices that encouraged urban sprawl, but not from the underlying concept of a compact city.

The other Utopians, with the exception of Jane Jacobs, Howard and Le Corbusier provided the founding base for compact settlements. In all cases, their concepts have been adapted in order to consider new contexts, that will hopefully, with the added support from sustainable development principles, increase in popularity and manifest themselves in creating a new urban form; one that is appropriate to its society, environment and economic situation, and ultimately provides a sustainable urban form. Nevertheless, no urban form is free of criticism and compaction does have weaknesses which should be highlighted.

6.3.2. A Critique on Compaction

The environmental debate within the urban realm revolves around the contribution certain urban forms might make in lowering energy consumption, lowering pollution and providing social and economic opportunities. The United Kingdom believes that urban form and planning can play a prominent role in achieving sustainability and the government released a White Paper on the Environment[19] in illustrating their potential role. This clearly illustrates that political commitment to the urban sustainability debate is surfacing but that a decision (especially in the UK) as to the most appropriate forms of development is still wanting, subject to further investigation. In Europe, the European Commission (EC) produced a Green Paper on the Urban Environment (CEC, 1990) which advocates a compact city. Although most issues of sustainable urban form are based on transport and energy consumption, the EC Green Paper sets forth that urban sustainability entails more than this, and therefore also advocates quality of life. "It is argued that the compact city, at its best, provides a superior cultural, social and economic base for society" (Breheny, 1992:139). Although many environmental groups and academics have welcomed these steps, the view has been challenged.

[19]This White Paper is known as, *This Common Inheritance* (DoE, 1990).

Breheny (1992) explains that due to a number of circumstances, (such as resistance to development based on "altruistic environmental protection grounds") a shift in the debate to one of growth management has occurred. This debate is seen as important, because in certain countries, in order to keep up with the demand for housing, new sites need to be developed. This is linked to the lamentation that present towns are being crammed. "It is felt that urban intensification has produced congestion, loss of amenity, and a general lowering of urban quality of life, particularly in suburbs" (Breheny, 1992:140). On the issue of a decline in environmental quality, Behrens & Watson (1992:28) state that "the direct equation of residential density with environmental quality is in fact, a misconception. . . environmental quality is the result of a configuration of housing types and buildings, rather than the density of dwellings or people *per se*. . . qualities of privacy, safety, rural ambience and child-rearing suitability are therefore not necessarily qualities of suburban environments".

Breheny (1992) states that the compact city does not consider the present trend of counter-urbanisation in virtually all Western countries. Remote areas are experiencing higher rates of growth than cities facing a net decrease. Breheny therefore believes that it might be more appropriate "to go with the trend" and apply sustainability principles to them. This trend may be manifesting itself in first-world countries, but in third-world countries the opposite is true. Every day, more and more rural people are migrating to cities, due to a number of circumstances revolving around issues of urbanisation. Behrens & Watson (1992) are in agreement with this and go on to state that suburban growth is an American ideal based on affluence permitting people to have their own houses and private motor vehicles.

Breheny (1992) furthermore identifies economic cost implications associated with centralisation, as property costs could be expected to increase in compact cities due to congestion. Behrens & Watson (1992:21) also identify this as a criticism of compaction and this author agrees that it is an important issue that requires serious attention. "Increased scarcity in the face of growing demand leads to inflated acquisition costs" (*ibid.*). However, Behrens & Watson (1992:26) believe that this assumption is not as accurate as it seems, for the following three reasons:

- "Certain measures can induce higher densities (e.g. second dwelling provisions, public housing programmes), without restricting the supply of land;
- Restrictive compaction measures do not necessarily limit the supply of developable land; and
- Housing markets tend to be segmented. Increasing housing costs in one sector therefore does not necessarily mean increases in other sectors" (*ibid.*).

This could possibly be a valid criticism. Another capital cost is also believed to be incurred by compaction. The argument is that residents in high-density environments require more expensive services and facilities than suburban residents. That is, suburban residents are

content with not having paved roads and street lights (Behrens & Watson, 1992). This is highly subjective and far from the truth, since as Behrens & Watson (1992:29) explain "suburban residents tend to constitute the wealthiest segment of a city's population, often with the greatest lobbying power in local municipalities. In practice suburban residents demand a high level of infrastructure, which tends to be provided".

It is possibly in the environmental cost debate on the following three issues, compaction is less effective than sprawl. Low-density environments are said to be able to deconcentrate air and noise pollution, making it easier for the environment to absorb these pollutants. Furthermore, high-density environments have a greater surface runoff volume, whereas sprawled areas have a greater absorption and retention capacity. Finally, the immediacy of the environment is felt more in sprawled than compact settlements. However, through better and effective design, these issues could be incorporated into compact settlements.

In terms of energy efficiency, Breheny (1992) refers to Susan Owens' (1990)[20] findings by stating that "the relationship between energy systems and urban form is complex, and it is difficult to predict how changes in one will affect the other. She [Owens] argues that spatial structure is only one of the factors influencing energy consumption. Life-styles, for example, have a major effect, but are notoriously difficult to predict." (Breheny, 1992:144).

In terms of petrol consumption, a strong debate has emerged as to whether the compact city is able to reduce consumption levels, thereby reducing car emissions. Breheny (1992) reports on the debate between Newman & Kenworthy (1989) and Gordon & Richardson (1990), where the latter criticises the former's findings and advocacy for compact cities as well as the methods proposed which could be implemented to obtain compact cities.
From research based on population density and the relationship to car travel and ultimately fuel consumption, Newman & Kenworthy (1989) conclude that land-use and transport policies should be implemented in tandem so that re-urbanisation can occur, which would reduce fuel consumption. Gordon & Richardson (1990) critically replied to Newman & Kenworthy' (1989) study by pointing out that:

- variations in petrol consumption between cities are not necessarily attributable only to urban form, but also due to variations in life-style and travel behaviour;
- rail transit to declining cities will not necessarily lead to further centralisation but could even encourage decentralisation (consider the historic trend of urban form and transportation illustrated in Chapter 5);

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[20]Susan Owens (1990) has done extensive research on the energy efficiency of urban forms and, although a proponent of compact cities, warns that a relationship between energy efficiency and urban form will be difficult to determine. However, the precautionary principle of sustainable development is inherent in her discussion.

- suburb-to-suburb commuting also occurs and reduces the weight of the Newman & Kenworthy (1989) argument, in that the relationship between fuel consumption and average journey-to-work length in US cities is lacking; and
- urban decentralisation of jobs and houses has reduced average work-trip lengths[21].
- Finally, Gordon and Richardson point out the practical merits of investing in mass transport systems in low-density cities.

Breheny (1992:147) describes Gordon & Richardson's (1990) article as: "pro-motor car, pro-market...pro the status quo, and anti-planning"[22]. Gordon & Richardson's (1990) article highlights the need to understand journey flows beyond basic home-work flows and also draws attention to the implication of radically changing existing settlements with massive capital investments (Breheny, 1992). Although these important aspects are mentioned by Breheny. His report does concede that Gordon & Richardson's view is antiquated and that Newman & Kenworthy "seem to be concerned about what is now generally regarded as a major problem. It may be that Gordon & Richardson are in tune with thinking in the USA, but not with the rest of the world, given that the US government is the only major national government not to have set a CO_2 stabilisation date" (Breheny, 1992:147).

Breheny (1992) goes on to say that the efficiency of the centralised compact city is not yet proven and that further research is necessary. This is true, but if one subscribes to the principles of sustainability, then a precautionary principle should be applied, meaning that some move towards a compact city must not be rejected simply because it can't be empirically proven. This leads to another issue which can be noted in the critiques on urban sprawl and compaction. That is, that the arguments presented tend to rely heavily upon hypothetical examples, assumptions and simulated evidence. However, in the absence of an alternative these will have to suffice. Breheny (1992) then proposes that a possible approach would be to permit a number of suburban centres.

From the discussion above, the concept of decentralised cities has its origins in the Garden City Movement, which has underlying principles of compaction, and in itself is flawed for the reasons mentioned above. Decentralised concentration (a policy closely

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[21]This is only applicable to the US, since data by Newman & Kenworthy (1989) illustrates that in non-US cities a positive relationship between work-trip length and petrol consumption can be noted. Breheny (1992) states that Gordon & Richardson (1990) ignore this evidence.

[22]It is this author's contention that it is precisely for these reasons (with the inherent lack of social and environmental responsibility) that the discourse offered by Gordon & Richardson (1990) is unsustainable and based on western ideologies which have been proven to be unsustainable.

associated with the Netherlands) or satellites are also proposed, but even here compaction is implied.

Breheny (1992) also draws attention to mixed uses. However, implicit in this argument is that planned mixed uses are not inappropriate, but that human-life styles render them ineffective. "It is doubtful that segregated or mixed land uses will necessarily produce different trip lengths or patterns. The success of changes in mixed land uses will depend in part, as with all of the changes that planners can introduce, on the prevailing propensity to travel. If this is high, as at present with low fuel costs, then mixed uses are likely to have little effect on travel patterns" (Breheny, 1992:150). Although this is true, it fails to consider that even if such prices were raised, and people were forced to walk or cycle, present densities and sprawled forms render certain areas inaccessible. One of the goals of compaction is to make the city more accessible.

Breheny (1992) argues that in the European context it may be inappropriate to concentrate new developments in the form of infill within the city. The lack of space, congestion, loss of quality of life are all cited as elements that will be adversely affected by infill, and there is no doubt to this. But, not all cities are as concentrated as in Europe. Most Australian, Namibian, South African and American cities/towns do have the ability to concentrate development within the town. For example, density policies could be implemented, permitting further subdivision of land in certain town areas. Walvis Bay, Swakopmund and Henties Bay in Namibia, are able to implement such a policy and benefit from it, as are Perth (Australia), Johannesburg (South Africa) and Phoenix (Arizona).

It becomes evident that sustainable development does not necessarily equate with a single settlement form. However, two approaches in attaining sustainable development through urban form exist. Furthermore, these approaches can be applied irrespective of the urban form envisaged. The approaches are:

- to begin with the available built environment; and
- implement sustainability in new environments.

The approaches ultimately relate to the ability and realism involved in the compaction of existing and future urban environments. Thus, strategies for sustainable development can be applied to either sprawled or compact settlements, as highlighted earlier by Steiner's (1994) argument that sprawl can be good if ecologically sound. The relationship between urban form and environmental improvement is not that clear and is a complex one, since it is riddled with political, social, economic and cultural factors that determine physical form, just as this dissertation advocates. However, as discussed, social, economic and environmental benefits can be associated with compaction, and if the physical effects are disentangled from the social, economic, apolitical and cultural problems, "there is little doubt that they do have an effect, and that planning can contribute. Thus, research into

urban forms that can help to move towards sustainability is required. But it must be put into context" (Breheny, 1992:156).

It is hoped that this critique on compact cities has outlined some of their weaknesses. More importantly, it has illustrated that any proposal warrants careful examination. Through the awareness of its weaknesses, mitigating measures can be taken to lessen an impact or initiate a change. This is crucial in the planning and design stage of any design, and will become more evident in the chapter on methodology.

6.3.3. The Advantages of Compact Settlements

It can be said that we have emerged from an induction of what works and what doesn't through the above critiques. Inherent in the critiques are the advantages of compaction. Following from a synthesis of the chapter on urban form and the critiques above, the following list can be considered as the basic advantages of compact settlements. Compact settlements:

- eliminate inconvenience (facilities are close by);
- save money;
- conserve time;
- conserve space;
- conserve energy;
- conserve material resources (i.e. less bulk infrastructure needed);
- permit the consolidation and centralisation of urban services through mixed land uses;
- reduce air pollution;
- promote the economical use of services (for example, higher densities increase the viability for public transport);
- enhance vibrance and legibility;
- enhance access;
- promote efficiency;
- promote the equitable distribution of resources; and
- eliminate urban sprawl.

From the discussion on arid zone settlement planning in desert environments (Chapter 8 and 10), more advantages will become evident. Sustainability is implicit in these advantages.

6.4. CONCLUSION

The contemporary discourse on the urban dilemma of having either a compact city or a sprawled city was presented in this chapter. The characteristics, advantages and disadvantages of both forms were discussed. Through the discursive formation of this

discourse, it became evident that compact settlements provide greater social, economic and ecological advantages than sprawled settlements. To highlight this, a variety of costs associated with urban sprawl were analysed and proven to be greater than compact settlements. Since compact settlements involve a number of strategies in attaining what in essence is concentrated development, the course of its development in the last 100 years was outlined. Misconceptions about compact settlements were ironed out and through the analysis of the characteristics of sprawled settlements, and a critique on compaction, basic advantages (such as energy efficiency, the conservation of space, convenience and greater economical use of services) were found to be inherent in compact settlements.

An analysis on Walvis Bay will be presented as a case study in Chapter 10. The study will illustrate a sprawled settlement and negative consequences of this sprawl will be highlighted. The benefits of compaction will also be discussed, which will prove that settlements can become more sustainable through the adoption of an urban form that is compact.

6.5. SUMMARY AND MAJOR FINDINGS

This chapter has emphasised the fact that compact settlements have a greater potential than sprawled settlements to achieve sustainability. This is because the characteristics of a compact settlement inherently reflect certain sustainability issues such as greater equity and access to resources. The main points from this chapter's discussion can be listed as follows:

1. Sprawl has no particular "form", but the characteristic of spread and continuity of a built environment.
2. Low-density free-standing houses on large plots of land contribute to sprawl.
3. The development of sprawl leads to stringent zoning controls, which in turn result in more sprawl.
4. Extreme zoning regulations and planning standards can also contribute to sprawl.
5. The most visible consequence of sprawl is the consumption of land.
6. Sprawl has capital, operating, social, functional and environmental costs. Of particular concern is the capital costs incurred on residential developments since these costs reduce the level of housing affordability.
7. Lifestyles, human comfort and convenience can all be adversely affected by sprawled settlements. For example, not all people are highly mobile and therefore access is reduced.
8. High density does not imply high-rise buildings.
9. Compact settlement has many characteristics, such as high density, mixed land uses and greenbelts.
10. The idea of a compact settlement is not new. Ancient cities were compact and within the last 100 years many planning achievements, used the concept of compaction.
11. Garden City movement (a variant of the compact settlement in the last 100 years) had a profound influence on planning. It helped articulate ideas regarding shape, structure and size of settlements.
12. The idea of compaction can be applied at many scales. For example, at a site-specific scale, high density housing can be set in clusters and at a city scale, the city can be surrounded by a greenbelt. Both scales have the characteristic of containment, a central image of a compact settlement.
13. Sustainable urban forms, based on transport and energy efficiency, advocate compact settlements.
14. Concentration does not imply centralisation.
15. Compact settlements enhance access, mobility and human comfort, thereby making the settlement more pleasant to stay in.

"By designing with nature in recognising that natural processes actually do us a great service. . . we should appreciate that inestimable benefit by adjusting to it and nurturing it."

(Timothy O'Riordan, 1995:12)

CHAPTER SEVEN : URBAN DESIGN AND PLANNING

7.1. INTRODUCTION

"Today's city is not an accident. Its form is usually unintentional, but it is not accidental. It is the product of decisions made for single separate purposes, whose interrelationships and side effects have not been fully considered" (Barnett, 1982:10). As discussed in Chapter 4 and 5, decisions and the way in which those decisions are made, influence our lives. In planning matters, decisions change our physical environment In order to promote sustainability within urban areas through physical changes, we need a strong vision of what ought to be. We were cautioned in Chapter 2 not to dictate a specific design vision, but the vision must nevertheless be based on viable concepts. In order to influence the shape of an area, the concepts must be based on the understanding of the relationship between the built and natural environment, as well as the relationship between human's and the built environment. The relationship between humans and the built environment, was discussed in Chapter 5. These relationships are briefly explored in this chapter, but greater emphasis is placed on the natural dimension.

Before these relationships are discussed, it is important to understand the basic emphasis of urban design, its principles and its qualities. Once these have been recognised, it is hoped that they will lend themselves towards an analysis of urban environments, especially on the visual image settlements portray.

To begin with, the link between form and design is explicitly stated, and in so doing, planning and design are considered to be integral parts of urban form.

7.2. THE LINK BETWEEN FORM AND DESIGN

The focus of urban design is that of the public environment, being those areas not privately or semi-publicly owned. Mugavin (1992:403) states that "urban design is the synthesis of the physical form of the city to achieve goals related to a range of human needs, particularly to activity and meaning. It deals with physical form, buildings, streets, parks etc., and the relationship between these, in order to achieve functional, cognitive, social and environmental goals". This public environment is experienced by people in a variety of ways. However personal these experiences are, there are transcending messages we all

experience and these have been manifested through urban form[23]. In many instances there is a break between the public environment and the private environment. In certain cases these breaks reduce human comfort and people feel threatened within such environments. Whether this has been done intentionally or not, these places become dysfunctional and inhospitable to humans.

An environmental impact has therefore occurred. In this sense, the environment is physical, social and natural and a new bond needs to be created to blend them back into harmony. Since disharmony was created through the built environment, emphasis needs to be placed in bringing harmony back by redesigning the physical or built environment. Quality of the environment needs to be emphasised in the redesign of the built environment.

Environmental quality is important for a number of reasons, including:

- the present environment is not of a good quality;
- human activities take place in a built environment and this setting influences activity and behaviour[24];
- eclectic planning, though not bad in its own right, could create an urban form that is not harmonious with its surrounding environment;
- quality could have economical implications, by cutting costs and improving efficiency;
- health reasons; and
- aesthetic reasons.

Urban design places a particular emphasis on quality.

7.2.1. The Emphasis on Quality

Planning literature has often been concerned with establishing what a good design is. The following authorities on urban design all emphasise a number of issues that could help in the attainment of improving the quality of the built environment. Their issues are highlighted below for further consideration.

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[23]The chapter on urban form illustrates that the built environment has been shaped by a number of elements. All of these elements influenced the human psyche and dictate human behaviour, as is explicitly discussed in the Cosmic Models of urban form.

[24]It has been proven that the built environment affects human reaction psychologically and that human conditioning is influenced by the built environment (Saarinen, 1976; Lynch, 1990; Jacobs, 1961; Shirvani, 1985). A good example to illustrate this is apartheid planning. Although settlements were designed predominantly for economical reasons, the mass production of similar housing designed with similar layout, reduces the identity of individuals, illustrating that they were not welcomed in such environments. Furthermore, the layout permitted the authorities to control people more effectively (refer to *Conflict in Urban Form Theory* in Chapter 5).

Crane (1960) suggests that change of the urban environment should come about through a combination of prescription and creativity. Design must therefore consider the symbolism, functionality and imageability that it wishes to manifest. In this regard practitioners must consider reflecting the values of man and consider his interdependence with nature.

Spreiregen (1963), through his historic analysis of city designs, emphasises that designs reflect the values of the time and the creation of place and legibility through design. Spreiregen believes that the design of urban areas should therefore support diversity of culture, allow variety and accessibility, achieve comprehensibility, reintroduce nature into the urban environment and complement old and new features. Criteria he considers in attaining these are:

- scale (so as to relate the city to man and to create places suitable and comfortable to man. Scale should also consider size, time, convenience and familiarity);
- time;
- space (divided further into urban space - focusing on activity - and open space - a contrast to activity);
- activity (so as to promote contact and access).

Lynch (1990) emphasises that throughout time, a society's values are reflected through design. Designs have also often tried to modify the environment with varying degrees of success. In many circumstances designs have been unsuccessful, resulting in economic wastage, environmentally inhospitable and antisocial places promoting crime rather than abating it. His objectives to reduce service costs, pollution and crime, to improve access and quality of life, and to stimulate productivity and efficiency, to stabilise and rehabilitate declining areas and to strengthen communities and preserve environmental character, could all be achieved through design. Lynch (1990) also emphasises a need to redress values and consider them in terms of appropriateness and ability of attainment through design. Lynch (1990) masterfully persuades the reader that design must reflect the values of society (shaped through religion, politics, history, culture and economics). These values need to be efficiently incorporated into designs which create functional places by enhancing access, instilling sense, maintaining vitality and legibility while emphasising control. As discussed in Chapter 5, vitality, sense, access, legibility and control can be considered as the dimensions of urban form. Vitality provides the support for urban life. Urban form is clearly perceived and mentally differentiated, and structures can be connected, varied and ordered. Sense is therefore inherent in design and urban form. Legibility permits people to fit function to form, related through variables such as scale, texture, massing etc.. Access needs to consider mobility, but is not only vehicular in nature. Access can also be visual, or have social implications, such as access to services, opportunities, information and stimuli, all by using design. If designs emit a sense of control, behaviours can be manipulated, encouraging management of resources and facilities and enhancing public involvement.

A synopsis of the analyses of urban quality of these three authorities on urban design, highlights the importance of reflecting the values of man through design. In order to achieve quality, emphasis is laid on symbolism, functionality, imageability, variety, accessibility, comprehensibility, scale, activity, sense, vitality, legibility and control. In turn, all these aspects can collectively be described as elements that comprise the image of the city. Elements that make up a city's image are discussed in section 7.3.

It can be argued that of the three authorities only Lynch (1990) addresses the importance of the natural environment in design directly. The natural environment has often been considered as a setting in which development could take place, and where it could enhance design from an aesthetic point of view. Environmental concern in planning and urban design has rarely focused on the relationship between the built and natural environment (Shirvani, 1985). Although this relationship has never been explicitly manifested, the natural environment is a key focus of urban design.

7.2.2. Concerns in Urban Design

7.2.2.1. Design of Place

The primary focus of urban design is on the design of place. Spaces are given a sense of identity through inherent qualities that either make them a special place to be in where our senses are stimulated or an inhospitable place. Although the latter is at times designed, it is done to serve a purpose. Quite often, though, the emphasis placed on individual buildings is not captured in an integrative manner and thus the cumulative effect of the various built forms together unintentionally produce inhospitable places. Urban design does not aim to reduce individuality and creativity. Rather, it tries to ensure that the spaces created blend together[25], not in a uniform rigidly planned area, but rather to ensure harmony and connectivity that ensure usability[26]. This leads onto the theme of contextualism.

[25]Although this can lead to pastiche (where a building is designed in the style of another) this is not the intention.

[26]"There is a clear shift away from the individual building, for example towards a more integrated streetscape, with an emphasis on usable public places and human scale, heritage retention, traffic calming and landscape, so that the place has a sense of identity" (Mugavin, 1992:404).

7.2.2.2. Contextualism

Contextualism is an urban design concept propagating that individual buildings should not be too different from the texture of a city[27], and that change should reflect the town's inheritance. Mugavin (1992:405) points out that this concept is often abused. Essentially the concept is about the public value of the city's character and that this character is "a shared resource and as such should not be abrogated by sectionalist interests"[28].

Nevertheless, the concept of contextualism does not mean that there should be no mix of form and land use. A lack of mix creates environments that have no identity, and different places often look much the same. This can create sterile environments confusing to visitors, whereas mixes create stimuli for humans and enhance their productivity[29].

7.2.2.3. Social responsiveness

Although design of place and contextualism are the major foci of urban design, including one which enhances the relationship between the natural and built environment (discussed further on), urban design's ability to achieve them is strongly associated with architectonics, appearance, townscape and decorative effect. Urban design is increasingly becoming aware of the need to address issues such as low-cost housing, urban renewal, environmental protection, equity and accessibility in an appropriate manner. Inherent in this, is the need to reflect cultural norms in designs. Mugavin (1992:406) strongly emphasises this point by stating that "it is beyond dispute that the liveability of any specific city has a lot to do with the cultural norms existing among the residents, and urban design therefore needs to deeply reflect these norms. Indeed. . . architects and planners, have too readily imported and imposed irrelevant and spurious design ideologies that conflict with local cultural norms and the environmental context".

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[27]See note 21.

[28]It will become evident through the course of the dissertation, that the present texture of the city is inappropriate to its environment and that a radical break from the present structure is required. This may appear to be in conflict with the concept of contextualism, but in the absence of any major architectural and urban design feat in Walvis Bay, it is contended that a change would not be 'bad', although it is recognised that the present texture creates a specific environment, that some individuals may value. Yet, the author does not believe that all future developments should follow the present scenario. Furthermore, a change in urban form will prove to be more sustainable.

[29]The chapter on urban form, as well as the one on compact settlements, mentioned that mixing of land-uses enhanced productivity.

Urban design, through its advocacy of societal values, is within the political process and is socially and economically astute as a result of this advocacy (Mugavin, 1992). The natural environment is also central to urban design, since it influences design decisions. Mugavin (1992:407) correctly points out that its importance "arises out of links to prime concerns of urban design: the retention of local character (a crucial element of which is the physical environment) and the positive contribution that the components and processes of the physical environment can make to the richness of urban areas as human habitat". This clearly illustrates that urban design is firmly rooted within the environmental context and, if applied in an integrative manner, could have environmental benefits. The importance of the natural environment will be discussed further in the section on the natural dimension.

Thus, in order to plan or design we must understand the processes of the natural as well as the social system (cultural, political and economical procedures). The latter was discussed in the chapter on urban form. Section 7.4 on the Natural Dimension, will illustrate that the design of structures and spaces has natural environmental implications and *vice-versa*.

However, before this is illustrated, a brief discussion will be given on the methodology used in urban design and townscape analysis. New concepts will also be introduced, to help in the analysis. Although many of the concepts/tools used in townscape were covered in Chapter 5 on urban morphology, here they will be applied from a visual perspective, since the visual perspective has social and psychological implications.

The next section has two goals. The first is to be able to undertake a basic visual analysis of Walvis Bay's image; the second, to illustrate how design can harness nature and how it can reduce the consumption of energy.

7.3. THE IMAGE OF THE CITY

In the chapter on urban form it became evident that settlements stimulate our perceptual abilities. This is caused by the design of structures and their relationship with spaces. The relationship between structures and spaces has a language which influences our social makeup to a certain degree. After all, the built environment reflects man and society's values. Thus the images a settlement projects influence our actions and behaviours, making urban design an integral part of the social environment. Greene (1992:177) indicates that urban design is not just the arrangement of various architectural forms to suit land use regulations, but also "the interplay among complementary and competing environmental and social forces". Urban form and design can therefore be discussed in physical, environmental, psychological, sociological and philosophical terms.

This section follows on from the discussion on urban form. Here, the expression of a settlement is discussed beyond its form and simple ideas of urban design will be

introduced. It should be mentioned that urban design has no real theoretical base, rather the knowledge of urban design is derived from the evaluation of the existing built environment. Theory of urban design ultimately follows from practical implementation (Lynch, 1978; Lynch 1990; Mugavin, 1992; Greene, 1992; Golany, 1995).

7.3.1. Evaluating a Settlement's Image

Each person perceives a town in a different way. Although we see similar features, we interpret them differently, since spatial elements portray non-spatial activities. For example, if we see a built feature and agree that it looks like a house, then supposedly it has the function of a house. We often associate a residential function with a house. This can be deceptive, for the house could be used as a clinic or as business premises for a company, although its built form is that of a house. Use and form can therefore be deceptive.

Maps, plans, bird-eye views, all indicate a complexity allowing us to give a conventional description of the built environment, but not necessarily of the environment's quality. As discussed earlier, quality arises from function and relationships which can only be noted once certain dimensions such as time, culture, ownership and control are included. There are difficulties in trying to evaluate a built environment. Such evaluations normally rest on subjective interpretations[30]. However, the interpretation and evaluation of urban design and town planning, "is grounded in research on basic human needs and on a broad range of concepts from the literature and practice of urban design, urban planning, the building arts, and the visual arts" (Greene, 1992:177).

Various aspects of the three dimensions of urban space will be discussed not just from an aesthetic point of view but also from a functional point of view, so that we can interpret townscape as an unfolding kinetic experience. This kinetic experience is manifested through serial vision. Serial vision can be defined as the scenery of a town as we move through it and is often revealed in a series of jerks and revelations (Cullen, 1977). Vision therefore can evoke memories and experiences aroused by the environment. Place and content of what we see influences our image of a settlement. Here place refers to openness and enclosure which permits us to distinguish a sense of identity of a space. Content is the examination of a town's fabric: colour, texture, scale, style, character, personality and uniqueness. All these and many more influence our images of a town. Cullen(1977) points out that all too often modern town planning wants to create an orderly scene of specific

[30]"Too often professional evaluations of designs are nothing more than subjective reactions based on a sophisticated - but poorly articulated - understanding of what 'works'. To complicate matters further, the design issues raised and the evaluation criteria selected - as well as their relative weight - often shift dramatically from site to site" (Greene, 1992:177).

uses - straight roads, styles etc. - and symmetry, balance, perfection and conformity. There is nothing wrong with this ideology, but to implement it through rational planning reduces the visual effectiveness of towns that our older settlements display. Older settlements exhibit elements of symmetry, balance, harmony etc., not through rigid planning and implementation of standards across the whole city but through a mixture of various styles and designs. The forms of the older cities were shaped by a number of evolving factors that cumulated in unique environments. It would be foolish to think that this could be created with one sweep of design, unless we wish to ascribe to thematic planning which is a plastic reproduction out of context with its environment. Through the realisation of how these older settlements work and relate to humans, we can begin to understand certain principles, which can be implemented in new designs to enhance the quality of our environments. From this visual understanding[31] we gain other principles that relate to functionality, after all, people have to live in these environments.

7.3.1.1. Basic principles of urban design

There are four basic principles of urban design: function, order, identity and appeal. Each of these principles has specific qualities and guidelines which enable lay-people, architects, planners and urban designers to evaluate the quality of design projects and proposals. An understanding of the four principles should be seen as an enabling tool for a better comprehension of the built environment. It suggests desirable qualities in the built environment and should not be seen as a formula for building a good environment (Greene, 1992).

These principles are defined as "conceptual constructs and beliefs necessary to describe, analyse and prescribe urban design. These principles represent distinct and vital attributes, significant enough to have universal application to all environments. . . There are four major principles of [urban] design. Each is distinct and essential to [urban] design.

- *Function* requires that the design work effectively for the convenience and comfort of all its users.
- *Order* assures that users can become oriented to the environment and understand it.
- *Identity* denotes a visual image of the environment that reflects special or unique qualities.
- *Appeal* characterises a design that gives pleasure to its users over time" (Greene, 1992:180).

[31]Our environment is almost entirely apprehended through vision, so it would be easier to describe the visual image of a city.

Qualities can be associated to each principle to expand the meaning of the principle. In turn, guidelines define each quality. Figure 19 tabulates the principles, qualities and guidelines.

Figure 19: Urban design principles, qualities and guidelines

Principles	Qualities	Guidelines
FUNCTION The design should be usable by all.	1. LINKAGE	Access/Interaction/Overlap
	2. SECURITY	Safety/Privacy/Activity
	3. COMFORT	Physical Ease/Visual Rest/ Friendliness
	4. DIVERSITY	Choice/Variation
ORDER The design should be easily understood.	1. COHERENCE	Entrance/Edge/Landmark/Vista/ Skyline/Groundline
	2. CLARITY	Structure/Articulation/Closure
	3. CONTINUITY	System/Sequence/Rhythm
	4. BALANCE	Pattern/Emphasis
IDENTITY The design should be distinctive and recognizable.	1. FOCUS	Visual Focus/Activity Node
	2. UNITY	Concept/Repetition
	3. CHARACTER	Integrity/Simplicity/Restraint/Style
	4. SPECIALNESS	Historical Quality/Symbolism/ Singularity/View
APPEAL The design should be pleasing and attractive.	1. SCALE	Human/Humanizing
	2. APPROPRIATENESS	Proportion/Authenticity/Familiarity
	3. VITALITY	Stimulus/Contrast/Tension/ Movement/Sense of Humor
	4. HARMONY	Light/Color/Texture/Line/ Sound/Smell

(Source: Greene, 1992)

A comprehensive analysis of the built environment can be achieved by using these principles, qualities and guidelines. Given this diagnostic tool to evaluate the built environment, it is important to consider the interaction between the physical environment (natural and built) and the user. Humans are the users of the built environment and thus the evaluation must be human oriented. It is therefore important to consider human needs. They fall in the realm of the physical, psychological and sociological, and according to Greene (1992:180) include "the need:

- for sensory pleasures;
- to feel safe and secure; to be free from fear and chaos;

- to have personal space and group space - for recreation, learning, socialising and participating in groups;
- to be able to identify objects and places - to create mental images and cognitive Maps for purposes of identification and orientation;
- for diversity, mobility, self-development, and surprise;
- for belonging, pride and self-esteem; and
- the need, indeed the craving, for beauty and aesthetic pleasure"[32]

These needs can be projected through the principles, qualities and guidelines defined above and in Figure 19. Greene (1992) refers to these concepts as a taxonomy of urban design, and states that the taxonomy is value-free and does not advocate a particular view. However, it is the author's contention, that although the taxonomy itself is value-free, its application is not, since we often rationalise issues or intuitively analyse issues from our value-based perceptions. The taxonomy should therefore be seen as a tool to articulate expressions about designs and places. Its value is also inherent in its ability to be used as a checklist in developing design criteria and as "a synoptic reference for research and design activities" (Greene, 1992:186).

These principles, qualities and guidelines need to apply to specific features of the built environment. "A visual survey in urban design is an examination of the form, appearance and composition of a city - an evaluation of its assets and liabilities. A visual survey also enables us to see where the city needs reshaping" (Spreiregen, 1963). Certain urban elements therefore project a city and give it an image. This image is physical, but image is influenced by issues such as social meaning, function and history as well.

The objective of this dissertation is to uncover the role of form in terms of sustainability. The role of form in terms of morphology was discussed and certain settlement patterns were introduced. Form itself presents the image of a city, but as Lynch (1975) points out, the form of the city can be classified into five types of elements: paths, edges, districts, nodes, and landmarks.

7.3.1.2. Five types of urban elements

Paths are the circulation routes people use to move about and a settlement has a network of such paths, each having a degree of importance in terms of its function and usability. Not all paths are designed to take equal amounts of traffic and they vary in size. Edges are

[32]Different cultures and societies have different needs. The most basic, as defined by Maslow (1970) are food, clothing and shelter. The needs mentioned in the text are also considered to be fundamental needs but at a different level in terms of Maslow's hierarchy of needs. It is proposed that they are just as vital as the basic needs and important to human development.

the boundaries between two distinct features. One area or feature is closed off from another to create distinct areas. Districts are areas of a settlement that are distinct from others. It can be argued that there is some degree of homogeneity (architectural, functional, social etc.) within an area that distinguishes it from another. Nodes are centres of activity and they can be junctions and points of concentration. Junctions are places of transition (for example, shifts in modes of transportation) and concentrations are places where importance is projected from the condensation of certain uses or merely by the character of an area. In general a node is a distinct hub of activity, and differs from a landmark, which is a prominent visual feature. Landmarks vary in scale and help people to orientate themselves.

These elements do not exist in isolation and often work together. For example a street can be seen as a path or an edge, so it depends from which perspective you view these elements (Lynch, 1975; Spreiregen, 1963).

The elements form the image of a settlement. They permit settlements to be clearly defined and add special characteristics to a settlement. Apart from making the settlement more legible, they also influences people's perceptions of their environment. Furthermore, these skeletal elements of a city form, allow us to evaluate a settlement, based on issues of sustainability (discussed in Chapter 3), performance dimensions (discussed in Chapter 5) and the basic principles of urban design mentioned above. These elements, dimensions and principles are applied in chapter 10 where a visual survey is made on Walvis Bay.

Ultimately, the purpose of urban design is to improve the function and aesthetic quality of the built environment for its users. Before plans are prepared, the interaction between the built and natural environment and the user should be considered.

7.4. URBAN PSYCHOLOGY AND URBAN DESIGN

Designs can get people to react in a specific manner. The chapter on urban form theories illustrated this briefly. This section will discuss certain important elements of architectural psychology and how they influence our perceptions. The concepts mentioned below should be considered together with the examples on how to read the urban environment mentioned in the previous section.

7.4.1. Visual Stimulation

Research in the field of architectural psychology suggests that people prefer complex visual environments to simple ones (Morris, 1981). Morris (1981) in his examination of people's images of medieval, classical, industrial, romantic and modern period styles of townscape, concluded that the visual austerity of modern architecture and planning

constitutes a negative component in townscape. Townscapes with older and mixed uses where there is a visual variety of forms possess "qualities which tend to provide aesthetic pleasure and inspire feelings of general well-being" (Morris, 1981:261).

According to Smith (1977) modern architecture and planning epitomises logic and rationality, so loved by Western society. Smith (1977) argues that these modern forms deny people emotions that were once stimulated by a varied and rich townscape. Many modern settlements with their strict concerns for standards, rational land use zoning and bland repetition of modern architecture, create townscapes that simply lack stimulation. Smith (1977), Morris (1981) and Lynch (1990) all concede that our traditional or old cities have better qualities that evoke emotions of comfort, security and a place of belonging, amongst others. Morris (1981:261) agrees with Smith's (1977) conclusion, and states "that if cities are to be a source of well-being they should possess both new stimuli and familiar reassurances, since without a dialectic rhythm between the intellect and the emotions 'environment drops psychologically stone dead'.

7.4.2. Location Dynamics

Social behaviour is influenced by the communication process. The presence of barriers or open paths influences the probability of contact.

Location in a particular portion of a town or even on a site, "may determine who is likely to get together with whom and the clique to which one belongs. Once formed, the social patterns may persist in spite of a constant turnover of residents" (Saarinen, 1976:70). (This is closely linked to ecological psychology). Nevertheless, to some degree a condition of homogeneity is required for such contact. Physical factors that produce such communities include the placement of patios and children's play areas, the direction and type of street, and even the placement of doors and windows. Clearly, urban design and planning could help improve the social environment and some degree of physical determinism is possible through design.

Oscar Newman (1972) illustrates the importance of design as a crime deterrent. His concept is a follow on to physical determinism mentioned above, in that he believes that isolation, lack of identity and controllable space, and lack of community, as a result of modern planning, is resulting in a breakdown of society which once kept crime in check. He therefore strongly advocates the use of design to combat crime and promote greater community interaction. Newman refers to the manipulation of buildings and spatial configurations as 'defensible space'. Jane Jacobs (1961) also emphasises the element of human scale in townscape.

Saarinen (1976) discusses the importance of replication, where similar forms are implemented on varying scales, so that a hierarchy of form is created. This is considered to

be a factor in the coherence of a town's image. An example, used by Saarinen (1976) is the replication of a house structure at the neighbourhood level that is then passed on to the city level. Saarinen illustrates this point by using the analogy of a patio. Saarinen (1976:119) states that "each home has a central patio surrounded by rooms which correspond to the barrio plaza surrounded by individual houses and the main plaza surrounded by the separate neighbourhoods. The patio serves as the main recreational area for children, the bario plaza for young adolescents, and the main plaza, for older adolescents and adults". Replication binds the home to the city and can be argued to be similar to the organic model/neighbourhood unit concept of town design. Here, the psychological attribute of such a design is emphasised, where people are given a sense of identity and as they grow they develop into their town by moving up the hierarchy.

It can be synthesised from this brief psychological perspective of townscape that greater co-ordination of future developments needs to occur. Co-ordination not in terms of linking modern developments to old ones, but rather through the integration of qualities that influence environmental perception that ultimately affect human well-being, by considering aspects such as diversity and human scale.

7.5. THE NATURAL DIMENSION

"Clearly there is a need to recognise the fact that there is no way to turn back to nature in the sense of reversing the development process, or forcing the abandonment of modern industrial society. Indeed, there are strong arguments supporting the contention that the integration of natural and human imperatives is both necessary and realistic. We need to relearn that the environment is not some almost mystical apparition: it is where we live" (Mugavin, 1992:407).

The purpose of this section (divided into: climate, vegetation and geology) is to illustrate basic effects natural processes have on urban developments and *vice-versa*. By realising these effects, urban planners/designers could manipulate the built environment to harness the benefits attributed to these effects and minimise their negative qualities.

7.5.1. Man-Modified Climates

The layout and design of the built environment modifies the climate of towns. By replacing the natural shapes and surfaces of the environment with artificial urban elements a new relationship is created with the natural environment. Chandler (1978), Attenborough (1973), Owen (1993), Hough (1984), Golany (1979), Golany (1978), Fink (1993), Griffiths (1968), Landsberg (1981), Shirvani (1985), Golany (1995) and Bitan & Potchter (1995) illustrate the relationship between the built environment and climate and that modifications to climate not only occur "in the immediate vicinity of the buildings, but also

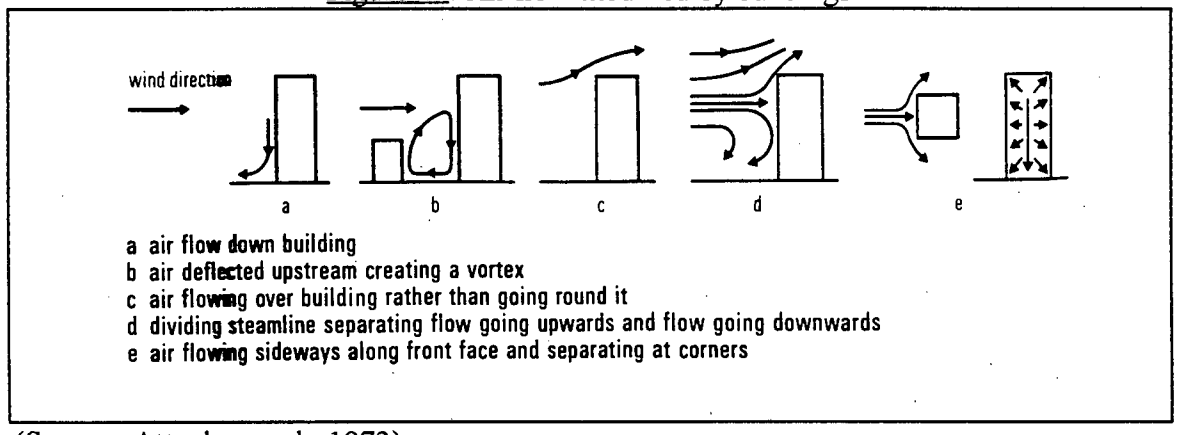
throughout the entire built-up area and to some degree and in some respects, well beyond the city boundary" (Chandler, 1978:1). Bosselmann *et al* (1995), Tromp (1980), Golany (1979), Chandler (1978) and Attenborough (1973) argue that these changes to climate have important architectural, planning, social, medical and economic implications. For built environments to be sustainable it is important that we become aware of the climatic changes we manifest and consider them in the design of our settlements. In due course, it will become evident that in considering climatic elements, benefits in terms of energy consumption and human comfort can be attained.

Wind speed, wind direction, sunshine, radiation, temperature, humidity, rainfall and hydrology are all climatic variables modified by the built environment. These modifications will be explained briefly and practical design solutions to mitigate them, or harness the benefits associated with them, will be discussed.

7.5.1.1. Airflow

Surface materials, surface forms and composition all influence airflow. In urban areas mean wind speed is decreased due to friction caused by increased rough surfaces. However, wind tunnels are created by the placement and composition of buildings and streets, and these areas have a high degree of turbulence[33]. Figure 20 illustrates how airflow is modified by buildings. Turbulence and an increase in wind speed caused by channelling can produce inhospitable environments for humans. By placing buildings and streets in a particular layout, airflow could be harnessed to disperse pollution and to provide human comfort, especially in hot arid regions. Figure 26 (in Chapter 8) illustrates how street layouts could modify winds favourably.

Figure 20: Air flow modified by buildings



(Source: Attenborough, 1973)

[33]Shape and height of buildings vary and this forces air to rise and descend, causing turbulence.

Plate A: A smoky scene in Walvis Bay.
The careful and strategic siting of industry is epitomised by this photo. Where possible, residential areas should not be located down-wind from industry.

Plate B: Clay house.
Through the use of appropriate low cost technology, self-help houses can be built, which are appropriate to the needs of the people. These clay houses in Henties Bay are environmentally friendly and are appropriate to the climatic conditions of the region.

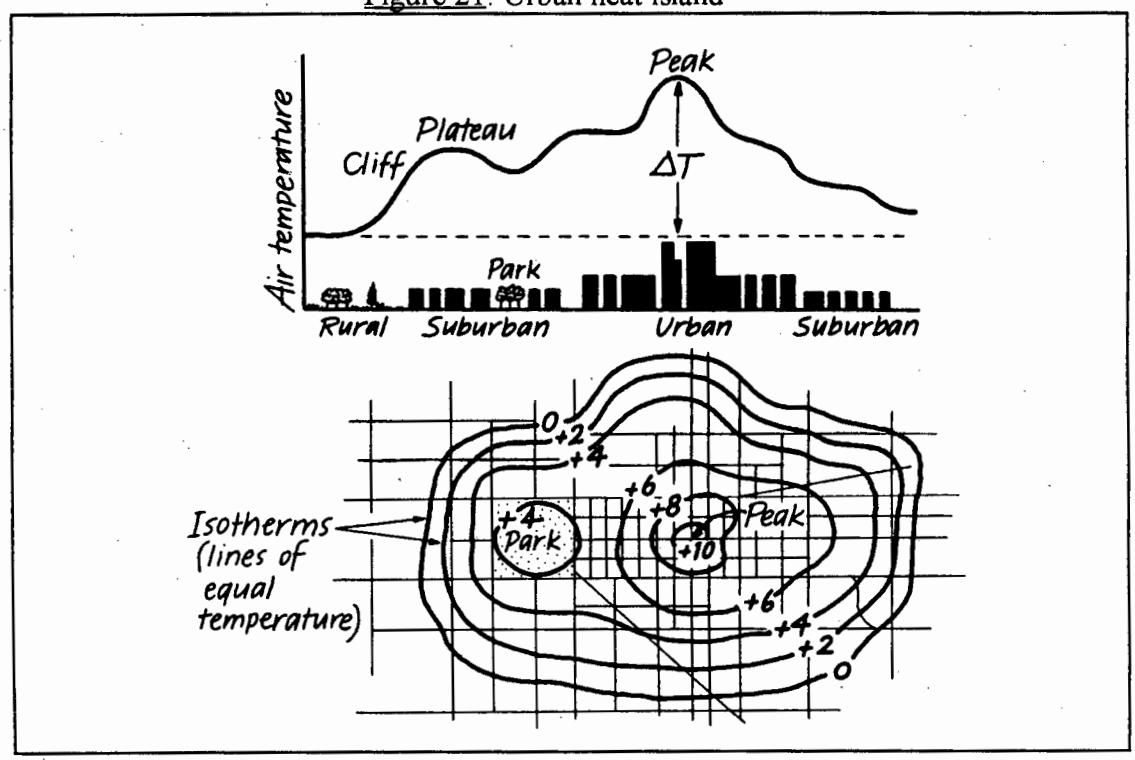
7.5.1.2. Urban Heat Islands

A particular phenomenon of cities and urban areas is that they produce heat islands. Urban heat islands are created through the cumulative result of a number of features, including higher temperatures, evaporation rates, amount and type of radiation received and pollution.

Higher temperatures are experienced in urban areas for the following reasons:

- artificial heat is produced due to consumptive uses;
- urban materials have higher thermal capacities and conductivity than soils, resulting in an increase in daytime heat storage and a decrease in evaporation;
- the geometry of buildings scatters long wave radiation within the urban layer, resulting in heat being trapped;
- urban areas being paved, remove water quickly from the surface, thereby reducing the opportunity for evaporative cooling of air;
- in general a reduction in wind speed causes a reduced sensible heat loss; and
- counter radiation by pollution increases temperature. Pollution caused by dust and the emission of CO_2 and other gases reflect long wave radiation.

Figure 21: Urban heat island



(Source: Lowry, 1991)

By considering the causes of higher temperatures in urban areas, the urban heat island model can be explained. At sunrise, buildings in the urban areas intercept the sun's rays, resulting in the faster warming of the urban environment than the non-urban environment. Between mid-morning and mid-day, air over buildings is warmer than the surrounding air, causing air to rise. This rising air is replaced by a flow of cool air from the surrounding non-urban environment. From midday to sunset, built surfaces are still intercepting the sun's rays, resulting in more heating. This is in contrast to the non-urban environment which is beginning to cool down. After sunset both the urban and non-urban environments begin to cool, but the urban environment is still warmer, because long-wave radiation is still reflected between buildings and artificial heating is still continuing. Figure 21 illustrates the urban heat island model.

7.5.1.3. Rainfall

In general, condensation and precipitation are higher in urban areas than in rural areas. The inversion layer over a city traps large amounts of dust and pollution particles which act as condensation nuclei. This increase in condensation nuclei with an increase in air turbulence, causes rain.

7.5.1.4. Humidity

With little vegetation in cities and few open water surfaces, the moisture content in cities is in general 2-8% less than in the surrounding non-urban areas. However, Lowry (1991) noted that closely packed buildings were likely to have higher humidity levels.

7.5.1.5. Radiation and Pollution

A related effect of the urban heat island is the entrapment of pollutants within the warm air layer. Apart from reducing visibility and illumination, pollution absorbs certain wavelengths and prevents them from reaching the ground[34]. The combined effect of pollution and radiation (that is, the scattering and absorption of certain wavelengths by pollution) also enhances the green-house effect.

Certain climatic conditions, especially those found over desert west coasts, where upper-air inversions dominate, influence pollution. The cumulative effect of urban heat islands, upper-air inversions, the occurrence of fog[35] and land and sea breezes could have major

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[34]This could have certain health implications, for example, bacterial activity at ground level increases if ultraviolet radiation is reduced.

[35]Dry west coasts adjacent to cold ocean currents produce fog conditions.

health implications for residents in these areas. A high occurrence of respiratory ailments has been reported in areas with such conditions (UCT, 1996). These conditions have major planning implications, where for example, the siting of industry needs to be carefully considered (see Plate A).

7.5.1.6. Sea level Rise

One of the most likely results of global warming is sea-level rise. O'Riordan (1995) reports that by 2050, the cumulative predicted sea-level rise will be about 30 cm. The effect on low-lying areas could be devastating. Walvis Bay at a contour interval of approximately 2 m above sea level, could have most of its coastal area flooded. The threat of future sea-level rise and of the Kuiseb River flooding, influencing Walvis Bay from the lagoon side, means that planning and design of the settlement and structures will have to consider flooding. Engineering structures may need to be built along the coastline, but as O'Riordan (1995) states, engineering solutions are limited, are not a panacea and can create damage further along the coast[36].

Land use controls could offer another solution to help reduce the negative consequences of sea-level rise. Such controls could include set-backs from the high-water mark, or the design of buildings which are raised from the ground. These controls will influence urban form, resulting in a pattern that could have a green buffer strip (the set-back) along the coastal strip. Such a buffer strip could enhance property values and result in the placement of high-cost structures or smaller erven along these strips, creating a different texture along the coastal area. Furthermore, the need to avoid damage to property could even result in a policy prohibiting sprawled coastal developments.

7.5.1.7. Other Climatic Considerations

Built features and surfaces, as well as the colouring and texture of the surrounding environment, influence reflection and amount of sunshine received. These aspects, along with airflow, affect human comfort. In recognition of these climatic variables, the design of buildings could create specific built typologies ultimately influencing urban morphology (urban form). The chapter on planning in desert environments, will illustrate certain design features that incorporate climatic variables.

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[36]Littoral action is influenced by engineering structures such as groins, which affect the natural sediment balance, thereby reducing the replenishment of sediments further down the coast.

7.5.1.8. Hydrology

Urban areas affect hydrology in four ways. Firstly, water runs off quickly in urban areas, thus reducing soil infiltration. This adversely affects the possible recharge of underlying aquifers and reduces the moisture content of urban soils. Secondly, the channelling of water out of the urban areas affects peak flow characteristics increasing total run-off over a short period of time. This could result in flooding and erosion. Thirdly, water quality is affected by urbanisation and finally, it has an "impact on hydrological amenities in general" (Shirvani, 1985:85).

Urban planning, especially in desert environments, should consider the hydrological impact built development has on the environment. Water tables could be radically altered in these areas and saline ratios closer to the coast could be altered, influencing natural habitat regimes. In Walvis Bay a diversion wall to prevent flooding of the settlement was built on the lower Kuiseb River. This altered the river course, resulting in the destruction of vegetative cover which helped to stabilise the sand dunes to the south and south-east[37] of the town. The town is now experiencing an increase in sand encroachment. This has major economic (capital and maintenance costs), social (decrease in living standards as a result of additional costs), health (respiratory problems associated with dust) and ecological (destruction in vegetation reduces the habitat of certain species, resulting in lower species diversity) implications. In Walvis Bay the movement of sand is also resulting in the infilling of the lagoon (UCT, 1996). This example illustrates the importance of hydrology and how it is interconnected with the entire environment.

7.5.2. Vegetation

The importance of vegetation was to some degree illustrated above, where the relationship between hydrology and vegetation and its important influence on dune stability, especially in desert environments, was highlighted.

However, vegetation also provides other functional benefits and aesthetic benefits. These include shading, reducing energy loss, controlling and preventing erosion, providing shelter, temperature control, air cleaning, adding cooling moisture into the atmosphere, modification of urban micro-climates, run-off retention and the muffling of noise (Shirvani, 1985). Figure 22 illustrates some of the benefits of trees and certain vegetation.

The aesthetic benefits of vegetation are obvious, but vegetation also has psychological benefits. In the visual analysis of Walvis Bay, vegetation provides a strong contrast to the

[37]These directions need to be considered in relation to those north of the diversion wall.

environment, adding comfort to the eye and giving perceptual qualities of shelter and containment. Trees and vegetative cover enhance the legibility of a settlement, reduce the harshness of geometry and impart a three-dimensional pattern to the roads, while also contributing to the rhythm and structuring of a settlement. Vegetation and trees also aid in distinguishing paths, edges and districts, thereby enhancing the vitality and legibility of a settlement, as well as enhancing character and instilling a sense of pattern. That is, trees help distinguish the road hierarchy[38]. Mugavin (1992:409) qualifies this by stating that "since the eighteenth century, trees have been used as structuring elements in the morphology of cities. . . The use of trees in this fashion grew out of the French Baroque garden, and is seen in the morphology of many of the great cities developed or rebuilt in the eighteenth and nineteenth centuries: Paris, Washington, Melbourne. The pattern includes landscaped parks, [and] broad tree-lined radiating avenues". The influence of the Baroque axial network settlement planning on urban form was discussed in the Chapter 5. The important concept here is that vegetation, and trees in particular, adds structure to settlements. The appropriateness of certain trees or of a Baroque pattern is questionable, especially when the harsh conditions of the Namibian environment are considered.

Vegetation, apart from being influenced by hydrology, is also influenced by soil and climatic conditions. Urban vegetation has to endure a number of stresses. In addition to those mentioned above, These stresses include air pollution, limited space, temperature, lighting, dehydration, soil compaction and physical injury.

It is therefore important to consider the contribution vegetation can make to an urban environment, not just for its functional qualities, but also for its urban design qualities. In arid (desert) environments the appropriateness in terms of economic viability must be considered, but weighed against social and physical environmental benefits. It is important to choose vegetation that will survive, which is, if possible, indigenous to the environment, and will provide maximum functional efficiency.

7.5.3. Urban Geology

Geological formations, such as underlying strata that influence building foundations and the laying of subterranean infrastructure, are critical in settlement planning. They place constraints on the construction of some buildings in terms of their use, height and bulk,

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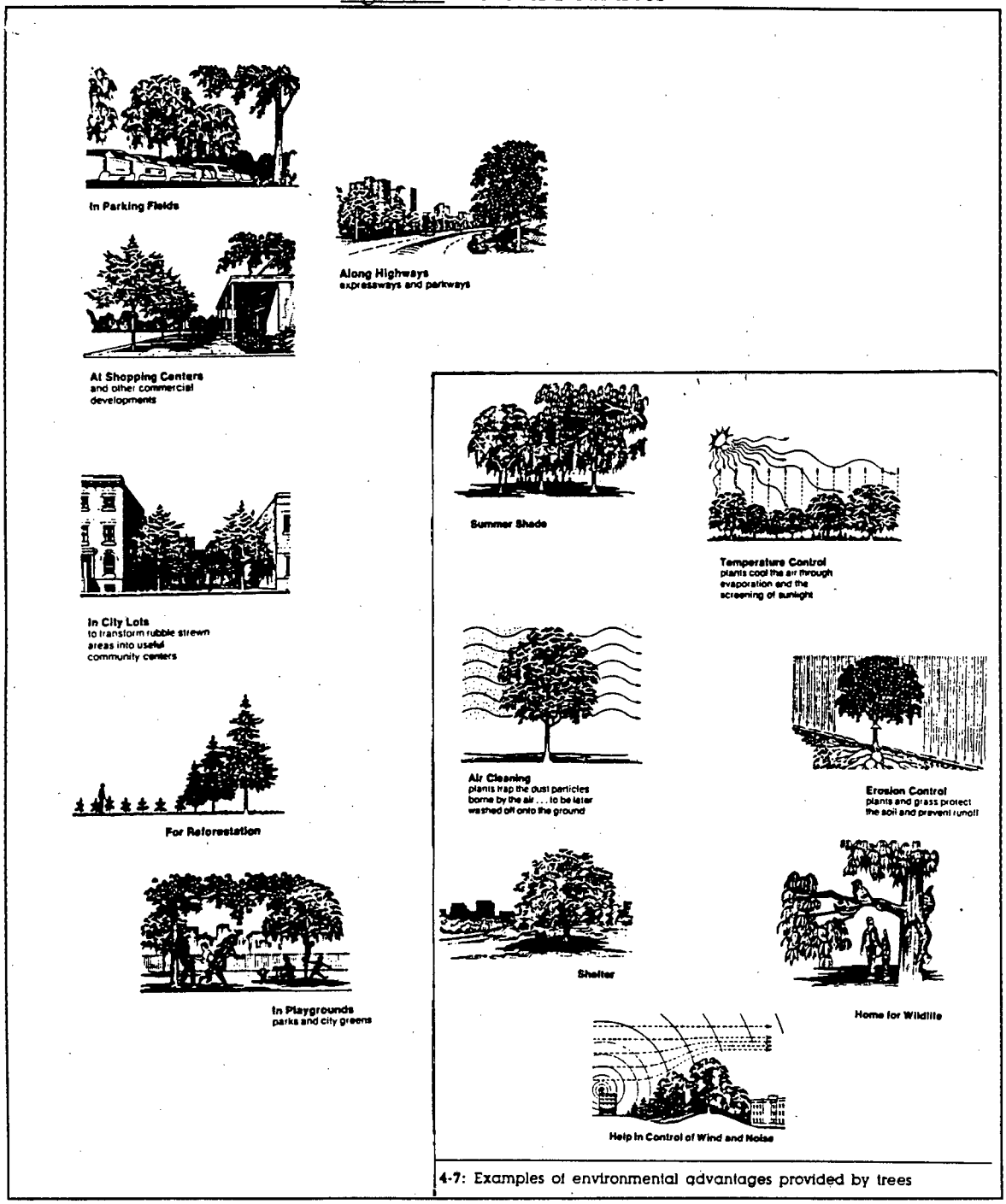
[38]Walvis Bay's street layout is difficult to distinguish in terms of a road hierarchy and vegetation (appropriate to the environment) could help people in reading the town better, thus making Walvis Bay more legible. Vegetation could also highlight the importance of certain streets, thereby enhancing symbolism while at the same time beautifying the area. Planting could also be beneficial by reducing sand movement and offering shelter from wind. However, the implications of water use in a desert environment with limited water need to be considered as well.

while also delineating areas that should not be developed due to active faults, or because they are prone to subsidence or they recharge underground water sources, or are geomorphologically unstable and therefore could be hazardous to humans if developed.

Figure 22: Benefits from trees



4-7: Examples of environmental advantages provided by trees

(Source: Shirvani, 1985)

Soils and geological stability are issues that have enormous impact on urban planning, development and infrastructure maintenance. Physically, they can dictate the form of a settlement, influencing the placement of certain land uses[39], demand the implementation of height controls, and even dictate certain design standards and specifications of structures. The use of certain building materials and products can even be determined by geological considerations. Structural problems associated with geological problems can result in capital and maintenance costs. Social costs could be increased through lower incomes, injuries and health problems[40]. In order to reduce economic, social (health) and even ecological losses, urban planners/designers must consider geological criteria. By using sieve techniques (similar to McHarg's (1969) overlay method[41]) suitable areas for development can be found.

Walvis Bay was established on a very low-lying coastal area and flood plain management is a reality, due to the inherent threat of floods. The previous example of a flood diversion wall, demonstrates how man-made modifying forces on the land can influence subsurface conditions. Planning in Walvis Bay now needs to consider the threat of flooding from the lagoon side, exacerbated by a possible rise in sea level. Furthermore, the effect of sand and dune movement into the settlement is a problem. A geological survey could have predicted these inherent problems and proper contingency plans could have been implemented. With the present understanding of these geological and geomorphological forces, settlement design and land use planning could help reduce the negative effects resulting from these processes. For example, dune stabilising techniques could be implemented to reduce sand intrusion and trees could be used as barriers. Even land use could be oriented to consider minimising costs associated with sand blasting and storms. Future poorer settlement could be located where these effects are of a lesser magnitude. The design of a settlement can be changed to closely resemble Arabic settlements.

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[39]Consider the siting of landfills that need to consider geohydrological principles in design in order to minimise or prevent leaching out of chemicals and formation of gases that could cause ground and air pollution.

[40]For example, rising damp in houses due to the use of inappropriate materials increases the moisture in such houses and could result in respiratory ailments, colds and fungal infections.

[41]This method is not only applicable to geological and morphological aspects, but also to criteria such as climate, ecology, agricultural yields and economic, social, tourism and recreational aspects. By combining all these aspects, the overlay process could delineate areas suitable for certain types of developments.

Geological factors do have planning and urban design implications and should be integrated in their planning processes.

7.5.4. Conclusion to the Natural Dimension

This section has emphasised the role of the natural environment in planning/urban design and has attempted to suggest some ways that natural processes may be incorporated into the urban scene. The incorporation of the natural dimension may increase our contact with nature, but more important is that the protection and enhancement of natural processes will have social, economic and ecological benefits.

By considering the natural processes of the environment, modifications to urban form will occur. This will result in a settlement with enhanced sustainability.

Finally, the concepts discussed have uncovered the necessity of a multi- and inter-disciplinary approach to environmentally sensitive settlement planning. Access to technical data and to specialists is needed in order to incorporate these issues into settlement planning warrants such an approach.

It is hoped that in the next chapter more physical characteristics of the natural dimension will come to light in the discussion on arid zone settlement planning.

7.6. SO WHY URBAN DESIGN ?

The approach of this dissertation is similar to that of Hough (1984), where it is argued that the integration of sustainability and urbanism can be achieved through the design process. As Hough (1984:17) states, "design is by definition a problem-solving activity - a process of integration. It makes connections between disparate elements to reveal potentials that may not otherwise be apparent. The insights that urban [sustainability][42] provides, when put together with social and economic objectives, creates a rational basis for design". Hutchings (1989:167) states that "from an urban planning viewpoint, perhaps urban design is simply that part of the planning system concerned with the quality of the end product; that our cities, towns and neighbourhoods should work well, look good and have a durable character that citizens are comfortable with over a long period".

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[42]Hough (1984) uses the word ecology. The author has replaced this with sustainability, since this essay, although linked in ecology, does not propagate it. In order to flow with the content of this dissertation, the word has therefore been changed.

This author, in agreement with the previous two authors, believes that urban design is the final visible product of planning. Planning without a result is meaningless. Quite often contemporary planners forget about the physical aspects of planning, but the result of planing invokes physical change and in order to achieve an optimal result, physical planning must consider the inclusion of urban design aspects as planning policy. By not linking the two, past planning standards have resulted in a built environment that does not respond favourably to people's needs. A third dimension therefore needs to be included in planning. This third dimension, which the author refers to as urban design, links the plan form and the built form with function. Pressman (1981:4) states that urbanity has acquired a new meaning, emphasising that quality can be applied to "spatial and functional organisation developed in reaction to planning practice" which emphasised standards, and segregation of land uses.

This does not mean that planners are urban designers. Urban design in its own right is its own profession, but it is integral to planning. Furthermore, environmental issues are not the sole responsibility of any profession. Integration is essential.

A goal of this dissertation is to illustrate that urban design concepts, including basic architectural components, are of relevance to urban form, since they can form design principles that ought to be considered by planning. Urban design is therefore conceptually referred to in this dissertation. The reason is that, in exploring the relationship between the built and natural environment, urban design concepts were found to hold benefits in the attainment of a sustainable urban desert form. The basic principles for attaining an appropriate urban form, covered in the following chapter, are in essence design oriented.

7.7. SUMMARY AND FINDINGS

This chapter has emphasised the importance of design in the creation of liveable and sustainable cities. By linking liveability and sustainability to environmental quality, it pointed out that environmental quality can be achieved through design. The role of urban design was also discussed to place it within a context of development. Since urban design is both visual and functional, it is mostly perceived visually. Given this, principles, qualities and guidelines were outlined which could help in the evaluation of a settlement's image. On a perceptual level, the form of a settlement was noted to consist of five elements. These could help us to analyse settlements beyond their basic patterns and textures as discussed in Chapter 5.

For settlements to become liveable and sustainable, urban design needs to consider the relationships between the built and natural environment, as well as the human and built environment. In so doing, urban psychology and the natural dimension was briefly discussed. From these two sections important design concepts were noted which could help in enhancing the urban environment.

Ultimately, this chapter explicitly states that policies for change and planning "have little meaning until they achieve designed expression in physical/social environments. Qualitative design [principles and guidelines] can impact on policy planning and help to shape it. Design is concerned with the precise physical/social forms which will emerge from planning decisions" (Eckbo, 1985:224).

The main points transcending from this chapter can be summarised as follows:

1. Planning and design are not separate activities, they are part of a continuing process.
2. Environmental quality can be attained through design.
3. Environmental quality is inherent in design, and if the relationships between the natural and built environment as well as human and built environment are understood, design can be implemented in a sustainable manner.
4. The major principles of urban design are function, order, identity and appeal.
5. These principles along with their qualities and guidelines can help in the evaluation of settlements and ultimately point out areas that need to be improved.
6. The physical and social environment can be enhanced through design measures. For example, buildings and spaces can be arranged so that they discourage crime and harness benefits from the natural environment.
7. Finally, urban form is influenced by design. Sustainable design could therefore alter the form of a settlement.

"The one charm of the past is that it is the past"

Oscar Wilde

CHAPTER EIGHT : ARID ZONE SETTLEMENT PLANNING

8.1. INTRODUCTION

The purpose of this chapter is to present an outline of the basic characteristics of settlements in desert environments. The forces that shape these settlements will be discussed and in most instances it will be noted that design for human comfort is of major importance. Furthermore, the arrangement of these settlements could have design and policy implications for Walvis Bay.

This chapter is divided into two sections. The first section is a review of settlements in a variety desert environments. This section attempts to discover trends concerning the planning of settlements in desert environments. The second section identifies certain policies and design considerations that may be of benefit to Walvis Bay.

8.2. A REVIEW OF SELECTED SETTLEMENTS IN DESERT ENVIRONMENTS

This review, in terms of analysis, was not set out with any yard-sticks, except the assumption that settlements in desert environments might have similar design characteristics. In trying to identify these characteristics, it was hoped that they could help set guidelines for development in desert environments. Detailed scientific criteria for the analysis are lacking, but it is nevertheless hoped that this review will highlight the importance of appropriate planning in desert environments.

A brief analysis of planning and morphology in Australia, Tunisia, Israel, Kuwait, Egypt, Arabia, Namibia, South Africa and the United States, reveals that the only characteristics settlements in these countries share, are the harsh environment of the desert itself. Little homogeneity could be found in design, negating the hope that a possible panacea for planning could be found in these environments. Perkins (in Golany, 1978:193) summarises this finding as follows: "The fact that a community is located in an arid region does not immediately define its physical form". This is a result of differing ideologies rather than physical environmental determinants. For this reason a distinction could be made based on the age and cultural forces that shaped these settlements. The distinction is, that settlements in Tunisia, Israel (the ancient settlements), Arabia and Kuwait developed historically. Through the years they adapted to the environment by coincidence rather than

by design[43]. As opposed to that, settlements in Australia, the United States and South Africa developed fairly recently and can be considered as pioneering settlements or planned developments based on a foreign ideology.

8.2.1. Arabic Settlements

The settlements of Tunisia, Egypt, Israel[44], Kuwait and Arabia (hereon referred to as Arab settlements[45] or ancient Middle Eastern settlements) adapted their settlements through the wisdom of experience, resulting in a specific urban character and architecture appropriate to their environments. In many instances these settlements adopted a form that was determined or influenced by climate. These settlements therefore evolved. However, the notion of climatic determinism, though an important form shaper, should not be romanticised in terms of primitive settlement design[46], because as discussed in the chapter on Urban Morphology and its theories, cultural values and significance were the overriding factors determining settlement form. Symbolic and cosmological theories were prominent in settlement form rather than climatic determinism. Nevertheless, the resulting morphologies and typologies do have ancillary benefits and in many instances the design of these old settlements was replicated through the refinement of new architectural and engineering techniques. Basic concepts from these old Arabic cities are still applied today. Arguably, the historical process of functional theory, as a branch of theory explaining urban form, can be applied to these settlements.

Urban form of the ancient Middle Eastern settlements varied. Not all ancient cities grew organically, that is without a preconceived plan. Some ancient cities were planned and thus a result of a predetermined intention, such as el-Amarna in Egypt (Morris, 1994). The degree of planning depended upon military, religious and social levels of complexity.

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[43]In later centuries, Islam did, however, perpetuate a specific urban form.

[44]Here reference is made to the ancient settlements in Israel.

[45]The term Islamic settlement is more accurate. However, the term Arabic settlement is preferred since these settlements are not purely a result of the Islamic period. As Morris (1994) reports, Islam had a major influence on the urban form of such settlements, but pre-Islamic features influenced Islamic urban form. "Islam perpetuated the essential morphology of the ancient Mesopotamian city, through a system of decision-making governed by semi-legislative urban guidelines" (Morris, 1994:26).

[46]Lowry (1991:129) proposes that the "generally uniform morphology of the older buildings is probably due to the limitations of the contemporary technology. Walls are both membranes and supporting members for upper stories and roofs - the more stories, the thicker the ground-level walls. . . the need for a maximum amount of bearing capacity for each running foot of outer wall made small windows the rule". Golany (1978) and Stea & Turan (1993) to mention a few, all propose similar ideas.

Urban form was therefore determined by human aspects, which in addition to those just mentioned, included other determinants such as economics, defence, culture and politics. The urban form of these settlements was also determined by location and influenced by aspects such as climate, topography, access to water and construction materials (Morris, 1994). As discussed earlier, the form of a settlement is influenced by a complex relationships of these determinants. Most of these issues have been covered earlier and it will be noted later that many have design principles which ultimately influence urban form.

In terms of urban form two features of ancient cities, ultimately carried on by the Islamic culture and religion are striking. The first, which applies to almost any settlement around the world, is that shelter is a fundamental human need and takes varying forms according to climate. In the ancient Arab settlements this predominantly took the form of an inward looking typology which had a courtyard. Morris (1994) proposes that many settlements acquired an organic form as a result of such typologies. Therefore, climate as a determinant of housing layout influenced the residential layout of settlements, ultimately influencing urban form. The second feature is that in most Arab settlements there was no major distinction between home and place of work. It was only with the advent of Islamic laws that some separation did occur (Morris, 1994). Mixed land uses were therefore evident in the early settlements.

Morris (1994) argues that pre-urban cadastre and urban mobility were major urban form determinants. Pre-urban cadastre such as rural property boundaries (for example a wall, or a man-made stream) were recognised, thereby influencing urban form. Interestingly, they can still be recognised today[47]. Urban mobility dictated the size and proportion of most ancient streets. This remains true, but in most Arabic settlements, as Morris (1994) remarks, "the minimum was taken to mean the maximum as well" resulting in narrow streets. However, streets "were the result of the patterning of buildings" (Morris, 1994:389), unlike modern Western settlements that are planned for the vehicle first and foremost.

Street systems in Arab settlements created an interesting layout. In most settlements, houses were grouped together in distinct units created by a cul-de-sac. Furthermore, in planned ancient urban settlements, the urban form seems to take on a grid-iron appearance. As Morris (1994:12) points out this appearance predominantly took the form of a super-block where "laissez-faire infilling of the grid-block occurs" (See Figure 23). This could ultimately give rise to the cul-de-sacs. El-Amarna is a classic example of such an urban configuration.

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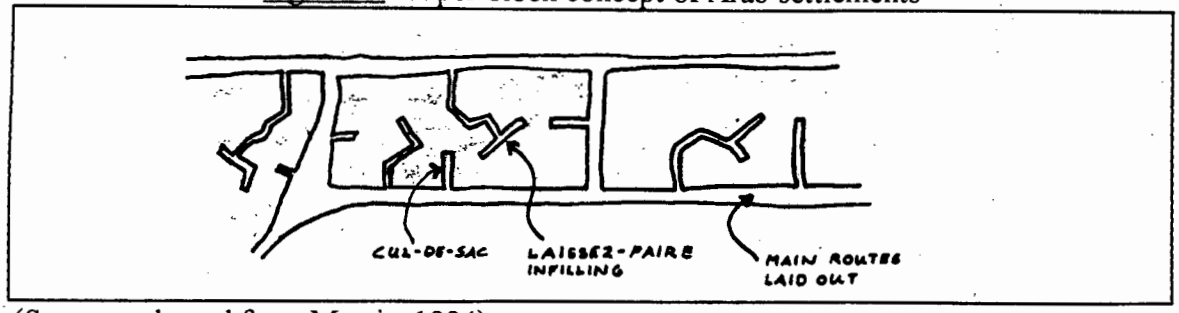
[47]The layout of Johannesburg and even its CBD, within the triangular portion between three farms, forming the Randjeslaagte, has given the centre of Johannesburg a peculiar shape and many streets at the seams of these old boundaries form irregular intersections today.

Figure 23: Super-block concept of Arab settlements



(Source: adapted from Morris, 1994)

The super-block concept can be regarded as partial urban planning, where main route structures are laid out and the rest is left to infilling (Morris, 1994). During the European Baroque period, streets were laid out for aggrandisement[48] thus setting out important streets first and letting the adjacent areas fill up. A similarity between the two periods can be noted.

The ancient city prevails today in the form of many Islamic cities situated predominantly in the Arab world. It can be argued that their ability to retain an urban form similar to that of ancient Mesopotamia, is due to the laws of Islam which perpetuated certain urban guidelines[49], but it can also be argued that the settlements were appropriate to the requirements of humans, sustaining them and providing comfort from the natural elements.

8.2.2. Israeli Settlements

Although ancient settlement patterns in Israel are included in the list above of Arab settlements appropriate to their environment, Israeli settlement planning (c. late nineteenth century until now) in general was not appropriate to its environment. The reason is that settlement planning in Israel was manifested through a number of ideologies and politico-strategic decisions which required an urban form that was security oriented, rather than environmentally (climatically) oriented. For example, before 1967 settlement patterns were based on Zionist ideals that emphasised agriculture and communitarianism. Kibbutzims and moshavs flourished during this period and are considered one of the few successful

[48]Aggrandisement is the glorifying of certain urban features. Note that the Baroque axial network can be regarded as a form of aggrandisement.

[49]In Namibia for example, the abandonment of many pioneering German settlements, i.e. Kolmanskop, was not due to an abandonment of faith, but to a harsh environment not conducive to the formation of a settlement able to sustain human life.

attempts at utopian community design[50]. Classical Zionist thinking was anti-urban, and the dominant ideology was that of a "physiocratic utopia of a Jewish peasantry" (Troen, 1988:3). The structure of Zionist agricultural settlements was largely the product of "ideologies that blended varying degrees of socialism with pioneering, while their location was dictated by security needs" (Troen, 1988:6). It follows then, that such settlements forms could be described through a combination of functional conflict theory and the city-as-a-machine normative theory of urban form. After 1967, non-agricultural villages, now termed urban but within rural settings[51] were being established in Israel for strategic reasons. These settlements were primarily determined by defensive needs. The typical form adopted, was concentrated and circular with limited access. Once again, both functional and normative theories influenced the urban form of these settlements. However, the spatial phenomenon of these settlements can also be explained through planning theory, since strategic decisions moulded a particular urban form[52].

In general, the form of these settlements did not consider the arid environment, especially its climate. Golany (1979:31) states that "urban and housing patterns used in the arid zone were largely the same as those in non-arid areas of [Israel]"[53]. Although climatic stress was considered in the orientation of a few single buildings. The few settlements that did consider environmental constraints (though not fundamental) in their planning and design, were, to mention a few, Elat, Haifa and Beer Sheva (Golany, 1979).

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[50]In Chapter 5 where urban form theories are discussed, the reader is drawn to the normative base of such settlement forms. However, in this case of kibbutzims and moshavs, the normative ideals were anti-urban establishments, since they emphasised rural living. Reference is, however, made to them since they are human habitats in desert environments, which may have bearing on desert settlement design.

[51]Troen (1992) refers to urban oriented communities in rural settings that are explicitly non-agricultural and having no functional relationship with the area in which they are situated, as rurban settlements. These settlements have a primary relationship with urban centres close by, but are not dormitory towns.

[52]Coincidentally, this discussion illustrates that no urban form can be explained through a single, clear-cut theory. Settlements gain a particular form through a number of interacting processes which can be explained through the various spatial theories. As mentioned earlier, the theories do impose on each other and cannot be viewed as inseparable.

[53]Golany (1979) and Troen (1988) mention that the garden city movement and its principles had a profound influence on settlement planning in Palestine/Israel. Troen (1988) argues that it was thought that the physical design of the garden city could contribute to the shaping of society. This would have a profound impact on the social environment. Whether it did or didn't is unclear. Golany (1979) states that the garden city design was highly inappropriate for arid areas. Nevertheless, a spin off from the movement, namely that of compact settlements could have relevance to arid areas.

In recent years, environmental parameters have been given greater priority in settlement design. For example, the new city of Bet-Shemesh (halfway between Tel Aviv and Jerusalem), although not in a desert environment, epitomises the use of climatic settlement planning. Climatological and other environmental parameters were integrated at all planning levels, from the regional site selection to building design, in the development of this settlement (Bitan & Potchter, 1995).

8.2.3. Australia, South Africa and Namibia

In Australia, South Africa and Namibia[54] settlements were in general built in terms of British and European standards. Freestone & Hutchings (1993) state that the spatial arrangements of Australian settlements had their roots in British planning ideology, driven by imperial, commercial and bureaucratic expediency. Home (1990:25) points out that "town planning had a symbolic role in creating an urban form which could reflect the greatness of the [British] empire", whether in India, Israel, South Africa or Australia. In the Southern African context and Australian context the city beautiful[55], city functional and garden city philosophies influenced planning in the early twentieth century. Although their concepts were adapted to suit indigenous constraints and opportunities, they weren't really appropriate to their environment. Shih (in Golany, 1978:201) sums up the inappropriate transportation of standards as follows: "In nineteenth century England, the plight of the early industrial cities of this country brought about an awareness of the need for light, air, and open space. These needs became codified in the form of zoning laws and sub-division regulations, and after several generations the established land use patterns achieved the status doctrine. They were then brought without change to new cities in arid lands"[56].

In the Australian desert new communities (especially mining settlements) are constructing pit dwellings to utilise the inherent coolness of the earth, a concept used by ancient communities in the Middle East and Meso-America. In north-Western Australia at Shay Gap, the houses are crowded closely together in a semicircle, to cast shadows on one another. Furthermore, the settlement has narrow walks between houses. Although this settlement is inspired by the Arabic city, this layout and the subterranean layout are not wide-spread or typical of Australian settlements.

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[54]In chapter 10, Walvis Bay, a settlement in Namibia, is analysed in detail.

[55]This movement was based on the ethos of civic improvements and aesthetics.

[56]Note the implicit progression from normative values emphasising quality and "city as a machine" theory, to planning theory, explaining urban form in this statement.

8.2.4. Settlements in the United States

The proclamation by King Philip II of Spain in 1573[57] (*Law of the Indies*) did not have a profound impact on settlement form in the Spanish settlements found in the present United States desert areas of California, Arizona, New Mexico, Texas and Colorado. Morris, 1994:305) indicates that the "legislation was not strictly enforced", and states that the isolation and distance of these settlements from each other, implied self governance to a certain degree.

However, certain settlements did have basic elements stipulated by the *Law of the Indies*, such as the central plaza, with specific dimensions for lots and streets around the plaza. In many instances function of the settlement dictated its form. Three types of settlements were established by the Spaniards in North America: presidios (military bases), pueblos (centres for trade and agriculture) and missions. Each one had a particular form in relation to its function. Furthermore, because they were established in hostile territories, most were planned in "response to strategic requirements of concentrating scarce human resources in a restricted and therefore militarily defensible perimeter" (Morris, 1994:316). These settlements predominantly had a defensible perimeter and were concentrated. This ultimately formed the basis for the presidios. Pueblos were in many instances located next to, or based on existing Indian villages and were slightly influenced by the *Laws of the Indies*. Segregation occurred in these settlements (but also in the presidios), with areas "planned" or set aside for Europeans and Indians respectively (Morris, 1994). Missions were quasi-urban and were left to the Franciscans or Jesuits to develop into self-governing civil towns, however, still under the requirements set out by the colonial powers (Morris, 1994). Function therefore dictated the urban form of many of the early Spanish settlements in the arid regions of the present United States.

Yellott & Aiello (in Golany, 1978), point out that neither the Spaniards[58] nor the Anglos considered the environmental demands made by the desert. Their needs were to establish settlements with relative ease and they therefore adopted a grid pattern[59].

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[57]This proclamation set out laws and standards for the layout of towns in the New World, and these considered the relationship between climate and town layout. The proclamation, as discussed previously in Chapter 5, was to reduce the fuss in setting out new towns. The "city as a machine" concept of normative theory, is the underlying facet of urban form in this example.

[58]Many of the Spanish missions built in the desert were identical to those missions in Spain. The Mediterranean design (high ceilings, covered patios and courtyards) was therefore also effective in California, Mexico and Arizona.

[59]This is a good example of the "city as a machine" concept, a Normative Theory of urban form discussed in chapter 5.

Pre-Columbian indigenous Indian settlements in these areas may have considered climatic features in their layout of settlements. These were not considered by the new pioneers, although assimilation of primitive responses can be seen in various Indian communities today. For example, a characteristic urban form is that of cliff-dwellings, where houses are built against a cliff [60](Stea & Turan, 1993; Golany, 1978). These settlement patterns are isolated cases and in no way extensive, nor do they have an impact on current settlement planning practice in the United States.

By the turn of the century, builders in Phoenix (Arizona) realised the benefits associated with designing buildings with the climate in mind. For example, continuous raised and covered sidewalks were erected in the business area to provide some degree of protection. Furthermore, the benefits of having a large veranda surrounding the house to provide cool living areas were included in the design of stylish houses[61]. The concept was abandoned in the 1920s in the United States (Cook, in Golany, 1978). It can therefore be assumed that modern settlement planning in the desert regions of the United States is not fully appropriate to the environment. Yellott & Aiello (in Golany, 1978:61) state that the "structures that they [the Spaniards and Anglos] built may have been appropriate to the cities from which these builders came, but they generally ignored nature's demands in a region where sunshine is magnificently abundant, rainfall is so scarce...".

Steiner (1994) also mentions that many modern settlements in the desert zones are sprawled, and designed for vehicles. As discussed in Chapter 6, sprawled settlements are unsustainable.

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[60]It has been proposed that the primitive response to such a settlement may have been more than seeking comfort from the climate, but rather an attempt to enhance the relationship between shelter and agriculture (Golany, 1978; Stea & Turan, 1993). For example, the fertile valley floor was used for agriculture rather than housing.

[61]The concept of having a veranda surrounding the house was also implemented in Australia and South Africa. However, the concept was not broadly practised and was considered old-fashioned. These houses can still be noted on old c. 1920s farmsteads in South Africa. Furthermore, the veranda style house was just a design modification to individual dwellings, creating a house typology, but not really influencing urban morphology. Some authors do, however, contend that in many settlements which had veranda houses, the social fabric of the towns was more closely linked. This is considered to be as a result of the street area being integrated into a so-called living environment. In recent years in South Africa, a few individuals have been calling for a return to these houses, because they face the road, which means that stronger communities could be promoted with a possible decrease in crime. Present trends in housing designs do not seem to adhere to this call, especially in the middle-income groups.

8.2.5. Impact of Technology

The impact of technology (such as transport and air-conditioners) also influence settlements. In certain Arabic cities urban growth led to the adoption of modern standards that weren't appropriate to the environment, as they rely heavily on technological solutions. In many of these cities, the so-called modern quarters, differ greatly from the settlement's original patterns and they are not as comfortable to live in. Leipold (in Golany, 1978) reported that in Tripoli (Libya) when the hot desert wind blew, the Arabic quarter "did not feel it". But in the modern quarter, he noted that one had trouble walking in the street because it was oriented in the direction of the hot desert wind. In Western settlements (notably the United States, Australia and Namibia), many of the desert settlements are sprawled, an effect of planning for the motor vehicle.

8.2.6. Discussion on Arid Settlements in General

An examination of settlements in different countries, to see if there is a basic desert settlement, has proved otherwise. Australian settlements may be similar to American, Namibian, South African and even European settlements, but not appropriate for the desert. In Australia new settlement designs are being used, but no homogeneity in settlements can be found for basic desert planning in that country. In settlements in the Middle East and north Africa, some degree of homogeneity was found, but it was based on cultural precepts and not environmental determinism. Even these settlements were corrupted by colonial influences, giving rise to modern settlements based on European standards. In Israel the various ideologies and politico-strategic decisions gave rise to varied settlement forms, however, with security in mind. In America the Spaniards, Anglos, Mormons[62] and native Indians all had their own settlement structure, but these never blended into each other. Each country therefore had its own responses to settlement design. Globally no true environmental deterministic homogeneity can be found in desert settlement planning and design. The theory on urban form has proven likewise; namely that there is no single good plan (Golany, 1978; Findlay & Paddison, 1986; Efrat, 1993; Auster, 1989; Hedgecock & Yiftachel, 1994; Home, 1990; Bunker, 1988).

The proof of this theory was not the objective of this review, since the author accepted the fact that there is no single good urban form. However, the author sought to see if there possibly was a single coherent climate-deterministic urban form which could be applied in

[62]Salt Lake City, the world centre of the Mormon Church, was founded on religious precepts (thereby having a normative theoretical base), but its layout was inappropriate to the harsh arid environment. Some degree of adaptability did occur, in certain Mormon communities, where, settlement patterns were culturally based on communitarian principles, but the impact was not profound.

principle, ultimately forming or even reiterating a new urban form theory specific to desert environments. Nonetheless, the following lessons were learnt.

Firstly, by inspecting the modern settlements of Australia, Namibia, the United States and the modern "suburbs" of the Arabic cities, we can note that many planning standards are inappropriate for desert environments. Change needs to occur.

Secondly, from the Arabic cities which have their roots in the ancient cities, we can note that man has thrived in the desert by clinging to resilient prototypes. By accident, these prototypes have proven to be most effective in desert environments. Although climatically oriented, the design of these settlements could prove to be of value to desert settlements all over the world. Recent planning of new settlements in Israel could prove to be the modern prototype envisaged for desert settlements, from which principles can be drawn. Modern settlements in desert environments could therefore possibly adopt a new urban form, based on old lessons. The older techniques may become the methods of last resort, especially in the search for sustainability.

Apart from its climatic adaptability, the Arabic city reveals two further lessons: first, little land is used for the settlement; and second, the streets are narrow. Coincidentally this coincides with the characteristics of a compact settlement. Headway can be made in attaining a sustainable settlement by adopting principles and concepts of these urban forms that combine climatic adaptability with the advantages of the compact city. The underlying theme is that physical design must be sensitive to the existing environment and must enhance it.

The next section will discuss the basic concepts that could be adopted from the Arabic city design. It is proposed that these basic design elements will form the basic principles of a "new" prototype for modern desert settlements. This will ultimately enable us to apply new planning standards or guiding principles for Walvis Bay, and possibly other desert settlements. Furthermore, it is proposed that these policies be included in the coastal zone management plan relating to urban settlements and urbanisation.

8.3. LESSONS TO BE LEARNT FROM DESERT SETTLEMENTS

It is evident from the previous section that certain design applications from the Arabic city could have beneficial implications for modern desert settlements, especially in Namibia. Due to their contemporary nature, design implications from certain experiences in Israel will also be considered. The purpose of this section is to consider the inclusion of some of these design implications in planning policy for modern desert settlements. Although the design implications are predominantly climate oriented, the overall effect - that of a

compact city - will become evident and will have other planning (such as density) implications.

The physical nature of these design implications are socially and economically crucial. For example, poorly selected sites may have financial implications, reducing the real income of their inhabitants. Health implications may also become prevalent in poorly selected sites, which in turn could have an impact on the earning and income ability of the home dwellers. Moreover, the municipalities of these settlements have to spend more on social and health services, not to mention the maintenance costs of public infrastructure and services. Physical design policies are therefore important.

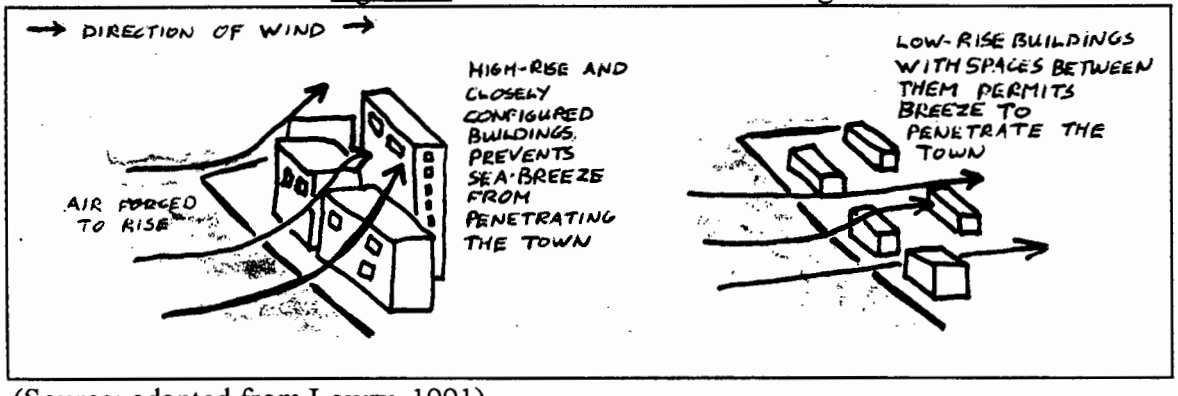
This section will not discuss the design and planning principles as utilised in the precedent settlements. Rather, it will synthesis these concepts into design and planning policy. This section will therefore highlight the policy and then give a brief explanation of the utility of the policy and the reason for its consideration.

The section in Chapter 7 discussing man-modified climates, illustrated the importance of considering climate in settlement planning. Emphasis was placed on the relationship between the built environment and nature. Air temperature, humidity and wind were discussed. Here they are re-emphasised only to illustrate their implication for design and planning policy.

8.3.1. Design Implications

8.3.1.1. Sea-land breeze ventilation

Figure 24: Sea-land breeze and buildings



(Source: adapted from Lowry, 1991)

It was noted from the design of Haifa, Elat, and Tripoli, that sea breezes provide a natural cooling effect. It is important to harness this sea breeze by not permitting high rise or closely compacted buildings along the sea front. If possible, these areas should also be

developed for residential use, since residential units are less able to afford high capital expenditures on providing other design modifications (See Figure 24).

8.3.1.2. Buffer Development

Most ancient settlements, especially the medieval ones, had a perimeter wall. Apart from being an obvious defence mechanism, the perimeter wall also minimised the effect of strong winds and reduced the effect of dust storms. The design of a perimeter structure or the use of vegetation could have a similar effect. It has been reported that the use of vegetation also lowers air temperature, acts as a filter by trapping dust and provides shade (see Figure 25).

A most important means of enhancing climatic conditions is through the design of urban configurations. A city dominated by large black asphalt streets and open parking areas is undesirable, because they absorb and reflect sunshine.

Figure 25: Buffer Developments

8.3.1.3. Street Layout

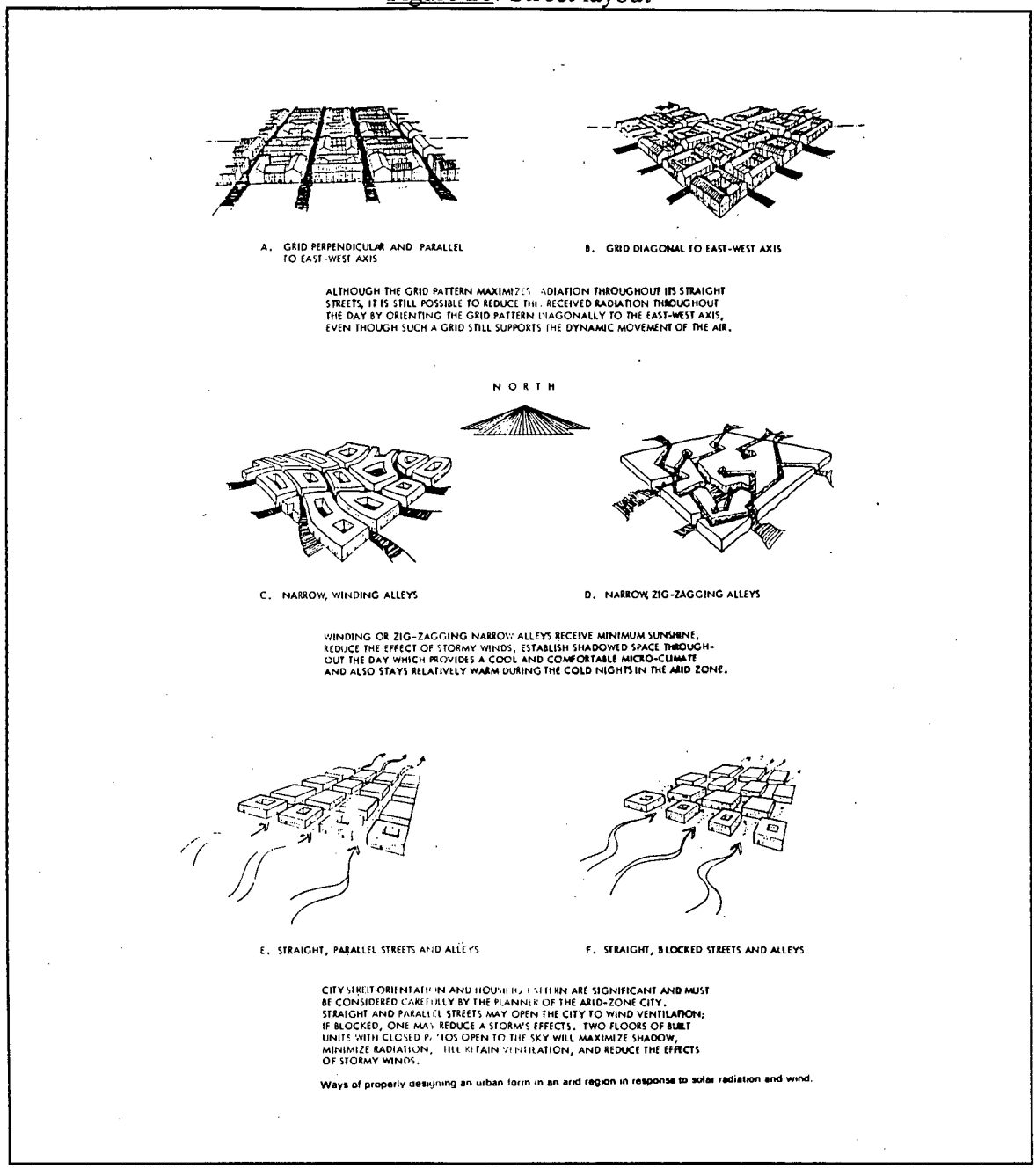
The winding narrow alleys of ancient cities provided shade and dissipated wind. Since winding alleys are not easy to plan, a simple orienting of a grid could reduce radiation (through the use of sun path alignment on buildings) and reduce the effect of wind (i.e. by planning the road grid against the predominant wind path).

Building configurations can also reduce wind and dust storms. Abrasive winds (due to sand particles) increase urban maintenance and accelerate the deterioration of buildings. It is therefore important to site land uses appropriately. A possible sliding scale in terms of ability to afford maintenance costs could be used. With this in mind, it is important that low-income settlements be buffered from abrasive winds. Furthermore, certain industries may need to be buffered or relocated on slopes that have lower humidity levels.

Design/planning principles for modern settlements should include:

- Orientation of street layout to consider wind patterns.
- Implementation of development control standards that consider the design distances mentioned above.
- Siting of low income developments in sheltered areas.

Figure 26: Street layout

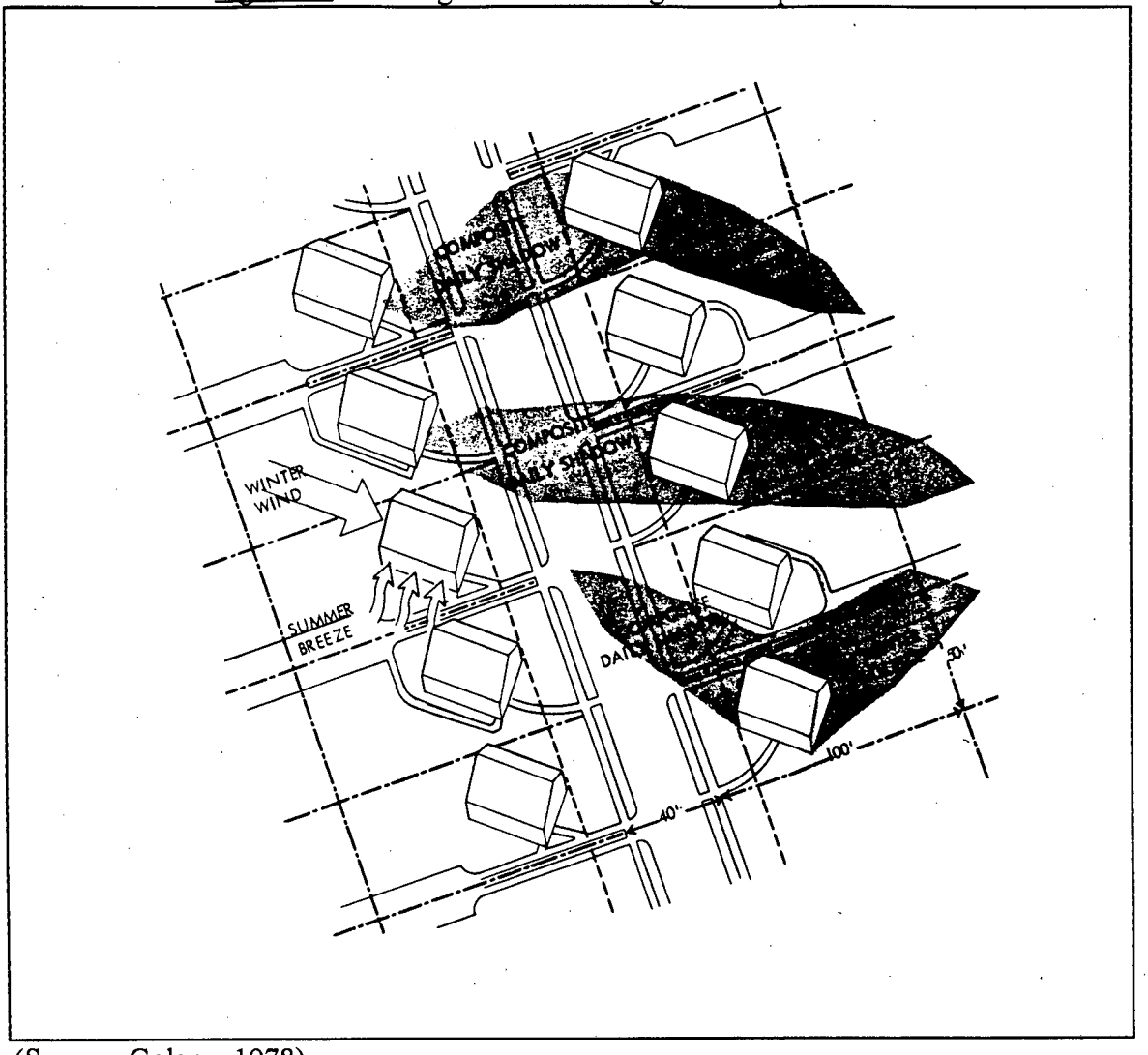


(Source: Golany, 1978)

8.3.1.4. Cumulative Shading Effect

The orientation of individual buildings could be planned so as to increase cumulative benefits in terms of shading. Shay Gap in Australia uses a semi-circular design so that buildings provide shade to each other. Figure 27 illustrates how houses have been oriented in a temperate zone so as to maximum sun access. In hot arid regions the reverse could apply, that is, aligning houses so that they cast shadows onto each other. Distances between buildings will have to be reduced and this may require the acceptance of smaller land units (erven). However, in cool coastal desert environments, houses may require some degree of solar gain. Therefore, designs must be manipulated to ensure shade, but also to ensure that buildings are heated adequately through passive solar gain.

Figure 27: Housing orientation design for temperate zone



(Source: Golany, 1978)

The design/planning principles should include the implementation of appropriate distances between buildings, through the use of development control.

8.3.1.5. Housing Design

Modern Western houses are not appropriate to hot arid/desert regions. For example, their windows let in heat, as do the roofs. At night these houses cool quicker. They are therefore inappropriate for areas which have high temperature variations. Specific housing designs need to be adopted for desert environments.

Furthermore, the Western house is designed for the nuclear family. In many desert environments in developing countries, of which Namibia is one, housing needs to be appropriate to the socio-cultural circumstances of that region. Bechtel, Ittelson & Wheeler (in Golany, 1978) reported that forced family separation may occur if only Western-style houses are available. They go on to state that this could have financial and social implications. They point to the fact that the extended family acted as "the chief conveyor of values to young, as the enforcer of law, as a welfare service for its poorer members, as baby sitters, an extension of church and school, as a place of usefulness and honour for the elderly" (*ibid.*:79). Housing typologies can therefore help promote a sense of community.

A number of typologies could also provide variety, enlarge the choice base and provide greater visual stimulus.

Figure 28: The courtyard house typology

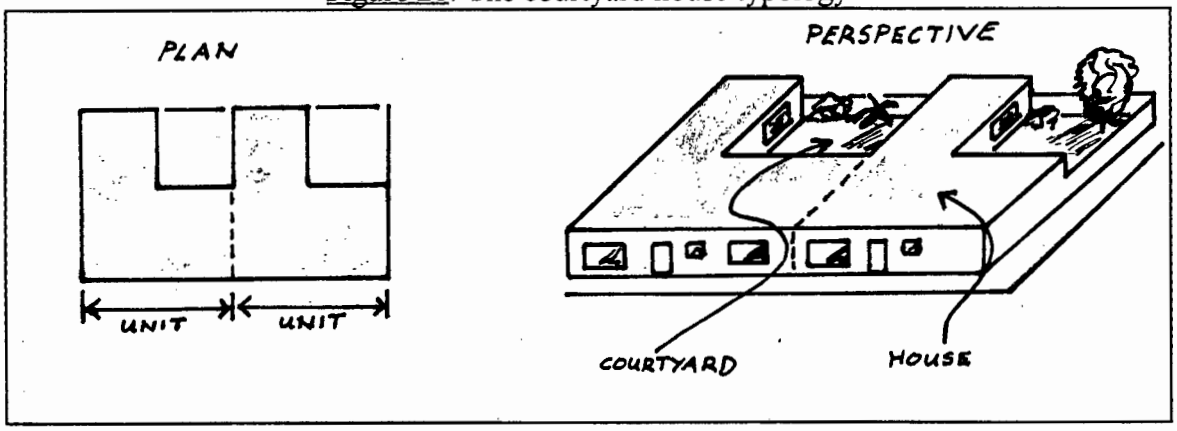


Figure 28 gives an example of the design of a courtyard house. This design has proven to be the most effective in desert environments, for it provides the maximum amount of shelter from wind, dust storms and sunshine.

Useful design/planning principles which should be considered include:

- Use of varied typologies of houses.

- Emphasis on the viability of other housing styles other than the Western-style house.

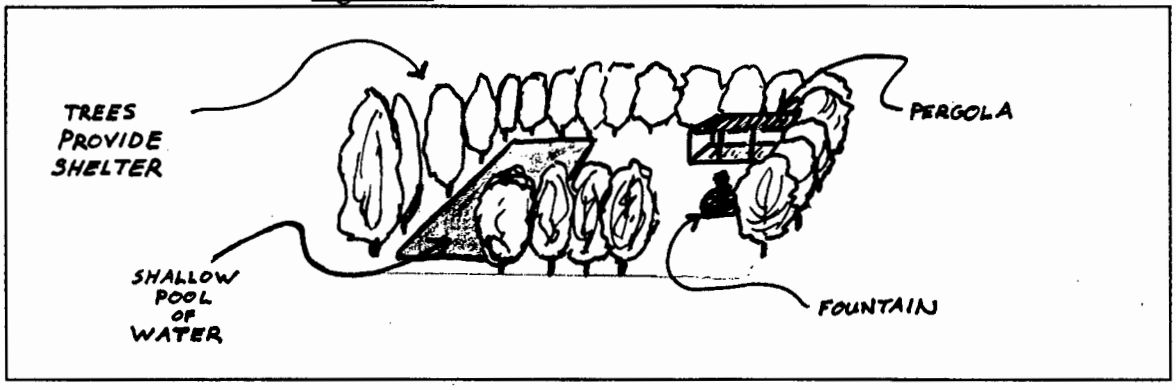
8.3.1.6. Water Features

To reduce excessive dryness, many Arab cities employed water features in gardens. It has also being proposed that the sound of water has a psychologically soothing effect, since it is in direct contrast to the harsh desert and increases human comfort.

The Alhambra in Spain, with its Court of the Myrtles and Court of the Lions, used water features to provide a cool and gentle area in the complex. The Alhambra, having Moorish gardens, was principally Islamic and Persian in origin. Many of the principles of the Moorish garden were developed in response to the arid climate. The primary principles were the maximum use of the minimum amount of water and the interweaving of interior and exterior spaces. Villa D'Este in Italy, also uses water as a cooling effect, and it has been suggested that the sound of water psychologically increases human comfort.

In desert environments, the use of water must be limited, since water scarceness is a reality. The Moorish garden, with shallow pools of water in enclosed courtyards, and other water features that use only a little water, enough to create the trickling sound effect, could provide some design principles for modern settlements. Large parks with large water bodies are inappropriate. Small parks that are not highly exposed with small-scale water features could enhance the character and vibrance of a settlement (see Figure 29).

Figure 29: Water features in sheltered areas



Design/planning principles to consider:

- The maximum use of minimum water in public places, and also for possible design detail consideration in certain houses.
- The planning of small open spaces and not expansive parks.

8.3.1.7. The Use of Trees and Vegetation

Shelter-belts, in the form of trees around settlements, offer protection against the hot winds and dust storms, provide shade, greenery and recreation opportunities, protect soils and road infrastructure against wind erosion and could even provide building materials for low income families, along with other enhancing characteristics mentioned in Chapter 7. To continue on the importance of trees and vegetation from a social perspective, Hough (1984:23) reports that gardening enhances community interaction, reduces vandalism and "improves the physical surroundings of low-income areas". He goes on to say that plants "help fulfil a vital element of emotional well-being by enhancing self-esteem". Earlier, it was mentioned how trees created a strong contrast to the desert environment, and enhanced perceptual abilities through the psychological interpretation of comfort and enclosure. Trees therefore break the visual monotony, and introduce a new landscape. This reinforces the point that trees and other forms of vegetation can enrich a desert town.

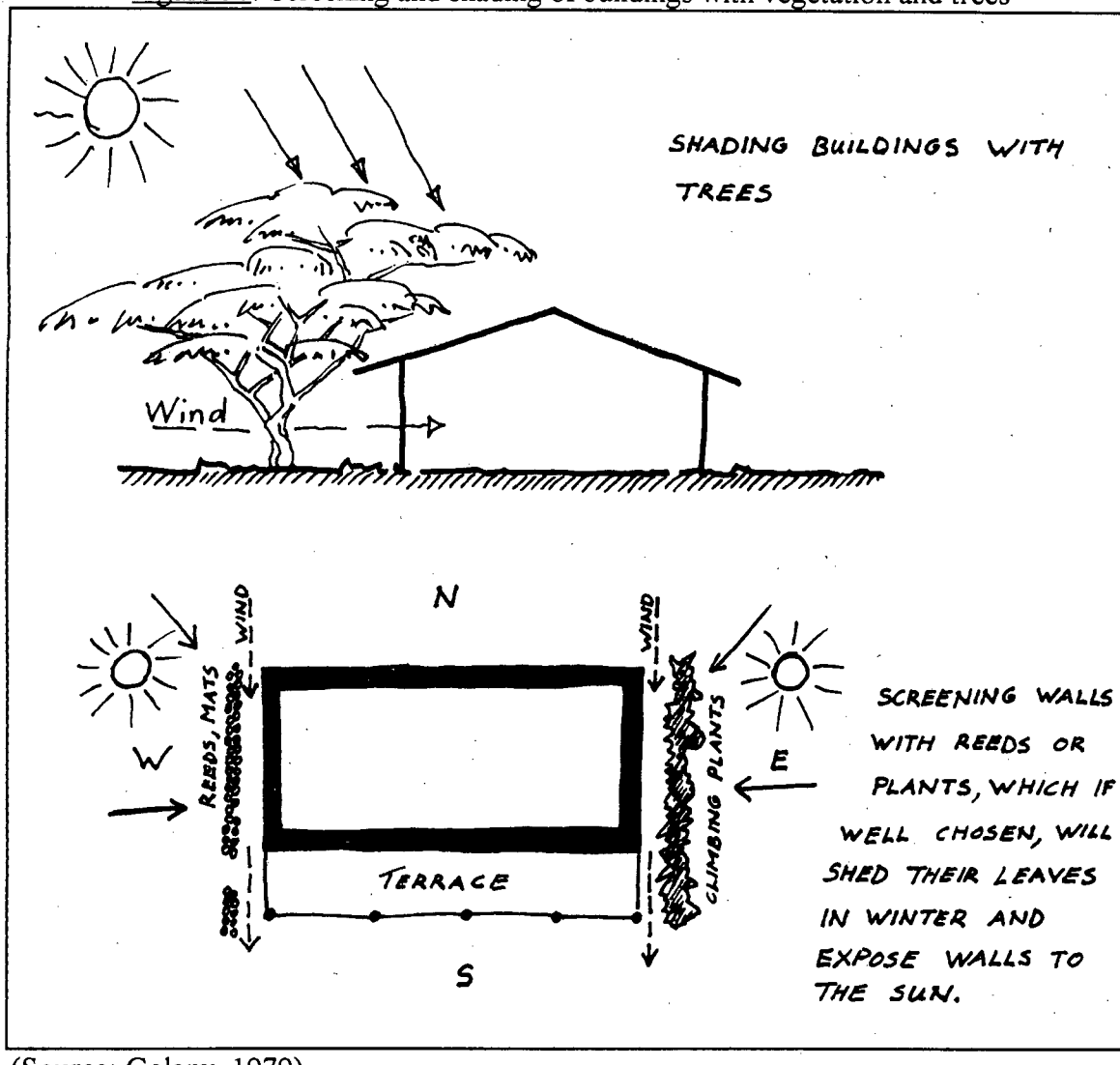
However, the hostile environmental parameters of the desert must be considered. The heavy winds, lack of water, excessive sunshine and infertile soils can all impose heavy financial costs. It is therefore essential to use vegetation that is indigenous or demands few artificial inputs. Large vegetated areas should be avoided, as they require too much water and other maintenance needs. Vegetated areas should be small enclosed areas, and should be designed in conjunction with the built environment, which can provide ancillary benefits, such as shade and wind protection.

It was mentioned that vegetation could increase climatic comfort through the lowering of temperature. This is primarily achieved by placing vegetation close to built structures such that they shelter buildings. The use of creeping plants against a buildings surface also reduces the heat load that a building can receive, while retaining moisture.

The use of trees and other vegetation should therefore be considered as a design principle and be included in planning policy. Design principles should include:

- Use of vegetation as a shelter-belt.
- Use of shelter-belt as a recreational strip, where the desert front could become a new "waterfront".
- Use of trees and other vegetation as structural elements in the town.
- Use of trees and vegetation to define spaces, thereby emphasising control.
- Use of trees and vegetation as climate modifying elements.

Figure 30: Screening and shading of buildings with vegetation and trees



(Source: Golany, 1979)

8.3.1.8. Self-help and Housing

Many ancient Arab and medieval cities, did to some extent develop incrementally. This meant that buildings considered the needs of the families and individuals. However, due to societal norms, these buildings did develop according to a specific prototype which, when viewed cumulatively, did blend into each other. The prototype formed the basis for homogeneity, creating a particular yet unique form. The key was that people developed according to their circumstances. Many settlements in developing countries still use the

concept of incremental building and self-help schemes. Since self-help housing will have a major impact on settlement form in Namibia, a detailed discussion on self-help follows[63].

The current world and local economic climate make it difficult for housing to be provided to all sectors of the community, especially where low-cost solutions are needed. With current world trends of privatisation, it becomes clear that housing problems could be solved by using another alternative, apart from direct government provision. The private sector could therefore have a lot to offer (Drakakis-Smith, 1981; Gilbert, 1992).

When the private sector is mentioned, the tendency is to think of an industry aiming for those who are financially secure. However, the private sector includes many categories of society, whether legal or not. The informal sector can therefore also contribute. With this line of thought, it is important to realise that housing is both a product and an activity. Considering this, and the fact that housing needs change and "organisations (private or not) can never adequately cater for all the endless variety of individual needs" (Nientied, 1985:312), it follows that the housing process will have to be left to the users.

With the failure of conventional housing methods and an increasing demand for housing as a result of rapid urbanisation, most of the urban poor have sought their own self-help methods to obtain housing. This implies squatting on which the conventional view is that it involves "the illegal occupation of land and self construction of shelter" (Amis, 1984:87). Both are misconceptions. Squatting does not always involve illegal occupation of land. Amis (1984) has illustrated that although illegal in terms of zoning regulations and other by-laws, occupants are often granted permission by the landowners, who can either capitalise on the land by selling it (without any administrative and legal procedures) or subdivide it into smaller plots charging rent. Smart (1986:38) noted that "although these transactions have no foundation in the formal legal system. . . most transfers of squatter property seems to occur in accordance with it".

Self-help is a market, providing access to commodity production. Smart (1986) states that self-help consumes commercial construction products, that building is often undertaken by others and that the labour used has a value on the labour market. Furthermore, self-help houses have values which could be realised on the market. The Namibian government is aware of these circumstances and believes that it should try to offer support to the

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[63]It has been suggested by a number of authors that the residential component of any urban settlement can be as much as 70% of a settlement's land use. It can therefore be assumed, that housing will have a major impact on the form of a settlement. In the chapter on Urban Morphology, housing type was discussed as giving a settlement spatial texture. A former section illustrated the viability of appropriate housing typologies that consider climatic variables and recommended that these typologies be considered in design and planning policy. This section discusses the importance of considering appropriate technology and self-help in housing and its inclusion into design and planning policy.

informal sector. Namibia has also realised its economic and technical constraints, and has admitted that it will be unable to provide low-cost housing (NDP I, 1995; UCT, 1996).

Certain constraints are making it difficult for the private (especially informal) sector to become effective in the delivery of housing to the poor. Land is probably the major constraint in providing affordable housing. High land costs can be attributed to simple urban land economics, speculative landowners as well as an over-expanding demand against an inelastic supply.

Standards and building materials also tend to make housing unaffordable. Irrespective of local culture and environmental suitability, housing designs rely upon Western-style houses that are inappropriate and expensive, and impose further restricting standards. Inadequate credit systems and the reluctance of lending institutions to finance low-cost houses also hinder access to housing. Limited public participation in the housing process, resulting in inappropriate solutions, is also exacerbating the housing crisis in Namibia (UCT, 1996; NDP1, 1995; MRLGH, 1994).

In Namibia over 60% of low-income households rely upon the informal sector's housing process for shelter (MRLGH, 1994). The Baseline Report for the CZMP for the Erongo Region[64] reports that Namibia has a comprehensive National Housing Policy. This policy recognises the vital role the informal sector has in the delivery of housing and has set in motion the implementation of a programme, known as "Build Together", which provides assistance to low-income groups. The details of this assistance are discussed in section 3.5.3.1 (page 37) of the UCT (1996) Baseline Report. The Namibian National Shelter Strategy and the National Development Plan 1 (NDP1), have made a number of recommendations to help aid the housing process. These include, *inter alia*[65]:

- the recommendation that local authorities be encouraged to adopt appropriate infrastructure standards (this will reduce the cost of development making land more affordable to low-income groups);
- the development of buffer zones in order to integrate previously separate areas;
- the revision and improvement of building and construction standards;
- the simplification of housing provision and planning procedures; and
- the encouragement of the use of locally available materials.

(UCT, 1996; NDP1, 1995; MRLGH, 1994).

[64]This baseline report forms the basis of this dissertation, and is referenced as UCT (1996).

[65]A short list of these recommendations is provided in the UCT (1996:39) Baseline Report.

These recommendations are emphasised, because they will have an impact on the urban form of a settlement. For example, the development of buffer zones[66], will create a denser settlement pattern, resulting in compaction. A revision of building and construction standards, as well as the encouragement of the use of local building materials, will result in a different urban fabric subsequently altering the town's visual image or townscape. The simplification of housing provision and planning procedures will alter the decision making process. As discussed earlier the decision process, as an element of planning theory explaining urban form, will alter the town's morphology. Subsequently, it will impact on urban form through the altering of normatively based values. This in turn will influence the choice of new appropriate standards.

In this respect, it is the author's argument that environmental parameters need to be considered in the decision process. Although the inclusion of environmental parameters results from an understanding of the relationship between the natural and built environment, thus being functionally oriented, it is also normatively implicit. That is, as discussed in the chapter on Sustainability, the adoption of sustainability principles[67], which are inherent in the acceptance of the functional relationship between the built and natural environment, are a result in a shift in values - the adoption of a sustainable worldview.

Design and planning policies for possible consideration could include the following:

- Planning legislation should be proscriptive rather than prescriptive. This is important because the process of housing must be supported and not suppressed. Furthermore, proactive planning will encourage development in other sectors as well.
- Guiding Policy. Such a policy is essential, so that land for development can be identified before development takes place. Land Banking, the holding of land by the state authorities could be a possible result of this guiding policy. At present, most undeveloped land in Walvis Bay is owned by the state and controlled by the municipality of Walvis Bay. In this way, Walvis Bay could delineate its urban form, since it can identify land for appropriate development and sell it off with certain conditions of establishment, which could include environmental design specifications. These conditions could then be transferred to the title deeds of created erven. However, this should be considered in conjunction with the next two policies.
- Community Involvement Policy. Government should act as a facilitator, though at times guiding developments. Community involvement increases people's control over their living environment.

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[66]Buffer zones are predominantly vacant parcels of land.

[67]The promotion and adoption of appropriate settlement design and planning principles are an aspect of sustainability. Since design is a problem-solving activity, it can be regarded as the final stage in the execution of sustainability.

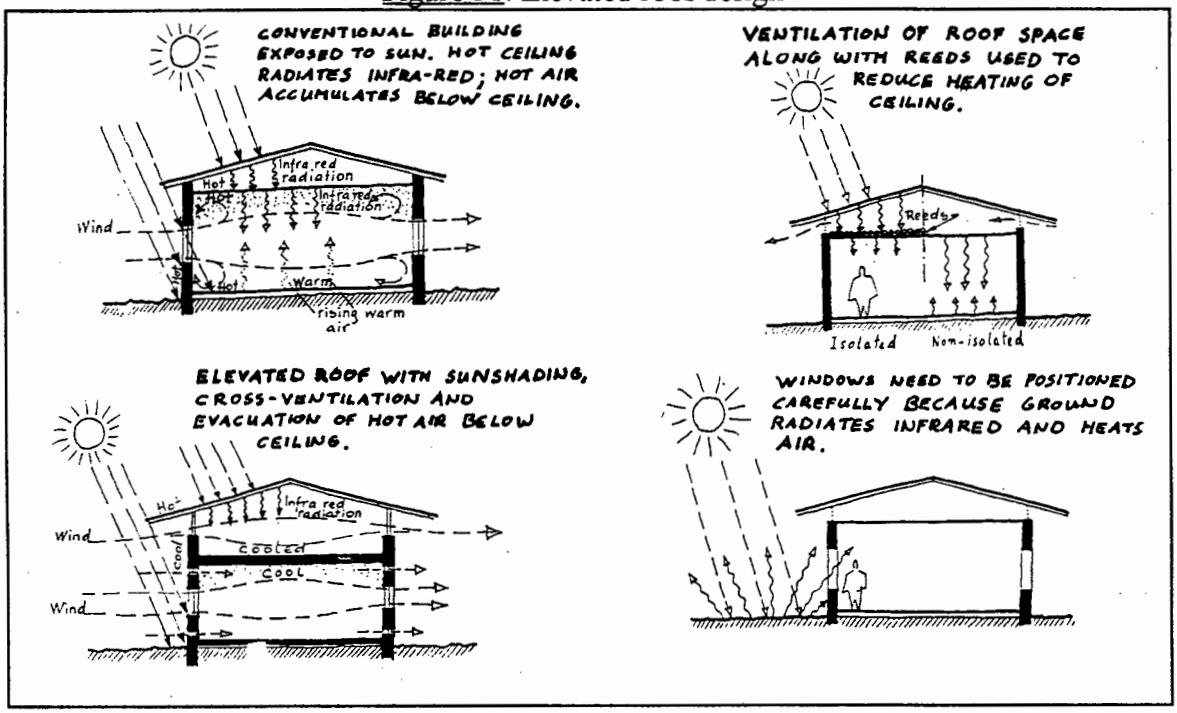
- Minimum Feasible Standards Policy. By reducing standards, costs can be reduced. A compromise in design standards needs to occur, where the optimal feasible standard can be applied. The authority could provide a basic model for development, similar to a housing prototype, that could be followed by others. However, the "the differences between 'popular' and 'official' norms [must be examined] in the light of the human situations and experience involved" (Turner, 1967:176). This policy needs to be considered in light of the design principles discussed.

8.3.1.9. Appropriate Technology

This principle will illustrate basic specific technologies that improve the comfort of a built feature without using expensive modern technologies. These technologies were used in ancient and Arabic settlements and before the introduction of modern technology in Elat (Israel) and have been extensively described by Kuhn (in Golany, 1979). Their use of basic materials and basic design alterations could be used in low-cost housing.

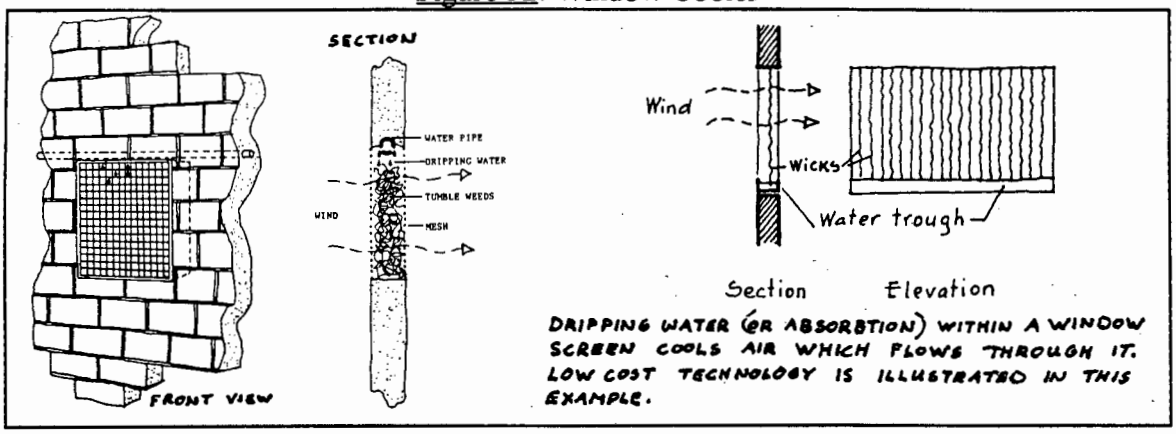
a). Elevated Roof Design (see Figure 31)
b). Window Cooler (see Figure 32)
c). Wall construction (see Figure 32a)It has however, been reported by Kuhn (in Golany, 1979) that thick-walled buildings are unbearably hot in coastal plains. This needs to be investigated further, since the statement applies to Israel.

Figure 31: Elevated roof design



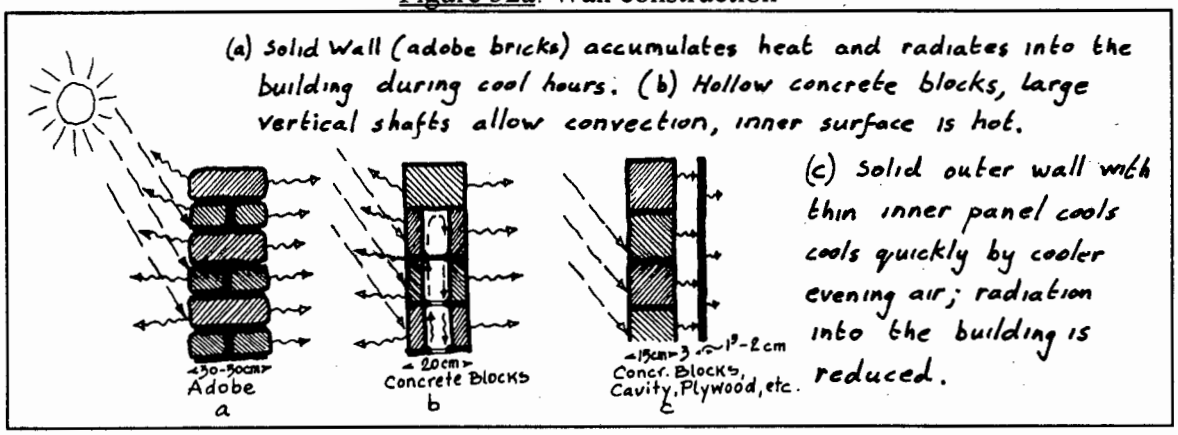
(Source: Golany, 1979)

Figure 32: Window Cooler



(Source: Golany, 1979)

Figure 32a: Wall construction



(Source: Golany, 1979)

The adoption of these basic design details could improve the comfort of the household, and reduce energy consumption. These design details also have economic and social beneficial implications and it is therefore important to investigate the feasibility of using them. If feasible, they could be used in the construction of low-cost housing. Furthermore, by educating people involved in self-help housing with these techniques, greater benefits can be achieved from low-cost houses.

The above-mentioned design implications followed from the review of settlements in desert environments. These settlements have created urban environments that are comfortable to live in. As a result, features of their built environment have been discussed here as possible design principles which could guide new developments in desert environments.

The remainder of this section will discuss design and planning principles with direct reference to issues of sustainability and urban form. Where the previous discussion predominantly revolved on the relationship between physical design elements, humans and the natural environment, and how they could be implement through physical design solutions, the discussion to follow refers to sustainability issues that have urban form implications through the adoption of an urban density policy. The discussion emanates from the review of settlements in desert environments. However, since all the Arabic/ancient settlements as well as those of recent planning history in Israel, are characterised by compact settlements, the discussion is also based on Chapter 6.

8.3.2. The Use of Density as a Planning Policy

The use of densities as a planning policy has a number of implications. A variety of these implications is discussed in this section. Once again these implications will provide us with specific planning/design principles. Before these implications are discussed, a brief introduction will be given on urban density.

8.3.2.1. Urban Density

An essential issue in the debate on compact or dispersed urban settlements is that of density. Urban density has three components: building density, occupancy density and population density. All three are related and interdependent. From a planning perspective, density implies the intensification of the use of space and is controlled through building density. Building density refers to the number of dwelling units permitted on each erf, expressed in units per hectare. It can also refer to the intensive use of an erven, thereby referring to bulk and coverage (percentage or ratio of land covered by a built feature). However, these are often development control mechanisms that influence densities and *vice-versa*. Development control mechanisms, *inter alia*, include: height restrictions, set back from the road, servitude setbacks, bulk and coverage ratios. These often provide the basis for planning standards and township layout specifications, which this dissertation argues should be more appropriate to their environments. Furthermore, densities are influenced through the typology of housing used. Obviously, these will have development control mechanisms appropriate to their configuration.

Urban density has a wide range of implications and is linked to economic, social, environmental and political factors. For example, economically, densities influence land values; socially, densities need to consider cultural precepts; environmentally, factors arising from the environment can influence the use of densities as is illustrated in the discussion on urban form; and politically, land is seen by many people as a symbol of power and access to decision making. The implications of density policies can influence water and electricity consumption and environmental quality and minimise transport and infrastructure. To this, it is often argued that high density living is socially unacceptable

and creates a poor living environment. This is a misconception and Elkin *et al* (1991) state that no direct correlation could be found between high density and dissatisfaction with living conditions. After all, high density is not synonymous with high-rise living.

From the ancient and Arabic settlements, it can be seen that buildings were and are tightly grouped in a circular manner. Apart from the environmental benefits associated with these settlements, in terms of interpreting the relationship between built features and natural systems, economic and social benefits accrue as well. These settlements are in fact high-density compact cities.

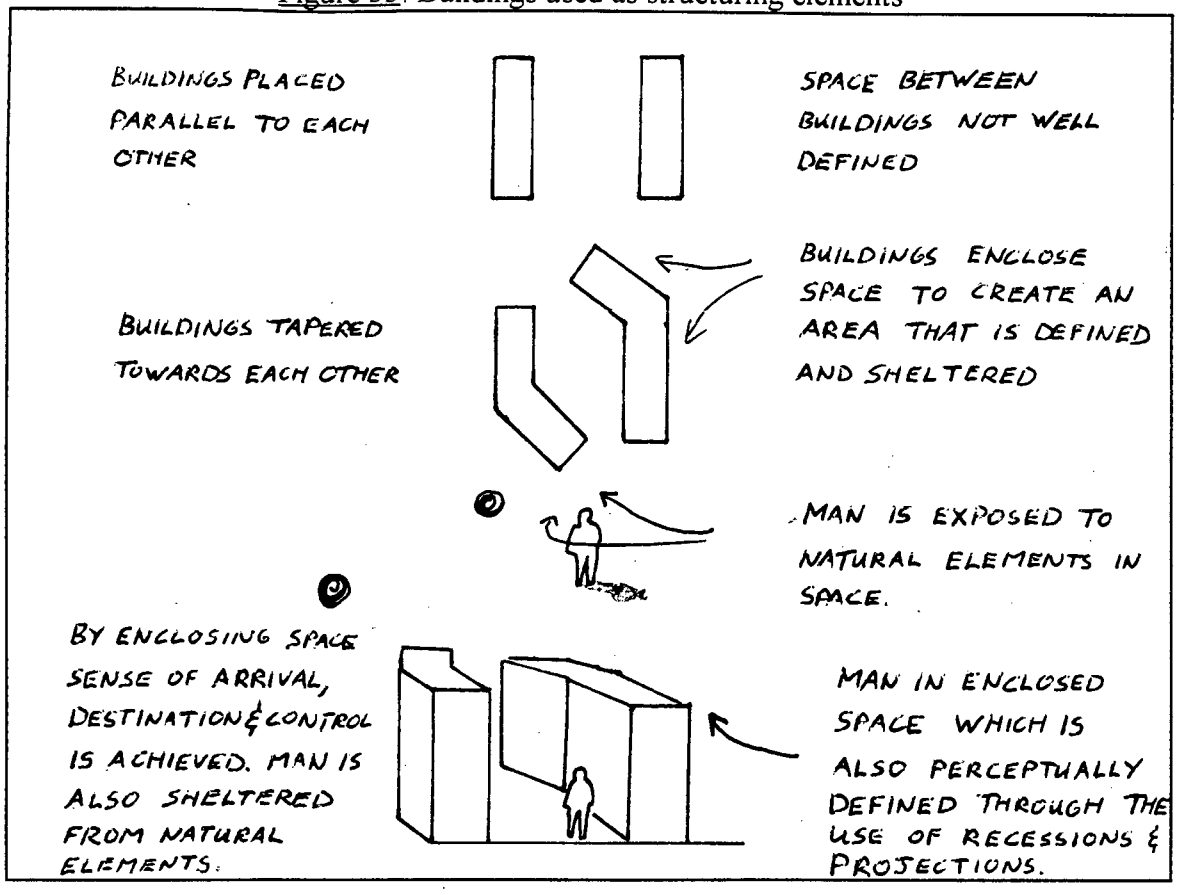
8.3.2.2. Mixed Land Uses

The mixing of land uses and the enhancement of quality through the attainment of accessibility, human scale, comprehensibility, sense, vitality legibility and control are discussed. However, it is important to mention beforehand that an aim of mixed uses is to bring homes, jobs and services together. This will enhance social equity, reduce costs and increase people's personal time.

The compact urban form reduces distance. Mixed land uses are often found in these compact settlements. "Mixed use means placing retail functions in residential areas and residential functions in retail areas and local industry in residential areas" (Elkin *et al*, 1991:22). This enhances accessibility, and is more apt to the climatic stress of the environment. Vitality through a mix of uses also provides the support for urban life, where spaces are used more often for a variety of functions. In this way, streets become places and not routes. For example, streets are not just used for cars, but as the day progresses so does the street scene. That is, early mornings it is used by vehicles to transport people to places of work if necessary, late mornings the street is used again for shopping and socialising functions, in the afternoon the streets have children and so on. Spaces are given a multitude of functions as a result of mixing land uses, whereas in strictly zoned areas, spaces and streets are mono-functional. This is an unsustainable use of space. Elkin *et al* (1991) enhance this concept of vitality, by proposing that renewed life can be brought back into many parts of a town, by mixing land uses. Elkin *et al* (1991:21) furthermore state that "diversity of activity is essential to community life, and the health of the city".

The compact settlement also provides an environment that is on a human scale. As Spreiregen (1963) recommends, human scale should consider size, convenience and familiarity. The ancient/Arab settlements tend to emphasise these elements, since the relative closeness of buildings creates space and activity, promoting contact and access, which in turn promotes access and familiarity, all through a human scale. Compact settlements, through their physical arrangements, tend to define spaces more since built features are used as structuring elements providing definition. Figure 33 illustrates the ability to bound space, and add definition to an enclosed space.

Figure 33: Buildings used as structuring elements



Legibility and sense (as defined earlier on) are furthermore enhanced through the structuring element of compact settlements. That is, spaces and functions can be interpreted more easily, since people are induced into those spaces that allows them to read the environment from a closer perspective. For example, in Walvis Bay, the spread nature of the town and the perceived definition of a house as being a residential unit, could be misinterpreted since the house might in fact be a business establishment. At a closer scale the clues and cues[68] of this establishment could have been interpreted earlier.

Legibility permits people to fit function to form and this can enhance control through the definition off space, which Newman (1972) and Jacobs (1961) believe are essential to any built environment. On the issue of control, Elkin *et al* (1991:22) state that mixed use of

[68]Cues and clues is a term used in planning and urban design where elements and images of the environment are used to help define that environment. For example, and this is by no means a universal interpretation, a neighbourhood with security signs well displayed, high walls and other security features, could define a neighbourhood, that has a crime problem or is extremely security conscious.

space can "enhance security in public spaces for disadvantaged groups". They go on to say that "many of the city's security problems can be related to separated land uses, quite simply the loss of a social milieu. We need a built environment which encourages social interaction, while discouraging crime". The compact city with its mixed uses can offer this.

Design/planning policy relating to the above discussion could include:

- The use of buildings as structuring elements defining spaces, to enhance the comprehensibility of the built environment, by implementing spatial standards that do not encourage sprawl;
- the implementation of a mixed-land use policy, so that accessibility and vitality of an area are enhanced;
- apply a strong planning system that resists the tendency for retail outlets to become larger, thereby maintaining a scale that is intimate and more conducive to a human scale (Elkin *et al*, 1991; Münster, 1994).

8.3.2.3. Transport Implications

By increasing urban densities the viability of transport modes is increased. An increase in densities increases population densities, which results in a catchment area that can support public transport. Elkin *et al* (1991:16) state that "there is an inherent conflict between lower densities and a good transport system". The relationship between transport, urban form and sustainability is described below.

Earlier in the dissertation it was mentioned that transport was a determinant in the shaping of urban settlements. This inherently influences lifestyles and consumption patterns, since trip patterns were altered radically (refer to Figure 15 in Chapter 5). As a result of the changes in transport reliance, many areas are rendered inaccessible and ultimately the mode of transport available to an individual influenced his/her residential location. The vital interaction between land use and transport cannot be separated and a transport policy will therefore influence land use.

Issues of sustainability are influenced as a result of this relationship. Firstly, the transport policy adopted influences people's access. This in turn has equity implications, both of which are fundamental principles of sustainability. Secondly, sustainability also involves the concept of carrying capacity, which in turn requires a reduction of pollution and emissions. Given this, energy efficiency needs to be improved, and since private vehicle transport is considered energy inefficient, some form of policy needs to address a reduction in the reliance on private vehicles.

In order to ensure a lesser reliance on the private vehicle, public investment is required. Public transport can be considered such an investment, and public transport requires a land

use policy to make it viable[69]. Public transport is more energy efficient. However, as Owens & Cope (1992) point out, this depends on load factors, because empty busses are not sustainable. The higher the load factor for public transport, the more significant its energy advantages become. It also has social and economic advantages for people, since fare prices decrease. A way of increasing load factors is to increase population thresholds, which implies greater population densities. Planning cannot influence population densities directly, only indirectly by increasing building densities.

The discussion has illustrated that a land use policy needs to be applied with any transport policy and that a solution in ensuring sustainability through transport implications requires an increase in densities. This (a shift in modal transport) is one approach in tackling the sustainability issue by means of a transport policy.

Another approach is to reduce the need for travel and involves the mixing of land uses. This has two further implications. The first has been discussed in the previous section. The second implication is that of a compact settlement. This increases the viability of other transport modes, such as walking and cycling. Physiological stress from walking or cycling under adverse climatic conditions can be reduced through the implementation of the design principles mention at the beginning of this chapter.

In order to achieve sustainability through urban form, from a transport perspective, a compact settlement is required, with high densities and mixed land uses.

Planning policies that could realise sustainable transport include:

- Density policy;
- Mixed land use policy;
- Encourage certain housing typologies.
- Encourage small-scale public and commercial facilities; and
- Implement stringent development control standards, such as reducing available public parking, reducing width of streets and changing the nature of streets through urban design concepts such as woon-erfs.

[69]Other policies exist to enhance public transport, such as fiscal measures, where price mechanisms can be manipulated through taxes and charges on fuels, vehicles and roads, to render private transport expensive. Since this dissertation is concerned with urban form and sustainability, land use planning mechanisms are sought. However, it would be idealistic to think that urban planning policies alone could induce a shift in transport usage. It is therefore important to consider the implementation of planning and fiscal policies in tandem with a transport policy.

8.3.2.4. Energy and Land use Planning

Owens & Rickaby (1983) report that "the details and significance of the relationship between settlement patterns and the use of energy are not yet fully understood". In 1993 Owens & Rickaby state that "although consensus has grown concerning energy and land use, there is conflict as to the sustainability of different forms of urban development" (Owens & Rickaby, 1993:250).

In terms of transport, Owens & Rickaby (1993) argue that dispersed settlements are not sustainable, nor are compact settlements, especially under the prevailing conditions of mobility. In this respect, as discussed earlier, land use planning and transport planning should be integrated.

From an energy demand perspective, the micro-climatic design of buildings could reduce energy demand. Methods of achieving micro-climatic energy-efficient buildings have been illustrated in previous design/planning principles. Policy methods discussed in attaining these principles could involve development control mechanisms and zoning requirements. In this respect the emphasis is on new buildings, because it is easier to incorporate design, layout and orientation requirements at the design/construction phase. The use of housing prototypes can also aid in reducing energy consumption. For example, Owens & Cope (1992) report that detached houses require three times more energy inputs than row-houses and intermediate flats.

The use of solar radiation as energy supplier should be considered. The implications of passive solar radiation have been discussed in terms of micro-climatic features in building design. In township layout, road structure, plot shape and housing position are important aspects to consider in passive solar gain. However, in order to reduce uniformity, the juxtapositioning of different housing types and spaces between dwellings are needed. Development control mechanisms could be used here once again.

Furthermore, active solar radiation through the use of photo voltaic panels to generate solar power should also be considered. Viability will depend on the buildings' orientation to the sun. In Namibia, the possibility of using solar power should be investigated, since Namibia is one of the countries which has the highest number of sun-shine days in the world (Golany, 1978). Although it has been argued that dispersed settlements provide greater opportunities for solar power, this is not necessarily the case, since in compact settlements roof tops could be used for photo voltaic panels.

Urban form and densities influence the viability of certain energy technologies. From the previous paragraph it is clear that there is a debate as to which urban form is most suitable for solar power exploitation. However, technology such as combined heat and power

systems (CHP) are more effective in compact and higher density settlements, as the viability of CHP depends on high densities (greater economic benefits) and the mixing of land uses to spread the demand for heat and electricity[70]. Energy efficiency, emission reduction and reduction of the ecological footprint of a town, are the basic aims of combined heat and power (Owens & Cope, 1992). The CHP system makes use of the heat produced during the generation of electricity to heat water and space, increasing the efficiency of primary fuel conversion. "It is widely acknowledged that CHP could make a substantial contribution to environmental sustainability. It also has implications for urban structure" (Owens in Breheny, 1992:84). CHP is being used successfully in Denmark, Sweden and Britain. CHP therefore has benefits in cold/temperate regions, and its application to desert environments is questionable. Although, the extreme temperature fluctuations between day and night could enhance the viability of CHP, this needs to be investigated further. It is the author's contention that energy saving benefits can at present best be achieved through micro-climatic design principles. Nevertheless, the possibility of CHP should not be discarded.

As can be noted from the above discussion, energy considerations should form an integral part of land use planning. Urban energy planning can help reduce energy consumption and associated emissions. This ultimately influences the built form.

Policies which urban planning should consider are:
- the energy implications of plans;
- integration of land use and transport planning;
- the use of development control and design details in the construction of buildings.

8.3.2.5. Infrastructure

The provision of urban services and infrastructure, is beyond the direct control of the land use planning system. However, the design of a compact settlement with medium to high densities could influence the provision and design of such services indirectly. Firstly, planning will influence the amount of infrastructure needed, and secondly, the pressures imposed due to density increases will determine the carrying capacity of infrastructure. Thirdly, in new developments, multi-use trenching[71] could be used, if the needs of a settlement can be identified before development. The social and economic as well as natural environmental benefits have been discussed in Chapter 6.

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[70]CHP system is also considered to be more viable in new developments, because it is cheaper to install infrastructure. Owens (in Breheny, 1992) calculated that CHP could be used in densities of between 75 and 25 dwellings per ha.

[71]Multi-use trenching is the use of a trench for more than one utility.

8.4. SOCIAL AND ECONOMIC CONSIDERATIONS

The principles and policies discussed have a physical bias, even though social and economic issues were considered. A brief discussion follows on how purely social and economic issues may shape planning principles and policies. Important issues that may have a bearing on urban form in desert environments will be outlined.

It has been reported that desert environments have, from a social perspective, peculiar demographic traits (Golany, 1978; Golany, 1979). Research by Golany (1978) illustrated that the age structure of desert environments is predominantly young, working age, with a preponderance of males. The reasons Golany (1978) cites for this trait is that wages tend to slightly higher in these inhospitable environments. However, in the Erongo region this is not the case. Although the Erongo region does have a higher preponderance of males, this is due to a migrant labour system combined with socio-economic hardships elsewhere in the country. The Walvis Bay area is seen as an economic centre (UCT, 1996). Due to an influx, particularly of young unemployed males, into the study area certain social ramifications need to be considered, such as the high unemployment rate, housing shortage, appropriate recreation and increases in tuberculosis and Aids (UCT, 1996). Although physical planning cannot respond directly to these problems it can respond to the land issues that result from demographic traits. For example, planning needs to consider the establishment of appropriate housing types, and plan in terms of services, jobs and space requirements. The demographic structure of society will influence the type, size, design, grouping and quality of housing as well as the schedule of development (Golany, 1978). Planning also sets land aside for appropriate social services and recreation.

In the Erongo region, the significance of female headed households also has planning implications. Housing types are influenced once again, but of particular planning concern should be the appropriate siting of support services, such as clinics, creches and schools. Young families also have special needs (such as creches and schools nearby to residential areas) and where possible these should be catered for.

The siting of clinics should be considered from a health and physiological perspective, and the settlement should be designed for human comfort. Throughout the dissertation, the human comfort perspective is iterated.

The isolation of most desert settlements, demands that they are self-sufficient in the provision of daily needs and basic services. This has economic considerations. As Golany (1978) argues, self-sufficiency is best achieved in the early stages of development and this requires a greater capital outlay at the early stages of an investment. Another economic consideration of desert environments, as Golany (1978) proposes, is the need for greater public spending. Golany (1978) refers to the psychological stress associated with isolation

and argues that government needs to spend more on the provision of socially important facilities. Other economic considerations, include the high cost of maintenance, especially in coastal deserts due to wind abrasion and corrosion. Appropriate planning can reduce maintenance costs, through the siting of facilities in areas where physical impacts are reduced. For example, slopes facing the ocean have higher humidities than those facing inland. Corrosion rates would therefore be higher and siting industry further inland could prove to be beneficial. However, spatial economic considerations need to be analysed as well and these tend to have a major impact on the shaping of urban form as highlighted in chapter 5 on Urban Morphologies.

8.5. CONCLUSION

The Arabic settlement and its preceding ancient settlement have lasted and evolved throughout the ages, and have slowly adjusted to their environments. As Golany (1978:20) states: "they have been excellent laboratories and as such, an asset to contemporary arid-zone planning".

The design policies[72] resulting from design principles based on the historic precedent or from urban density policies, are all related to issues of sustainability. Whether achieved through sustainable design principles and concepts (or policies as referred to in the discussion) or through sustainable land use planning, urban form will change.

Whether a new urban morphology for desert environments will arise, giving settlements a specific form, is unknown. The plethora of issues influencing the shaping of a settlement, as discussed in Chapter 5, indicate that a single urban form is difficult to attain. Factors such as climate, topography and other natural environmental features, as well as cultural, economic, political and social issues, vary from region to region, thereby influencing urban form.

The variables influencing the establishment and design of a settlement are numerous and cannot be considered as a constant homogenous set of criteria applicable to all localities. A blueprint settlement for applicability in all desert environments would be as inappropriate as the establishments of the early pioneer communities who disregarded environmental constraints. It would also be idealistic and arrogant to do so and this dissertation does not motivate it. Also, the mistakes made in the establishment of settlements in desert environments have increased our knowledge. This experience supplemented by the age-old knowledge of the ancient/Arab settlements provides us with

[72]Remember, that policies (design policies) in this dissertation are the means of attaining objectives, and objectives are the design principles.

a basic understanding of what works in such environments. By combining them with issues of sustainability (although sustainable in their own right), they provide us with design/planning principles which could alter the urban form of modern desert settlements.

With the ever increasing awareness of natural environmental and economic constraints, the reality of a new urban form becomes more realistic. The implementation of principles and policies mentioned, which have sustainability as their goal, could help in the attainment of a sustainable settlement from an urban form perspective and should be adapted or discarded according to local circumstances. After all, there is no single answer to problems encountered in establishing settlements in desert environments.

In the Namibian context, these principles could have major implications (such as a new density policy and the orientation of streets) for the future development of settlements along the Erongo coastal region. Economic, social and natural environmental benefits have been shown to accrue from a shift in development strategy, if the design principles and policies discussed above, were to be implemented.

Furthermore, the discussion on the variety of principles and policies has illustrated their intricate nature and the fact that they are all interrelated. Although the above discussion has been comprehensive in illustrating the relationship between urban form, natural environment and sustainability, it has being design oriented through a physical perspective. Social and economic perspectives need to be consider as well. Pressman (1981) emphasises that many factors need to be taken into account if we want to create liveable towns. Many of these factors may seem to be aspatial in nature, but in fact the components of these aspatial factors have "corresponding spatial or physical demands which must assume an architectural or urbanistic expression" (*ibid.*:7). Social and economic considerations were discussed briefly, and although not comprehensive, have illustrated the plethora of issues that influence land use planning.

Chapter 10, will present a Namibia case study. Walvis Bay will be evaluated in terms of its urban form and character. This evaluation will be based on principles outlined throughout the dissertation. From this evaluation it will become evident that Walvis Bay can learn a lot from other and older desert settlements. In this respect, the design principles discussed in this chapter could radically transform Walvis Bay.

8.6. SUMMARY AND FINDINGS

A review of selected settlements in desert environments was presented in this chapter. These settlements were analysed in terms of urban form. A number of valuable lessons resulted from this review, and basic planning/design principles were drawn from these experiences. The following points summarise the major findings of this chapter.

1. Desert environments do not define urban forms. Pure, natural environmental determinism is a historical myth. Nevertheless, desert environment characteristics and constraints are a facet of many issues that influence urban form. Environmental determinism (especially climatic determinism) only began to play a conscious role from the mid-twentieth century. However, the advent of modernisation during the same period, made planners believe that technology could overcome natures obstacles.
2. There is a perception in contemporary thinking that all ancient settlements, including medieval ones, grew organically. This is not entirely true, since many settlements were planned with predetermined intentions. This, however, depended upon the sophisticated nature of that society.
3. Of the settlements analysed, Arabic settlements seem to be well adapted to their environments. The word adapted is stressed, because it is proposed that environmental determinism in design was not a conscious effort. Urban form was therefore determined by human aspects in many instances and reflected human needs and culture. Nevertheless, many of their design principles are still employed today with beneficial consequences.
4. Arab settlements are inward looking. Very few city elements are exposed.
5. Arabic and ancient settlements predominantly acquired their forms from the residential units.
6. The courtyard house layout has proven to be highly effective in terms of human comfort in desert environments. Climatic, economic and social advantages have resulted from such typologies.
7. Israeli settlements were predominantly established on ideological, political and defence grounds. It is only within the latter half of this century that settlements have been planned with the environment in mind. Climate is highly emphasised in these settlements nowadays. In most respects, designs have been based on ancient settlements.
8. Most desert settlements reviewed in the Middle East are characterised by compact, high-density, mixed land use settlements and are organic in texture. Settlements originating from Western influences are predominantly characterised by sprawl and have extreme low densities. Culture and lifestyle have played a prominent role in the development of these two distinct forms.
9. Settlements founded by Europeans in the "new world", were not, in most instances, designed with the environment in mind. Modern settlements in Australia, South Africa

and the United States, which are in desert environments are also not suited to their environments.

10. Technology has had a major impact on urban form. Developments in transport led to the advent of the private vehicle which in turn influenced urban form, resulting in urban sprawl and the implementation of standards that could accommodate private vehicles.
11. A number of design principles have been developed from Israeli and Arabic settlements and it is anticipated that their concepts will prove to be beneficial to other settlements in desert environments.
12. The design principles are expected to increase human comfort and the livability of settlements in desert environments. These principles should therefore be considered when developing in desert environments.
13. Human scale can best be achieved through compact settlements. The Arabic settlements, due to size, convenience and familiarity, are considered to be on a human scale.
14. Spaces are more clearly defined in compact settlements.
15. Since over 55% and at times even 70% of the urban landscape is dedicated to residential uses, any changes in housing typology will have a major effect on the urban form. Since the courtyard house is recommended for desert environments, new settlements, if they adopt the typology, will become more intensive in their use of land resulting in tighter housing configurations.
16. Housing in most of the Arabic settlements developed incrementally within broadly based control guidelines.
17. Urban density comprises three components: building density, occupation density and population density. All three are related and interdependent.
18. Density in the planning sense, implies the intensification of the use of space and is controlled through building density.
19. Urban density has economic, social, environmental and political implications.
20. Vitality and accessibility can be enhanced through the mixing of land uses.
21. Mixed land uses and higher urban densities are also able to support public transport infrastructure and are less energy intensive.
22. Desert settlements require special social and economic considerations. These considerations may influence urban form through the need to develop specific built features (such as clinics, sports complexes and schools) that may alter the spatial layout of a settlement.

"General ideas are no proof of the strength, but rather the insufficiency of the human intellect."

Alexis de Tocqueville

CHAPTER NINE : A BRIEF OVERVIEW OF IMPORTANT CONCEPTS

9.1. INTRODUCTION

The arrangement of settlements has implications for sustainability and liveability. Liveability in itself is an element of sustainability and it often arises from peoples' perceptions of the environment, the ease with which they can relate to the built environment and the basic comfort and amenity it provides. By promoting the liveability of settlements, attitudes, health (psychological and physiological) and productivity are enhanced. By combining issues of liveability which are effectuated through design, the realm of sustainability can be addressed from an urban design perspective. However, urban design - a final stage of town planning - needs to come about once planning issues are resolved. Sustainability can be considered a planning issue. By considering economic, social and environmental sustainability, the analysis of urban form could enable planning to implement planning principles that enhance sustainability through urban form. Issues such as mixed land uses, densities and compaction, have been shown to improve the sustainability of settlements. Yet, sustainability of settlements does not end here. Liveability needs to be included thus encompassing sustainability with design features. This discourse has been emphasised throughout the dissertation.

The strong relation between planning and urban design was noted in Chapter 7 and Chapters 6 and 8 illustrated the relationship between design and sustainability of urban forms. From Chapters 5, 6, 7 and 8 urban form and its relationship with the human and natural environments was emphasised. From these chapters urban concepts (such as texture, function, sense, appeal, fit) were noted which could enhance urban sustainability and liveability, and these were emphasised in their respective chapters.

This chapter structures these concepts into a basic checklist. The term checklist is used in its broadest sense, because it is basically a list of elements which ought to be considered. This checklist is in **no** way static and all encompassing. Its role is to offer the reader some guidance as to the urban elements discussed so far, since this checklist is used in the analysis of the case study, to help focus the analysis and measure its performance.

Nevertheless, with greater refinement, this checklist could be developed into a Framework. Such a Framework could help decision-makers in evaluating designs for urban areas, especially when there is more than one alternative. The use of the Framework

could help highlight important aspects that ought to be considered, and would provide greater clarity as to the overall effectiveness of the design.

9.2. CONCEPTS TO CONSIDER

All the factors and concepts listed below are interwoven into a complex net of relationships. They should, where possible, be considered together in a cyclical/iterative manner for each element, dimension and principle investigated.

Although listed, they are in no way ordered, but the structure does provide some sequential guidance as indicated by the verbs (understand, consider, determine and evaluate).

Understand the basic urban form of a town/plan through the following aspects:
- Pattern
- Density and Texture
- Basic theoretical understanding of a town/plan's evolution

Consider defining urban form elements:
- Paths
- Edges
- Districts
- Nodes
- Landmarks

Determine the performance of a town/plan in terms of:
- Vitality
- Sense
- Fit
- Access
- Control
- Efficiency
- Justice

Evaluate the town/plan with respect to:
- Function
- Order
- Identity
- Appeal

At all times consider:
- Economic;
- Social; and
- Environmental suitability which can only be determined within the local context, since costs and benefits will vary between sites and communities.

9.3. CONCLUSION

These concepts can be applied at any urban scale; from the town level to the neighbourhood level. They can also be applied to existing urban areas or future urban developments. In essence, the concepts should be used as a guide to help evaluate existing and future urban forms. By considering the intrinsic relationship between sustainability and liveability, design can achieve a sustainable urban form through an understanding of urban design concepts.

"Sustainable city must be user-friendly and resourceful in terms not only of its form and its energy efficiency but also its function as a place for living."

(Elkin et al, 1991:12)

CHAPTER TEN : WALVIS BAY : AN ANALYSIS

10.1. INTRODUCTION

Throughout the dissertation important concepts, theories and principles of urban form were highlighted in terms of visual and physical attributes. Walvis Bay is presented in this chapter as a case study. Its urban form will be analysed in terms of these concepts, theories and principles. From this analysis Walvis Bay's form and character will become evident and, as will be argued, its present form is unsustainable. Some pointers will be given as to possible solutions to overcome the settlement's unsustainability. The next chapter will provide a coherent set of recommendations for the present urban form, and for future urban developments.

This chapter is structured around certain themes (such as street layout, street standards, housing stock, and impressions of the town from the road) based on visual analysis. Where possible, statistical information has been used to highlight important factors.

However, before these are discussed, a brief guide to visual interpretation and the methodology used for the interpretation follows.

10.2. GUIDE TO A VISUAL INTERPRETATION

Appleyard (in Saarinen, 1976) believes that the image of the city is recorded by individuals through a combination of four reasons:

- the distinctiveness of its physical form;
- the visibility of features within the townscape;
- the feature's role or importance to the person;
- the feature's cultural significance.

Buildings, structures or features are known to different people and environmental perceptions therefore vary between people. As stated earlier, the author's perception of the town will differ from that of the reader or the resident of Walvis Bay. This does not imply that any perception is either right or wrong; it depends on the phenomena being studied. Since the phenomenon in the case of this dissertation are based on the hypothesis of a sustainable urban form in desert environments (which has been proven to be a compact settlement), Walvis Bay's image will be analysed against the concept of a compact settlement and the general sustainability principles. Table 2 indicates the verbal and

graphic rules that could be used as a general guide for evaluating and identifying urban forms and elements.

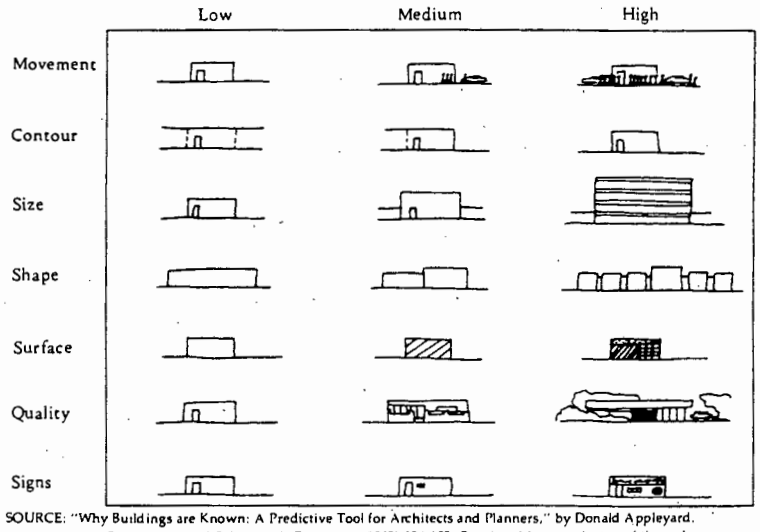
Table 2: Verbal and graphic rules for identifying forms

Form Intensity Scales (Verbal Rules)

	Low	Medium	High
Movement	No movement.	Potential movement, parked cars, few people.	Many people, moving cars, flags waving, water falling.
Contour	Slurred boundaries hidden by vegetation attached to other houses.	Semidetached corner buildings.	Isolated buildings with sharp contours.
Size	Single-storey buildings: houses.	Two-storey buildings: movie houses.	Over two-storey buildings: industrial sheds, steel mill, General Electric.
Shape	Simple.	Two or three block buildings.	Complex building divided into several parts.
Surface	Plain white.	Colored.	Brightly contrasted colors and textures.
Quality	Bahareque (wattle), mud floors outside, no fences.	Modest materials, walls, garden.	Landscaped, fenced, expensive materials, clean conditions.
Signs	No signs.	Small signs.	Large signs readable from a distance.

SOURCE: "Why Buildings are Known: A Predictive Tool for Architects and Planners," by Donald Appleyard. Reprinted from *Environment and Behavior*, Vol. 1, No. 2 (December, 1969), 134-135. Reprinted by permission of the publisher, Sage Publications, Inc.

Form Intensity Scales (Graphic Rules)



SOURCE: "Why Buildings are Known: A Predictive Tool for Architects and Planners," by Donald Appleyard. Reprinted from *Environment and Behavior*, 1 (December, 1969) 134-135. Reprinted by permission of the publisher, Sage Publications, Inc.

(Source: Saarinen, 1976)

10.3. METHODOLOGY

Unfortunately, a comprehensive sample representation on the perceptions of the built environment could not be obtained, due to time, budgetary and space constraints imposed on this dissertation. Nevertheless, the following methodology was used.

Firstly, selected individuals[73] were asked to describe Walvis Bay: its character and its physical attributes. Once, they had described the built environment, they were asked to comment on certain characteristics they mentioned and what problems or benefits they could apply to these characteristics. Secondly, a tour of Walvis Bay was undertaken and direct observations were made. Thirdly, an evaluation of the town was conducted by supplementing spatial data (i.e. Maps and photos) with verbal explanations[74], personal experience, the principles of sustainability and urban design, performance dimensions and basic elements of a town, backed by normative and urban form theories.

Since no quantitative research methodology was used (i.e. questionnaires) some degree of communicative bias may have occurred. Therefore, realising the shortcoming of the methodology used, the outcome, should be regarded as subjective. As Lynch (1990), Harper & Stein (1992) and Parkin (1995) point out, the author's perception is value-directed. However, Lynch (1990) reaffirms that "professionals tend to use [this methodology] as mnemonic devices, once they have actually experienced a place, or as stores of information which must be renewed and tediously reworked for each new particular problem. They rely on field reconnaissance, [and] discussions with knowledgeable local residents" (Lynch, 1990:349). The analysis to follow is only valid in this context, since the phrasing of questions produced a specific answer. If a different question was set, a similar answer with a different perspective may have been received.

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[73]These individuals were officials who worked in Walvis Bay and were identified by Ramboll and the UCT Master's class. Ramboll was the first mission sent to Namibia, and their task was to identify key players in the development of a CZMP for the Erongo region. The UCT Master's class was then sent to Namibia to collect baseline information. These individuals were therfore those identified by Ramboll, and those from who information was sought.

[74]The selected people interviewed, either lived and worked in the area, or had some knowledge about the town.

10.4. THE URBAN ANALYSIS

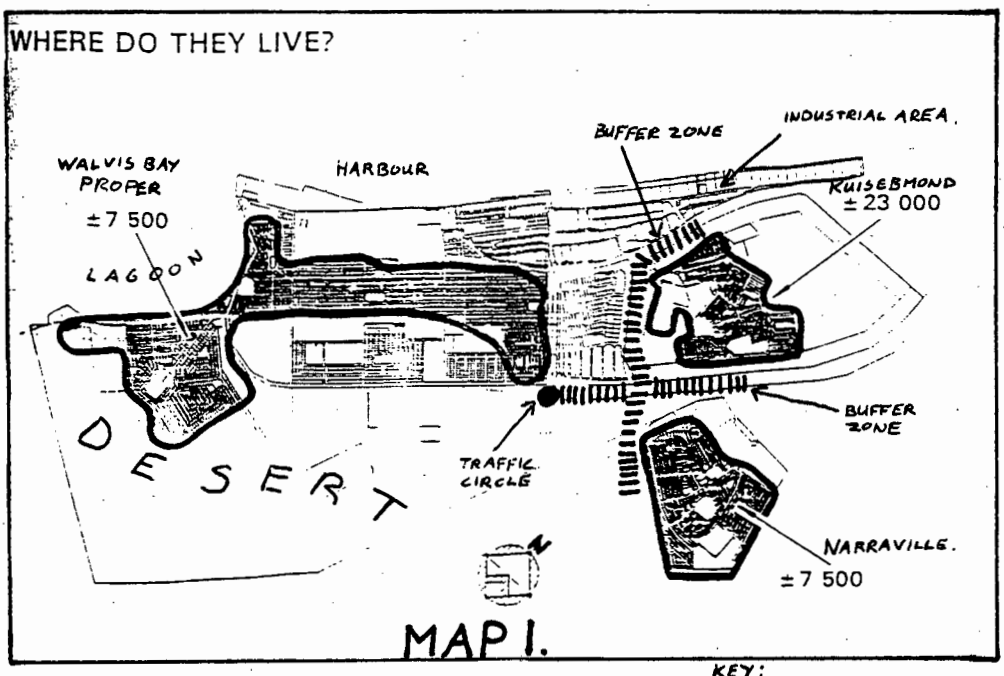
10.4.1. Walvis Bay's Approach

The only approach to Walvis Bay is marked by a traffic circle (see Plate 1) planted with palm trees (*Phoenix canariensis*). This area acts as a counterpoint (a feature that is in contrast to the main element) to the desert and gives a sense of arrival. The traffic circle can be regarded as a landmark and a gateway to the town by which people can orientate themselves. The palm trees down the centre aisle of the road (Plate 2) provide rhythm to the road, imparting a three-dimensional pattern to the road, while also forming an edge to the town. The tree-lined road enhances vitality through the strong contrast in colour to the surrounding built environment. The encounter with the settlement through the use of vegetation gives a comforting sense of enclosure in contrast to the desert and raises a sense of expectation. The enclosure that the trees provide prevent the eye from wandering aimlessly and focus them down the road. A sense of destination is therefore achieved. On entering the town, this sense is lost as the settlement reflects the openness of the desert through a bland built form.

10.4.2. Street Dimensions

The wide roads give a strong sense of geometry, though in some areas trees reduce the harshness of this geometry (see Plate 3). In many cases these wide streets are inappropriate as they portray fluid traffic routes and not residential streets they really are. In all instances, the streets of Walvis Bay are too wide, reducing the sense of community. The wideness of the roads preclude the use of building facades to create projections and recessions which tend to enclose space and introduce the dominant function. The effect of enclosure, which creates different spaces and produces places that are more easily controlled by people, is also lost due to the wide road. The very deep set-back from the road reserve limits interaction between dwellings and the road. This tends to isolate the road and projects the image that the road is not part of the public realm.

The design of the road should be considered an integral part of urban life, as roads create a scene which adds vibrance to a community. Furthermore, by designing roads with the community in mind, control and access can be enhanced. As Sherlock (1991), Jacobs (1966) and Newman (1971) argue, streets should be returned to the people. Since a lot of time is spent en route, the street scene is of fundamental importance to our image of a town. That is why they need to be made as interesting as possible with the aid of visual stimuli. The large streets, also imply large building set-backs, resulting in more wasted space. By reformulating building control and development control standards, set-backs could be reduced, thus allowing the use of projections and recessions that add a perception of depth, rhythm and semi-enclosed spaces. This could be achieved if erven

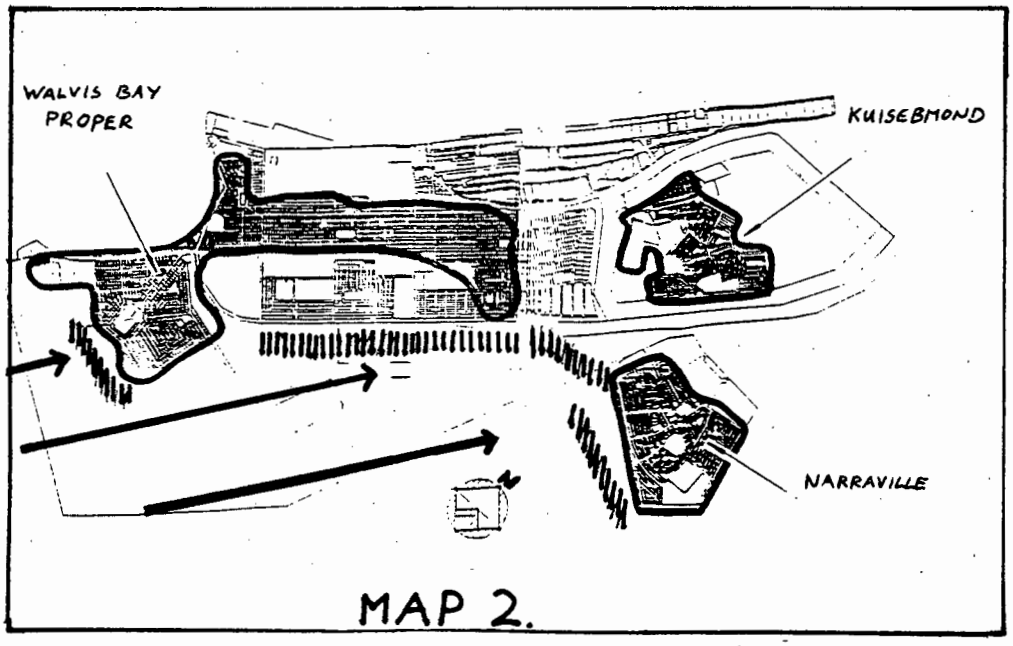


KEY:

IIIII - BUFFER ZONES (APARTHEID PLANNING)

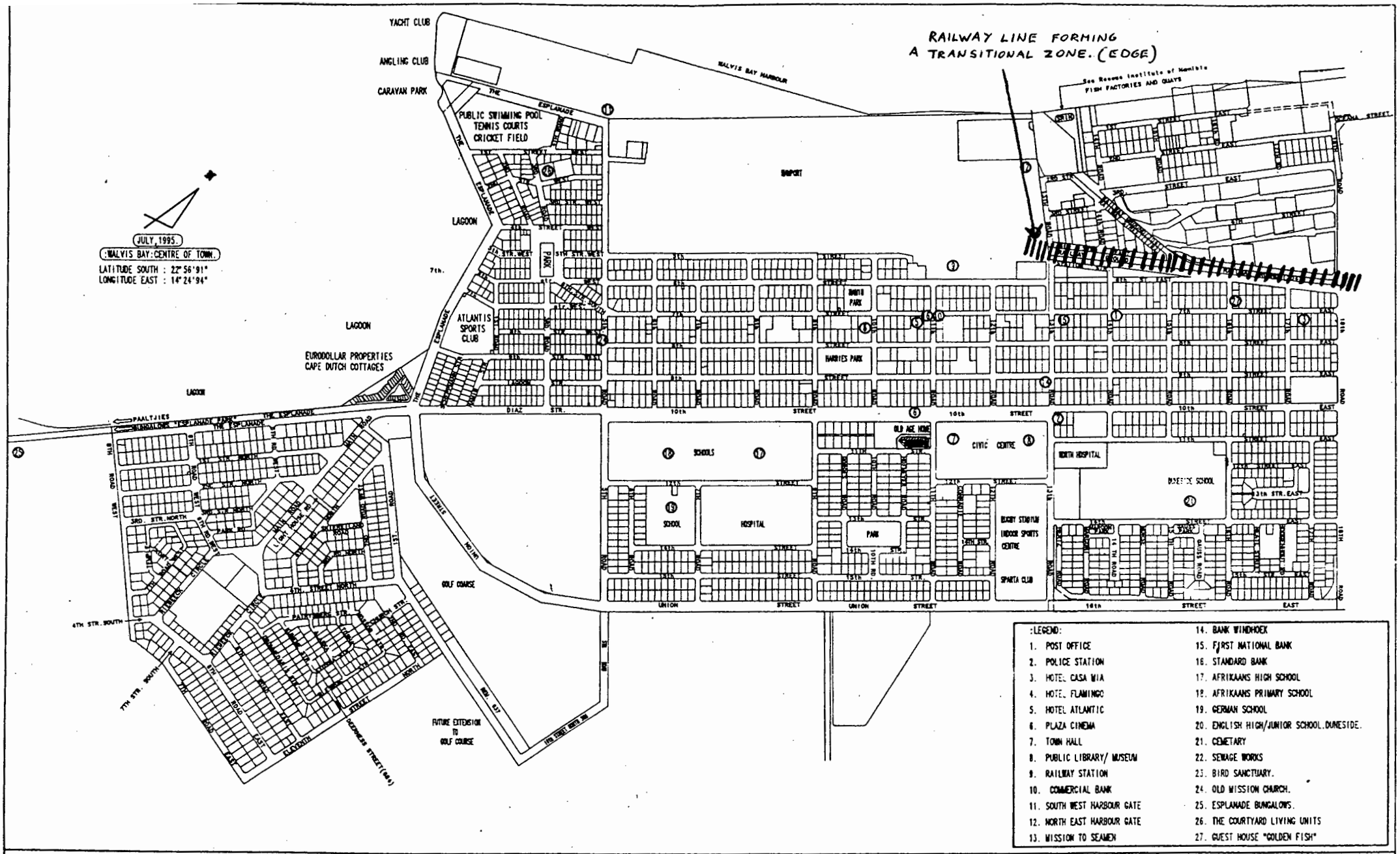
● - TRAFFIC CIRCLE

(PLEASE NOTE: CLEARER MAPS OF WALVIS BAY, IN ITS ENTIRETY, COULD NOT BE FOUND.)



KEY:

IIII - AREAS THAT SHOULD HAVE A BUFFER (GREENBELT) SO AS TO PROVIDE THE TOWN WITH SHELTER FROM THE WIND. BUFFER WILL A SO PREVENT SAND ENCROACHMENT FROM DESERT.



TITLE:

WALVIS BAY TOWN MUNICIPAL AREA.

MAP 3.

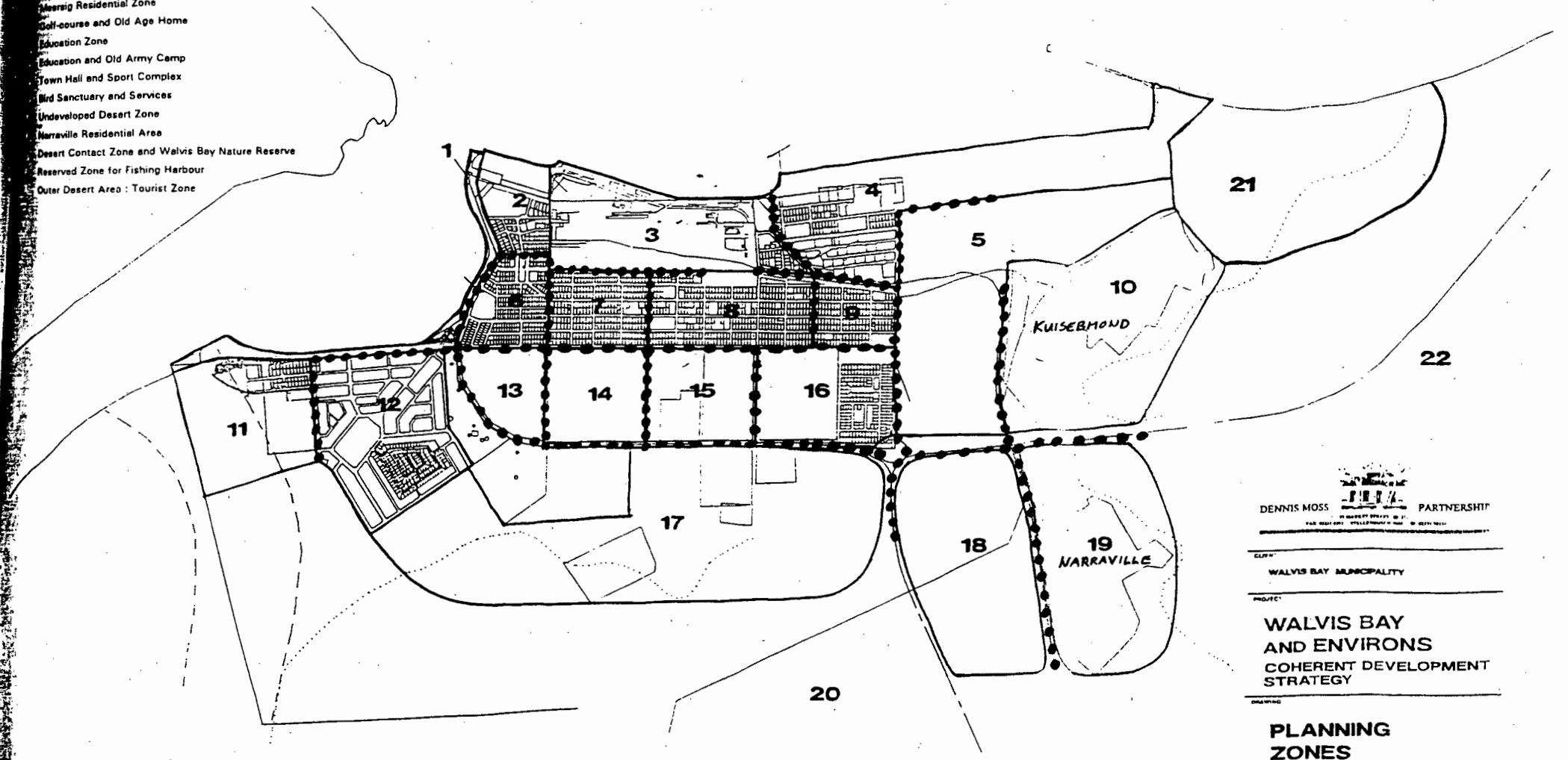
TOWN ENGINEERS DEPT.

TOWN ENGINEER

MUNICIPALITY OF WALVIS BAY

P/BAG 1017, WALVIS BAY. TEL. (0642) 5981.

nade
ven Park and Holiday Housing
mercial Harbour
ng Harbour
strial Area
liday Houses
ge of Central Business District
ntral Business District (CBD)
Use Zone
sebmond Residential Area
liday Chalets and Desert Contact
Meersig Residential Zone
Golf-course and Old Age Home
Education Zone
Education and Old Army Camp
Town Hall and Sport Complex
Bird Sanctuary and Services
Undeveloped Desert Zone
Narraville Residential Area
Desert Contact Zone and Walvis Bay Nature Reserve
Reserved Zone for Fishing Harbour
Outer Desert Area : Tourist Zone



MAP 4.

KEY:

DENNIS MOSS PARTNERSHIP

CLIENT: WALVIS BAY MUNICIPALITY

PROJECT: WALVIS BAY AND ENVIRONS COHERENT DEVELOPMENT STRATEGY

DRAWING: PLANNING ZONES

PROJECT NUMBER: J 2459

SCALE: 1 : 30000

were subdivided or bulk restrictions relaxed, thus permitting an intenser use of land. The planting of desert/arid vegetation in the existing road reserves could also improve the street scene. Such vegetation could also have a functional use by reducing wind speeds and trapping airborne sand. However, the financial feasibility of maintenance needs to be weighed against existing sand clearing costs.

10.4.3. Street Pattern and Layout

Walvis Bay is a medium-sized town. Its shape is relatively concentrated, but it does have the characteristics of a linear settlement following the coastline. A grid-iron street pattern is clearly defined (See Map 1). A possible reason for this may have been the need to establish a town as quickly as possible, as the "city as a machine" concept of Normative Theory suggests. However, the street standards are disproportionate to their function and are a financial burden on the town. The town's 94/95 budget for capital expenditure on streets was N$6 390 134-, this being 25,91% of the capital budget for Public Work's Maintenance. N$2 600 000- was budgeted for streets on land development projects, approximately 36,46% of the capital budget for land development projects. A further N$3 556 112- (15,47%) was spent on streets from the operational budget. In 1994/95, N$650 000- was allocated for the tarring of sidewalks, N$300 000- for the paving of parking areas and N$150 000- for the resealing of sidewalks. N$60 530- was spent on the maintenance of tarred streets and N$415 449- was spent on gravel roads (Municipality of Walvis Bay, 1995). The percentage allocations are relatively speaking fairly high compared to other settlements, and could have been much lower if narrower street standards were used. Furthermore, in new developments, a disproportionate amount is spent on streets, and ultimately, this is reflected in the purchasing price of land. The amount of road provided in low-income residential areas is disproportionate to the benefit the road has for the inhabitants, who generally do not own private motor vehicles. It nevertheless is a cost included in the land price they have to bear. This rational and the figures mentioned above call for new standards and road dimensions.

The town's longitudinal axis is roughly south-west north-east (see Map 2). With the predominant and strongest winds blowing from the south-west reaching a Beaufort scale of 5 or 6, the town is wind-swept (see Appendix A for a description of the climate in Walvis Bay). With non-vegetated dunes (Barchan type and transverse type) to the south of the town from the horizontal, the winds blow up loose sand into the town. Sand becomes deposited against the windward side of buildings and fences. Sand accumulation in the town has major social and economic implications. Socially, it creates health problems associated with dust. Furthermore, the regular house-cleaning needed reduces people's quality time. It also incurs a financial burden in that damage associated with wind blasting imposes a maintenance cost, thus effectively reducing people's disposable incomes. The town's expenditure on sand clearing operations from streets, fences and greenbelts in the 1994/95 financial year was N$839 834-. Approximately 62 676m^3 of sand was removed.

Sand removed with a mechanical street sweeper incurred a further cost of N$197 482-. Construction and maintenance costs incurred by wind blown sand totalled N$1 643 460- (Municipality of Walvis Bay, 1995).

The present street standards prescribe heat-absorbing materials, which contribute to the urban heat island. The streets are also contributing to high albedos.

Street orientation needs to be carefully considered as should the pattern. Design principles of the Arab settlements such as those mentioned in Chapter 8, should be considered.

10.4.4. Districts

The coherent structure plan (1994) for Walvis Bay, indicates various segments, which could produce a number of districts (see Map 1). Large buffer strips separate some of these districts and isolate the former black township and coloured township from the traditional white town. These districts also have different stand sizes which gives the town a number of textures and grains (see Plate 4). Note the fine grain and uniform texture of Kuisebmond and Walvis Bay proper, in contrast with the industrial and harbour area, which has a course and uneven texture. The size, shape and pattern of Walvis Bay is also modified by density variations (compare Kuisebmond with Walvis Bay proper), and this also defines a variety of districts. The districts are also defined by the patterns of movement. Note the railway reserve in Map 3 forming a zone of transition between the town and the harbour/ industrial area. Map 4 illustrates how the paths of movement, densities and texture divide the city into a number of districts. The delineation of these districts permits the town to be divided into a number of cells. Planning seems to be following an organic model in which each cell is planned appropriately according to the town's needs. This is enforcing the separation of land uses.

The buffer strips separating Kuisebmond and Naraville from Walvis Bay proper also encourage sand encroachment into Kuisebmond. The open space between the townships is evident on Map 1, while Plate 5 and 6 illustrate these open spaces used as buffer strips. In order to reduce sand encroachment into Kuisebmond and Naraville, these buffer strips should be vegetated to stabilise the dunes or provided with fences or sand nets.

Although the districts can easily be defined on a Map, the reality is different. There is no doubt that function changes from place to place, but this is not easily distinguished in Walvis Bay. For example, Plate 7 illustrates a main road in the CBD of Walvis Bay, but as one moves down the road the CBD gradually fades into a residential area. This can be extremely confusing, because no clear boundary is defined and the vista down the road does not acknowledge any change. The change could have been punctuated by a physical signal, such as the narrowing of a road, the use of an alternative road texture or the use of a focal point.

Plate 3: One of the many wide roads in Walvis Bay.
In this photo, the harsh geometry of a very linear road, is softened with vegetation. Note the very low traffic volume (if any in this photo), implying that the road standard is inappropriate. The need to maintain these wide roads are economically unsustainable.

Plate 5: Open space in Walvis Bay, previously used as a buffer zone.
In this photo, the sand dune is being flattened for a possible new development.

Plate 6: Open space used as a buffer zone.
In this particular photo, the buffer strip provides a channel through which sand can blow. Unfortunately, because the area is flat, providing little resistance to sand, the sand is blown into the settlement.

Plate 7: Main Road in the CBD of Walvis Bay.
Vista down the road does not acknowledge any change in the settlements function. The photo also illustrates that the settlement is not on a human-scale. Note how the man crossing the road is dwarfed by its dimension. The inappropriate scale also reduces human comfort, convenience and access.

10.4.5 Densities

Settlements generally exhibit high-density development within city centres with gradual decreases in densities towards the outer suburbs. Walvis Bay does not exhibit this typical pattern. "Walvis Bay has no concentration of high density residential development, particularly adjacent to the town centre or other business centres" (Municipality of Walvis Bay, 1995b:5). Walvis Bay has one of the lowest population and building densities in the world, especially in relation to settlements in arid environments[75]. The areas with the highest densities are found on the town's outskirts. This is visually illustrated in Map 1, and is statistically enforced by Table 3. However, high-density residential developments are situated randomly throughout the town and average about 50 units/ha. In general the overall population density is 51 persons/ha and a building density of 8 units/ha (Municipality of Walvis Bay, 1995b).

Table 3: Developed Erven in Walvis Bay

Land use	**Area**	**Number of erven**
Developed Residential	Walvis Bay Proper	2171
	Meersig	96
	Kuisebmond	1660
	Naraville	970
Total Developed Residential		**4897**
Other Non-Residential	Walvis Bay Proper	495
	Meersig	1
	Kuisebmond	37
	Naraville	32
Total Non-Residential Erven		**565**

(Source: Walvis Bay Town Engineer's Annual Report 94/95)

The population distribution for 1993 and the spatial dimension of the existing settlement are given in Table 4. Predicted spatial requirements for the year 2015 at a growth rate of between 3-4% are also provided.

[75]In Israel, the density of a development is about 70 units/ha (Golany, 1979).

Table 4: Walvis Bay's Population Distribution

			1993		2015
Area	Population #	Area	Population Density	Population #	Area Required
Walvis Bay Proper	7 500	400 ha	18 p/ha	21 000	250 ha
Naraville	7 500	105 ha	70 p/ha	21 000	180 ha
Kuisebmond	23 000	110 ha	210 p/ha	43 000	220 ha
TOTAL	**48 000**	**615 ha**		**85 000**	**650 ha**

(Source: Dennis Moss Partnership [DMP], 1994)

The population growth scenario predicts a population of 85 000 people by the year 2015 (Dennis Moss Partnership, 1994). This is almost a doubling of the 1993 population, and a doubling of Walvis Bay's physical growth. According to DMP (1994), 650 ha is needed for housing and 450 ha for other land uses. This means that Walvis Bay will need an additional 1 100 ha of land, based on present planning standards.

Table 4 also illustrates that 60% of the population of Walvis Bay lives on 110 ha of land, whereas only 14% live on 400 ha. This can be considered as inequitable, resulting in inappropriate subsidisation of infrastructure and services based on per unit of running metre of infrastructure per person.

These low densities are a result of large stand sizes enforced through planning standards regarded as inappropriate for arid environments. The relationship between large stands and harsh climatic circumstances has negatively influenced the maintenance of most residential developments. Indirectly, a density policy can attempt to address and eliminate this problem. This has also been recognised by the municipality (Municipality of Walvis Bay, 1995b). Low densities, subsequently influencing urban sprawl, are resulting in high infrastructure costs as mentioned earlier. For example, 36,46% of the capital budget for the 94/95 Municipal Budget is budgeted for streets in new developments, and a further 25,91% of the capital budget is budgeted for street maintenance services. 15,47% of the operational budget is also spent on street maintenance (Municipality of Walvis Bay, 1995a).

A compact settlement implies a denser settlement that requires a density policy. Such a density policy can ensure a better utilisation of existing essential services and reduce costs of the spreading urban area, resulting in a more efficient town (see Chapter 6 on the advantages of compact settlements). Furthermore, much of the land requirements projected for 2015 could be internalised into the existing settlement if higher densities were permitted, thus reducing the town's physical expansion. For example, if the envisaged residential densities in Table 5 are achieved, the existing 5000 erven will be increased to about 21000 erven (This argument is developed further in the next section). According to

the Walvis Bay town planner, a final building density of 19 dwelling units/ha and a population density of 130 persons/ha is anticipated (Municipality of Walvis Bay, 1995b; Steward, Pers.Comm., 14/02/96).

Table 5: Envisaged Densities for Walvis Bay

Zones*	Envisaged Density
7,8,9,15	100 units/ha
2,6,14,16	50 units/ha
11,12,13,17	20 units/ha (at 500m² erven, present average is 1000m²)
10 and 19	20-30 units/ha.**

(Source: Municipality of Walvis Bay, 1995b)

* Refer to Map 1.

** This is the status quo. Maximum permitted is 30 units/ha at 300m² erven. Ideal, however 20 units at 500m² erven.

Popular support for a denser and compact settlement seems to exist. This can be deduced from a constant increase in the number of applications the municipality has been receiving for sub-divisions, flats, townhouses and duplex units. In the 94/95 fiscal year, 263 additions to private residences were approved, 17 to industrial buildings and 18 to commercial buildings. Respectively 127, 15 and 10 alterations and additions were completed in that year (Municipality of Walvis Bay, 1995a; Municipality of Walvis Bay, 1995b). The illegal erection of buildings is also occurring. In Kuisebmond for example, informal structures for habitation are erected on the under-utilised land of existing erven (see Plate 8 and 9).

Residents and developers are calling for a review of the town's density. Reasons for such a call include rising maintenance costs of houses and gardens (due to large stands), increasing land costs, the constraints imposed by the harsh environment, need for a more secure environment and a changing lifestyle in general (Municipality of Walvis Bay, 1995b).

A density policy has therefore been proposed. It is argued however, that the densities proposed in Table 3 could be increased to about 50 units/ha on average. This could be achieved by altering the standards set for minimum residential erf size. In Kuisebmond the minimum residential erf size is 300m² (a standard set nationally). This is considered to be wasteful, since the number of informal dwelling units on the excess land indicates that a compact arrangement is acceptable to residents. Erf sizes could therefore be reduced. This argument is picked up in the next section on housing requirements.

A higher density would be more efficient in terms of the utilisation of land and utility infrastructure. It would also prove to be more sustainable as argued in Chapters 6 and 8.

Plate 8: Informal dwellings in Kuisebmond.
The informal dwellings are indicative of a housing shortage. The photo also illustrates lost spaces around formal dwelling units. This could imply that erf sizes are too big. The photo also illustrates that no clear spatial definition is evident. Dwelling units, therefore open up immediately into the public realm reducing a households control, over an area that is its own.

Plate 9: Informal dwelling units in Kuisebmond.
This photo illustrates that the area could be densified further, by using smaller erven and different plot configurations, if not different housing types. For example, by combining the informal dwellings in this photo together, a formal structure could have been built. The photo also illustrates an inappropriate erf size, in that the house on the right, has built its boundary (improvised fence) attached to the house. Legally, the dwelling's boundary, is in the middle between the two houses in the foreground.

However, as a principle of urban design, a range of densities should be permitted to create variety, thus providing more choices of housing types and more visual stimuli.

10.4.6. Existing Housing Stock

The present housing stock is varied in terms of architectural style. In the former white areas most houses have the conventional box shape of the 1950s, 60s & 70s. Diversity in style is apparent in the newer affluent suburb of Meersig. Housing stock in the traditionally black area (Kuisebmond) is predominantly the conventional mass produced box house ('58 design prototype). There is also a hostel. Informal dwelling units are also mushrooming in Kuisebmond on privately owned land[76]. Naraville, the traditional coloured area, has a combination of the housing styles found in Kuisebmond and Walvis Bay proper. Throughout Walvis Bay the Western-style-single-dwelling concept is dominant. It is considered unsuitable for the Walvis Bay environment and lacking in variety.

A combination of inappropriate style (or design) and typology has a number of adverse sustainability implications. Firstly, the style is inappropriate to the environment as the dwelling unit is exposed to wind and sun. (See Appendix A for a description on the climate for Walvis Bay). In most instances the building materials make them unbearably hot during the day and cool at night. A design based on ancient Arabic settlements, where the house is designed in a courtyard layout providing sheltered spaces protected from dusty winds and sun would be appropriate (see Chapter 8 for further details). Soboil (1996), in his random interview of residential households, discovered that people were spending considerable amounts of income on maintenance and sand clearing. Many residents, also indicated that they had to conduct a "spring-clean" almost every week. This incurs socio-economic costs which could be avoided through a more appropriate design. Secondly, the single residential unit typology is consuming land, thereby imposing capital and operational infrastructure costs, and directly influencing urban sprawl. As argued in Chapter 6, more houses could have been built on the same infrastructure if the level of utilities service is adequate (see Chapter 6). Thirdly, the present combination of style and typology is ineffective at harnessing climatic environmental benefits. Due to the exposed nature of the dwellings no cumulative shading or heating occurs and the dwellings are exposed to the climatic extremities of the desert. Elevated roof-tops to permit air to cool and higher window sills to reduce reflected radiation are not used (see Chapter 7 and 8). Fourth, present typologies do not provide a variety of choice (see Chapter 5) and prevent people from finding a dwelling that suit their needs. Fifth, the lack of housing variety creates a bland repetitive environment which reduces variety and stimuli and has negative psychological connotations - ultimately affecting the quality of life.

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[76]See section 8.3.1.8. where informal housing is discussed.

10.4.7. Future Housing Requirements

Walvis Bay is a strategic town for Namibia and the Southern African Development Community (SADC) (UCT, 1996). Walvis Bay is accessible to major centres in Namibia. It has one of two developed harbours in the country and has the potential to enhance the already well serviced harbour. If oil and gas were to be discovered and the fish stock recovers, Walvis Bay will experience an unprecedented boom. This will place tremendous pressure on the existing urban structure and housing stock (UCT, 1996). Since housing is an important urban element, it will have a major influence on the urban form. This is because housing is a major land use, which until now has been consuming extensive tracts of land. Should courtyard houses, for example be used, the settlement will automatically become more compact, with a higher density, and a finer texture (see Chapter 5).

According to the Walvis Bay Structure Plan (DMP, 1994) 11000 dwelling units will be required by 2015, as a result of the population increase and the current backlog. The area that would be required for residential purposes is approximately 650 ha (see Table 4). In terms of the densities proposed in Table 5, the existing 5000 erven could be increased to 21000. Assuming that only 40% of the 16 000 new erven are for residential purposes, 6 400 erven will be for residential purposes[77]. Assume that each erven has one dwelling unit, and that by 2015 only 11 000 units are required, then only 4600 dwelling units need to be developed on new sites, since 6 400 units can be integrated into the existing settlement. At about 300 m^2 a site this would entail a physical town increase of 138 ha for residential purposes, and even this could be reduced if smaller erven were permitted. By comparison the structure plan, which does not consider an increase in density, proposes 650 ha. However, most of the 6400 units that could be developed within the existing town, will enter into the market system (since they are predominantly privately owned) and will thus have a higher market price which may be unaffordable to the urban poor (those who form a great majority of the housing backlog).

Approximately 550 erven need to be developed per year over 20 years. N$4 720 000- was required to develop 500 erven in Kuisebmond, 120 in Naraville and 20 in Walvis Bay proper in 1994/95. This involved the preparation of land and the provision of infrastructure (Municipality of Walvis Bay, 1995c). The cost per erf was approximately N$7 375-. At 300$m^2$ per erven this would be approximately N$24,58/$m^2$. According to current standards of the structure plan, each erf is allocated approximately 500m^2, 660m^2 and 833m^2 in Kuisebmond, Naraville and Walvis Bay proper respectively. As mentioned

[77]In this argument it is also assumed that it is feasible to increase the density by means of subdivision or building alterations. Not all erven will therefore be able to accommodate changes. It is a hypothesis, with figures based on Walvis Bay's Residential Density Policy, and the assumption that a change in density can occur.

earlier, land is wasted and could be used more intensively. If erven were smaller the capital cost would be decreased, since less infrastructure per running metre would be required. It would also reduce future operating and maintenance costs (see section on streets).

Housing could be made more affordable if standards were revised and existing urban areas densified. The capital saved on land development in the proposed previous example could be directed towards the dwelling unit.

The provision of housing has a direct effect on people's quality of life. Affordability can be increased if standards are revised. By increasing affordability, security of tenure is made easier. This has a profound effect on human satisfaction, psychological well-being, empowerment and community control. Dwelling units also impact human life physically, psychologically, health wise and also affect the economic health of the family unit.

Diversity in housing and density improves quality of life since it provides interest, variety, pleasure and stimulates people's senses (Hough, 1984). A variety of housing types needs to be provided. In Chapters 5 and 8 (section 8.3.1.8.), the housing situation in Namibia was discussed and in light of the National Housing Policy and the Build Together Programme, three options suitable for low-income groups are highlighted: conventional housing, starter house and site and service.

Conventional housing consists of a completed house with a high level of infrastructure, services and facilities. At 1994 estimates, a 52 m^2 house would cost N$35 000-. These houses predominantly adopt Western-style design concepts inappropriate to the Walvis Bay environment. As mentioned earlier, the houses are exposed to the adverse natural elements of dust storms, winds and heat and tend to be hot during the day and cold at night. The building materials, orientation and general layout of the house do not provide effective insulation and shelter.

A shell with no internal walls and a low level of finishes is considered a starter house. External appearances are very similar to conventional houses, although smaller. These units can be enlarged and upgraded according to people's needs. In 1994 a 30m^2 unit would have cost N$12 500-.

The site-and-service option consists of land that is developed with infrastructure (either rudimentary or of a high service level). No dwelling units are provided and people are encouraged to erect their own structures which can be upgraded over time. This complements the Build Together Programme (see section 8.3.1.8 and section 5.6.2.5.). At 1995 average construction costs (excluding contingencies, design and supervision costs) a 300m^2 stand could be developed with full infrastructure services and tarred roads for

N$7 200-. This excludes the cost of land[78]. With 60% of the urban population unable to pay market prices for housing because they are living below the subsistence level, the site-and-service option may appear to be the most appropriate (see Chapters 5 and 8). However, sites need to be developed for the middle-income sector as well. Such plots could be sold at a market-related price. Cross subsidisation could then be considered to help reduce the cost for low-income areas further. Moreover, with an increase in applications for higher densities, the municipality could increase its income significantly if developers were charged a betterment levy[79] on the approval of a rezoning. The Town Planning Ordinance makes provision for such a payment, but Walvis Bay has not been charging the levy. Should it be implemented, the income obtained could be directed to low-income housing projects.

The Build Together Programme could possibly provide environmental planners an opportunity to promote environmentally sustainable housing typologies. By means of advocacy and facilitation, planners could inform communities on the appropriate typologies based on Arabic settlements. Furthermore, since people will be building for themselves, the houses will be more appropriate to their needs and result in increased use of appropriate local building technology and building materials. However, the key role of planners in low-income areas, is to provide guidance. In the established middle-income suburbs, development control systems could be enforced by planners. This should not be seen as the adoption of double standards, but rather as the adoption of best practical means practice.

Based on the National Housing Policy and the NDP1, the role of the local authority can be listed as follows:

- provide and prepare land for development;
- provide utility services;
- if necessary, plan, survey, service and sell individual building plots to developers and individuals;
- promote and maintain the use and amenity of all buildings, spaces and equipment constructed or installed in residential areas for the general use of the community; and
- provide services (MRLGH, 1991; Municipality of Walvis Bay, 1995; NDP1, 1995).

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[78]The price estimates are a synthesis from a number of sources. The Walvis Bay Municipality owns most of the townlands, and in terms of its Housing Policy intends to write this cost off as its subsidy for low-income housing (Municipality of Walvis Bay, 1995).

[79]Since new developments in existing areas generate an additional load on municipal services, due to an increase in densities, and since in many circumstances developers are not charged for the extra load generated, developers tend to obtain the benefit of the greater development potential. A betterment levy would ensure that a developer is charged a percentage (as stipulated in the Town Planning Ordinance) of the anticipated development potential.

Within this framework local authority planners could develop land in a sustainable manner, taking design principles (chapter 8) into consideration. The present size of erven in Walvis Bay was discussed earlier in this section. By revising these sizes, Walvis Bay could have a compacted form, facilitating the use of the mentioned design principles. However, the minimum stand size of 300m² nationally applicable to freehold tenure needs to be revised. If this is not feasible, the option of sectional title deeds needs to be considered to enable the implementation of row-houses, and courtyard houses.

10.4.8. Human Scale

The present scale of the town is reliant on the motor vehicle. The centrality of the street is a dominant visual image of the town, illustrating past planning emphasis on motor vehicles. Apart from the direct environmental implications of private motor vehicles such as air pollution and non-renewable resource exploitation[80], economic implications in terms of maintenance costs are also incurred. Human scale is also reduced through the reliance of a motor vehicle.

Human scale is especially important if accessibility and familiarity are considered as essential elements of any town. With no public transport accessibility in a sprawled settlement is reduced, creating a harsh environment for pedestrians. Climatically, the settlement provides little if any comfort to the pedestrian and little to no shading is used throughout the settlement. Pedestrians are vulnerable to the natural elements (wind, sun, rain, and glare caused by the albedo of the building materials) and human comfort is reduced (see Plate 7).

A compact settlement with higher densities reduces distances and could enhance accessibility. The design of narrow roads could provide shade, enhancing human comfort.

10.4.9. Mixed Land Uses

Walvis Bay is also characterised by a strong degree of land use separation. This creates sterile environments that are not used to their full potential. Mixed land uses could ensure a greater degree of land utilisation, enhancing the town's vibrance, vitality and control. Accessibility and convenience could also be enhanced (see Chapters 6 and 8).

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[80]Evidence suggests that large urban areas with low overall densities use more fuel than compact cities with higher overall densities (Breheny, 1992; Elkin, 1991; Owens, 1994; Owens & Rickaby, 1993; Owens & Rickaby, 1983).

10.4.10. Standards

The implementation of standards that are totally inappropriate to the environment can be noted in Plates 10 and 11. Plate 10 once again illustrates a wide road within a residential area. A combination of wide roads and low traffic intensity is unnecessary and wasteful in terms of land and servicing costs. This contributes to the town's sprawl, resulting in lost space and unsustainable consumption of land. The low intensive use of land is evident through barren open spaces surrounding buildings. Furthermore, it is increasing capital and maintenance costs. Plate 11, illustrates inappropriate stand sizes, which create lost space. Plate 12 illustrates inappropriate erf layouts. The wide street frontage and shallow depth exposes the house to sand and wind, which blow from the direction in which the photo was taken. This erf configuration also adds to servicing costs as all erven are serviced with infrastructure and utility networks and each metre of erf frontage means a metre of road, water pipe, sewer and electricity cable which has to be paid for by the dwelling unit. The settlement is also given a course grain through these standards, especially in Walvis Bay proper, illustrating a high dependency on personal mobility. The layout of the houses does not promote opportunities for social interaction, and the continued and repetitive layout of the town creates a boring environment (see Plate 12) which is dehumanising because people were not planned with in mind. Note how people try to reduce the monotonous rhythm of the houses and the impersonal layout of the dwellings by using colour to distinguish their dwellings. (Plate 13 is an example from Swakopmund which illustrates the monotonous rhythm of the houses).

10.4.11. Exposure and Enclosure

Plate 12 illustrate that the settlement is highly exposed. Emptiness, a great expanse of sky and a stark horizontal geometry create the feeling of exposure. (The same can be said about Plate 11, where the house seems isolated with no defining boundaries). The feeling of exposure has both psychological and environmental implications. Psychologically, it does not create the sense of permanence a settlement should provide. Exposure also reduces intimacy, once again dehumanising the settlement. (Plate 13 and 14 are examples from Swakopmund).

Plate 15 illustrates the use of enclosure. The enclosure of the park with the houses provides a third dimension to the space, creating a clear boundary to this precinct. Note how the enclosure of the space and the colour of the grass add vibrance and allows the houses to open onto a public realm. The linking aspect of these houses surrounding an open space promotes a sense of community and may possibly permit the surrounding residents to control the area.

The settlement is exposed to a variety of natural elements such as wind and sand encroachment. Sand is of special concern, because it could have economic implications on

Plate 10: A wide neighbourhood road in Naraville.

The roads dimensions are inappropriate to the traffic volume it experiences. These wide roads are dangerous for children since they encourage motorists to drive faster. Furthermore, the wide roads reduce comfort, and community interaction. The wide roads also act as wind channel in which sand is deposited.

Plate 11: Isolated dwelling surrounded by lost space.

Lost space, is created by an erf size that is too big. Two more dwellings could have been built between the existing three houses. This would reduce each dwelling unit's cost of land and infrastructure, as well as maintenance costs.

Plate 12: Dwelling units in Kuisebmond.
From this plate three features can be noted. The first is the inappropriate plot configuration of wide street frontages and shallow depths, noted through the longitudinal side of the dwelling units facing the street. This increases capital costs and municipal rates and taxes. Such plot configurations also encourage sprawl. The second feature is that the repetition of housing types and implementation of constant planning and development control standards, creates a monotonous environment. If it were not for the use of colour, individuality and identity would be lost. This could have serious psychological implications. The third feature is the developments exposure to wind and sand.

Plate 13: Example from Swakopmund of a monotonous and repetitive environment.
The photo also illustrates the exposed nature of the settlement. This example is used to illustrate that not only Walvis Bay is highly exposed but other settlements in the region are as well.

Plate 14. Repetitive environment.
Another example from Swakopmund.

Plate 15: Example of enclosure.
In this illustration, the small park is enclosed in a space defined by the buildings surrounding it. Note how the contrasting colours add vibrance to the scene.

the built environment (as been discussed in section 10.3.3). Physical health problems can arise as a result of exposure to the dust blowing unhindered into the settlement.

Design can reduce the effects of exposure. Transitional edges between the desert and urban environment can be created through the use of a greenbelt or fence. Building densities could also be increased along the outer edges. The compact erven in combination with a height allowance could create an urban barrier similar to a wall in medieval Arabic settlements. This barrier could reduce the amount of sand blowing into the town. Special construction technology would have to be used in such buildings. For example, a finer compaction of concrete would be needed on the outer walls to prevent penetration which could cause brittleness.

10.4.12. Focal Points

The lack of vertical structures creates a monotonous skyline, creating no true focal point by which people can orientate themselves. It is only within Walvis Bay proper that two visible vertical focal points can be noted. These are the post office communication tower and a church tower which can be seen in Plate 7. These two features can also be regarded as landmarks, since they are easily identified from all over the town.

10.4.13. Use of Colour and Texture

The use of colour, texture and enclosure as illustrated by a small park (Plate 15) attracts the eyes immediately. Note the deep contrast between the green grass, and the sky and sand.

Due to high albedos, it may be necessary to shade a number of public areas. Shading often changes colour and this adds depth and rhythm to many built elements[81]. However, this may not be feasible in many areas and in order to reduce albedo and glare, darker colours and textures should be used. However, many buildings should be painted predominantly white to reduce the heating of buildings. The use of colour may seem contradictory, but the secret is in balance.

10.4.14. Edges

Plate 16 and 17 illustrate the use of edges to create a boundary and a sense of hereness and thereness. Plate 16 also illustrates the functionality of the edge in that it is used to

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[81]Imagine a colonnaded passage with the sun shining into the passage. The columns provide shadows which create rhythm and depth.

Plate 16: Town "wall".
This photo illustrates the town's edge. A boundary is clearly defined between the town and the desert, creating an edge. This boundary, apart from defining the town's limit, functionally prevents sand from encroaching into the settlement. It also shelters the town from prevailing winds.

Plate 17: The neighbouring desert.
Though a distinct urban edge, i.e. the boundary wall, it is not effective against sand encroachment. The lack of a town buffer has also resulted in the road being covered by sand. From a psychological perspective, space is well defined between an enclosed setting, and the desert's expansiveness. A sense of hereness and thereness exists.

Plate 17a: The road is given an end through the use of an edge.
Note how the buffer of reeds and shrubs prevents the road from being directed into the desert's expansiveness.

Plate 17b: The town's boundary.
The reeds and wall create an edge with the desert. Note how the wall prevents sand from entering into the settlement.

prevent sand encroachment into the town. Plate 17, though a distinct urban edge, does not create an effective boundary against the desert, as can be seen by the encroachment of sand into urban areas.

10.4.15. Culture of Endless Space

Space is seen to be endless and is reflected in the town's layout and standards adopted. Plate 5 illustrates the cost of such a thought. The clearing of a sand dune to make way for development impounds a capital cost and environmental cost. Furthermore, these dunes perform a vital function by supplying relief which reduces wind speed and hence the volume of sand blown towards the settlement. This advantage should not be underestimated. Plate 6 illustrates an area which was cleared of its dunes in anticipation of future development. The darker sand in the foreground is graded sand. The lighter sand is recently deposited aeolian sand, which will blow into the settlement and cover the graded sand. Grading will therefore have to be done again, imposing another cost.

As argued in the theoretical chapters of this dissertation, culture and values are difficult to change. However, a physical change could begin to change culture and value. It is therefore important that the economic, social and environmental costs imposed by a culture of space are highlighted to residents, developers and even the town council. The decision model discussed in Chapter 4 could be beneficial in developing a sustainable urban form discourse that is able to capture present social currents. As part of the discourse the advantages (made applicable to people's circumstances) of a denser compact settlement should be presented.

10.4.16. General Comment

The unsustainable low intensive use of land is evident throughout the settlement. Planning standards are too rigid and inappropriate, creating a sterile environment. The town's design does not work effectively thereby reducing convenience and comfort of all its users. Orientation is made difficult within the town due to a monotonous street frontage and uninspiring skyline. Visual stimuli are limited, reducing the qualities that give a settlement a comforting identity. The present visual image of the town is that of a bland sterile environment with little vitality, diversity and vibrance. Its appeal is extremely limited in terms of human comfort and general quality of life.

10.5. CONCLUSION

Through the use of an appropriate human scale, an interplay with space that focuses on activity and the promotion of contact and access through the use of mixed land uses, human comfort and convenience could be greatly enhanced in Walvis Bay. Rather than prescribing standards as done in the past, planning should unleash creativity; it should

offer guidance, but not stifle development. Past planning ideals of a highly organised settlement which implicitly enhanced control (a strong element of apartheid planning) need to be abandoned. Societal values need to be considered in new plans and designs. These values should be functionally translated through design promoting vitality, sense, access, legibility and citizen control. In turn, all these dimensions will enhance the urban character.

Such urban character is visually perceived and mentally differentiated through urban form and its elements are the paths, edges, districts, nodes and landmarks as defined in Chapter 7. Most of these elements have been analysed through the analysis of the street network, erven sizes and textures, densities, and housing situation. Beyond this, a third dimension was included, that of relationships between the built and natural environment, including human relationship with the built environment.

The intricate relationship between the built environment and the natural environment has illustrated the importance of designing with nature. In this respect design principles from settlements in arid environments (as illustrated in Chapter 8) could improve Walvis Bay's quality of life and human comfort.

Social and economic costs were highlighted as a human-centred approach to sustainability. This in itself is a discursive formation relevant to decision making. Urban form, through the interrelationship of all its theories and principles, has been shown to have major sustainability implications. The unsustainable characteristics of Walvis Bay as evidenced by negative criticisms, testify to this. Urban form can therefore be made sustainable through the implementation of physical design principles.

10.6. SUMMARY AND FINDINGS

The following points can be considered as the main findings from the analysis of Walvis Bay's urban form and visual image. The next chapter will expand on the major issues and will recommend possible solutions.

1. Walvis Bay has a grid pattern, which although definable on a Map, is illegible on a street scale.
2. The settlement is characterised by urban sprawl. Densities are very low and erven are very big. This reduces the settlements human scale and increases capital, maintenance and operational costs.
3. Land is not intensively used, resulting in the unnecessary consumption of land.
4. The built environment is not developed to capture benefits from micro-climatic features.
5. Housing in the town is not suitable for the harsh extremes of the natural environment.
6. Standards adopted are also not suited to the environment. Street dimensions are very ample, which is unnecessary in terms of the town's traffic volume. It is also inappropriate to the environment.
7. A certain degree of future development can be contained within the existing settlement. This will change the town's form by making it more compact.
8. A variety of low-cost housing solutions exists; courtyard house and row-house are not among them. Depending upon their economic and political feasibility, they could alter the density and texture of settlements.
9. Present socio-economic conditions in Namibia favourably influence the option of self-help housing schemes.
10. Walvis Bay is highly dependent on the motor vehicle. Present densities do not warrant a public transport system.
11. Economically, socially and ecologically (in terms of water, energy and land consumption) Walvis Bay is unsustainable.

The following findings refer to an urban synopsis on the entire analysis of Walvis Bay, based on urban design principles of function, order, identity and appeal.

12. Function:
    - In terms of linkages, the town is inaccessible to many disadvantaged groups, such as the aged, young, and those without private transport, because the scale and distances are not on a human scale. The town is highly dependent on the motor vehicle which reduces people's mobility. Interaction between function and people, is also reduced due to planning standards that have resulted in rigid zonation and distances between buildings.
    - Due to the high suburban standards, resulting in single-family dwelling units on large erven, the possibility for privacy is increased, but security is not enhanced.

Spaces are in many instances not clearly defined (due to a lack of structuring elements) which reduces the psychology of perceived control.

- In terms of comfort the settlement does not promote physical ease. It provides little shelter from harsh desert extremes, possibly resulting in physiological stress. The town's harsh geometry (due to very few green areas, linear street patterns and a sterile environment in general) does not provide visual comfort.
- Choice and variation in most of the town are very limited. The town appears to be very repetitive in style and architecture.

13. Order:

- The town is not well defined and lacks quality of coherence. Although the entrance to the town is well defined, giving a sense of arrival, the town's edges and districts are not defined through human imposed structuring elements such as buildings and trees. The town relies on the physical natural environment to do this. For example, the sand dunes are the town's outer boundary (no real transitional boundary exists), the town's districts are really distinguished by the coast line (the lagoon area through its shape creates a district) with little distinction within the town. The townships of Kuisebmond and Naraville are clearly defined as districts due to their isolation and densities. The definition of districts and edges is only noticeable on a plan scale, but on a human scale districts and edges are not clear. Although the road structure is clearly defined (i.e. a grid for the major part of the town) the road hierarchy is not. Major roads from secondary roads and collector roads from residential roads are indistinguishable on the ground.
- The town is therefore not well articulated in terms of structuring elements which articulate places from spaces (place has a quality of being able to define a function to its form and *vice-versa*).

14. Identity:

- The town's character is very simple and repetitive. Visual focus is lost due to a monotonous skyline and groundline (the town is relatively flat in both senses). Due to the repetitive nature and lack of visual focus, activity nodes are predominantly defined by function and not through a special quality or view. Singularity and symbolism are rare, and rely on juxtaposition (i.e. a visible contrast to its environment).
- From the horizon the town provides some degree of identity, but this is lost once one enters it.

15. Appeal:

- As mentioned, the town does not have a human scale which influences its appeal.
- Due to the town's proportion (once again influencing human scale) it is not really appropriate to the socio-economic realities of the settlement. It is also not appropriate to its natural environment. Authenticity is reduced, implying that the concept of the town and its standards were imported from other countries.
- The monotonous skyline, limited use of vegetation and implementation of sterile planning standards does not provide visual stimulation, inherent in the contrast of

hard features (human built) and soft features (trees) and contrasting architectural styles. This reduces the town's vitality. Vitality is also negatively affected by the misfit between planning standards and the real situation. For example, the road is so wide that even though it has movement (which enhances vitality), this is lost due to a lack of enclosure.

In general Walvis Bay has not developed with the relationships between the environment and humans in mind.

The next chapter provides a number of recommendations that Walvis Bay could adopt to achieve a more sustainable urban environment.

"I Believe in a created universe where all things have place and purpose and where we humans are challenged everyday to make this a better place. I believe it is our obligation to act respectfully toward all living things and to manifest an approach to life in which the dignity of all species is sustained and common interests flourish. It is my belief that we must learn all that we can about our world in order to live upon it wisely."

Roger Kennedy
Director U.S. National Park Service

CHAPTER 11 : RECOMMENDATIONS

11.1. INTRODUCTION

This chapter provides a number of specific recommendations for Walvis Bay, as a follow-on to the previous chapter. These recommendations are based primarily on the exclusive characteristics of Walvis Bay. They could, however, be considered in other settlements along the Erongo Region's coastline, namely Swakopmund, Henties Bay and Wlotzkasbaken. Langstrand-Dolphin Beach falls within Walvis Bay's jurisdiction. These recommendations are not directly applicable to it, but could be considered there as well.

The recommendations are empirically and theoretically deduced from the previous chapters, ultimately being applied to enhance Walvis Bay's urban sustainability including its liveability. More explicitly, the recommendation attempt to improve Walvis Bay's function, order, identity and appeal as defined by the town.

The recommendations are structured into themes (such as vegetation and tree planting, street layout, densities, housing style, plot layout and mixed land uses). A brief statement of either the problem is given or what is envisaged, and in many instances both. This is followed by the recommendations. Some of these recommendations closely resemble the design principles mentioned in Chapter 8.

11.2. RECOMMENDATIONS

11.2.1. Planting of Trees and Vegetation

Trees and vegetation provide rhythm, vitality, legibility, comfort, enclosure, shelter, micro-climatic benefits, socio-psychological benefits and visual contrast. They also define spaces.

The following is recommended:

- Research should be undertaken to determine the financial and ecological feasibility of planting more trees and vegetation. This research should also seek to identify the vegetation best suited to the environment.
- "Greenbelts" should be established in those areas at present exposed to the desert and prevailing wind direction. These greenbelts, whether made of reeds, trees or desert shrubs and plants, or a combination of them, should be planted to stabilise sand and

prevent encroachment on the town. The greenbelts will also act as wind breaks. Map 5 conceptually illustrates the areas which need greenbelts (buffers). If a greenbelt is not feasible other barrier techniques should be sought, such as sand nets.

- Trees should be planted to act as buffers and create an urban edge, clearly defining the town's boundary. It is recommended that such an urban edge (a greenbelt) be included into the town's future structure plan. This can be used as a method to contain development. When including the greenbelt in the structure plan, cognisance should be taken of the town's projected growth. For the greenbelt to be effective as a buffer and shelter, it needs to be located as close as possible to existing developments, but such an edge should not be seen as static.

The concern that a greenbelt may hinder development or place undue development pressure within the contained area is considered. If development meets up with the greenbelt, it could be moved further outwards. The former belt area could be reduced to form small parks within a new development. Figure 34 illustrates the concept.

Figure 34: Expansion of "greenbelt"

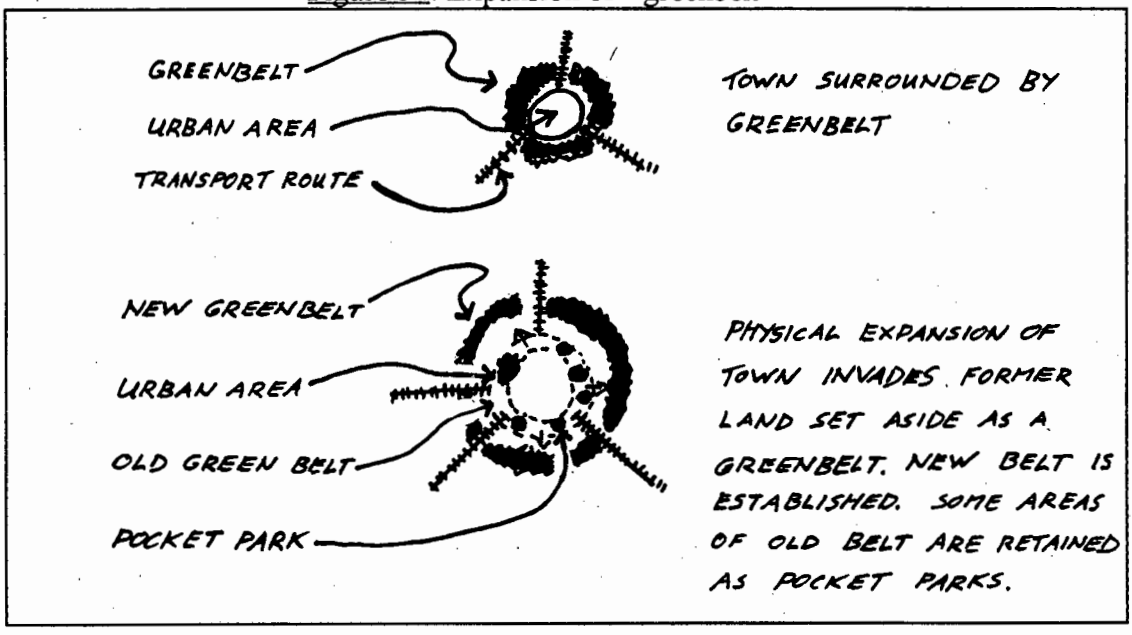


Plate 18, a photo of Arcadia (Arizona) illustrates a similar concept. A citrus orchard was converted into a residential area. By retaining most of the trees and setting the houses within them, a lush environment was created. Apart from people having fruit for their own table, the residents benefit from micro-climatic advantages, such as those illustrated in Figure 30.

Given the harsh, dry environment and scarce water resource (even though grey water could be used) of Walvis Bay, extensive greenbelts would not be feasible. These

Plate 18: Arcadia

18. The Arcadia district, a highly successful transposition from productive citrus orchards to lush residential neighborhoods with the regularity of tree plantings complimenting the gridiron land divisions. (At the lower right is an area developed using desert landscaping without the lushness provided by flood irrigation in Arcadia.)

greenbelts should be located strategically to provide the maximum amount of shelter with a minimum amount of planting.

If these recommendations are adhered to, development will be encouraged within sheltered areas and densification contained by the greenbelt. The recommendations will also help curb urban sprawl and add definition to the town. Sand encroachment will be reduced. Capital, maintenance and operating costs, associated with sand removal, will decrease.

•Greenbelts could be used as a recreational interface with the desert. Apart from providing obvious green areas sheltering the town, they could be developed functionally with recreation in mind. These recreational areas could possibly be based on a concept similar to a waterfront esplanade, only in this case it would be a desert front. A golf-course could also be used as a recreational buffer.

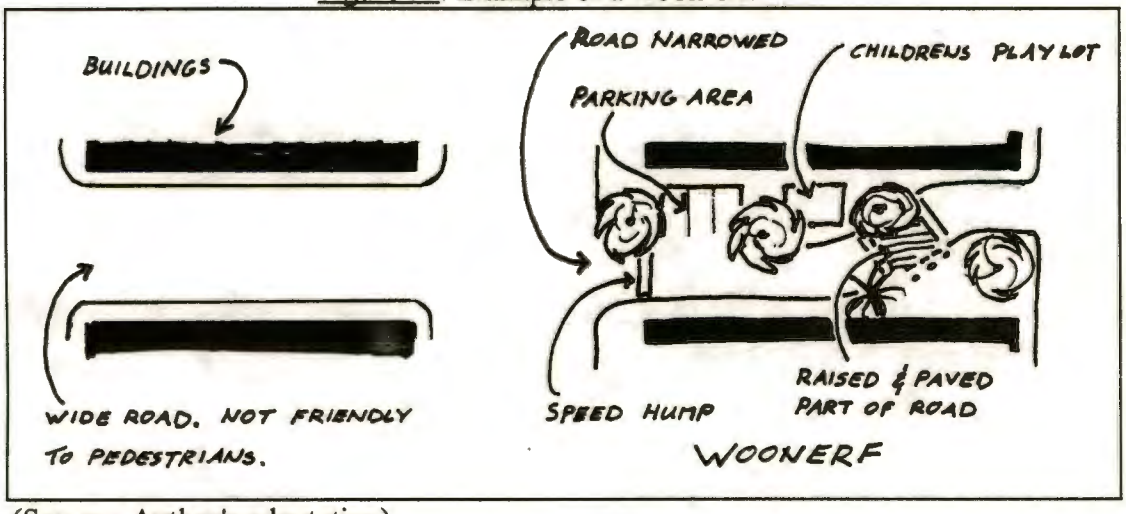
•Small private gardens should be encouraged to reduce maintenance costs, water consumption and urban sprawl. Small enclosed gardens provide micro-climatic benefits as well.

11.2.2. Street layout

As illustrated in Chapter 10, the present street layout is inappropriate to its environment. The following recommendations are suggested for the existing town:

- *Woon-erf concept*. This concept is based on "returning" the streets back to pedestrians and reducing the importance of vehicles. The woon-erf concept seeks to create a street environment that is friendly to pedestrians and where social interaction can be encouraged. Figure 35 illustrates the concept. Woon-erfs can be implemented in areas which have higher densities.

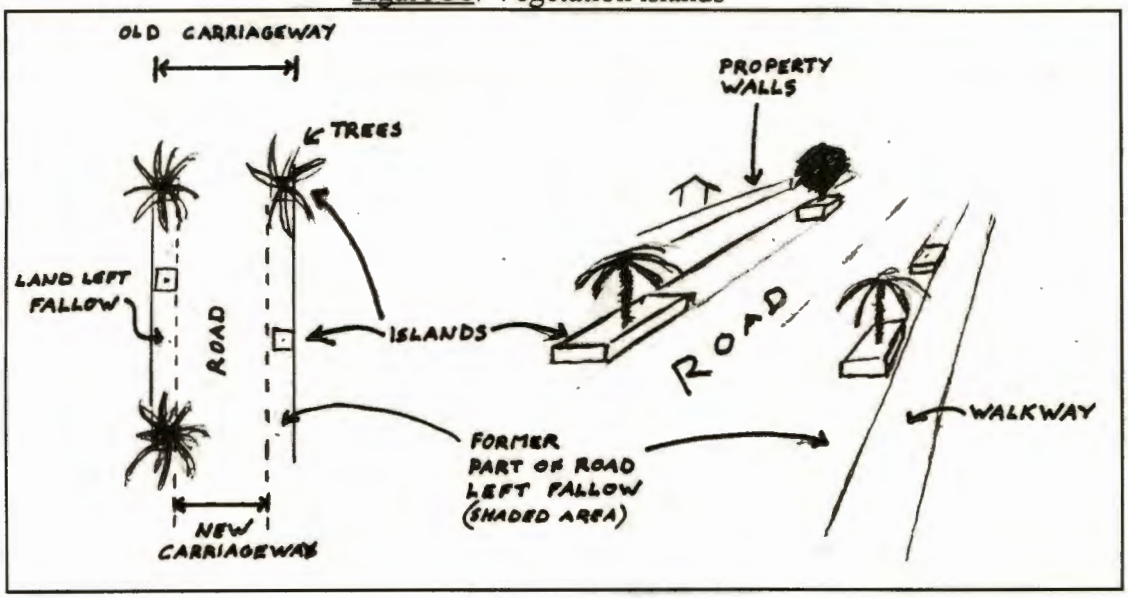
Figure 35: Example of a woon-erf.



(Source: Author's adaptation)

- *Road narrowing*. Since the woon-erf concept is expensive, it may not be feasible to implement it throughout the town. In this regard, streets can be narrowed with the use of vegetated "islands", similar to flower boxes. These islands could be placed at random intervals within the existing wide roads (see Figure 36).

Figure 36: Vegetation islands



The advantage of this concept is that the street can be restored to its former standards if the volume of traffic picks up. The "islands" also require less maintenance costs and less water is required than an extensively vegetated roadside. The trees in this configuration also provide an element of enclosure and rhythm to the road.

- *Subdivision and consolidation*. This recommendation is linked with the policy of densification outlined further on. By reducing the road reserve, land is freed for development. Through a combination of subdividing erven and consolidating land from the road reserve, a new smaller erf could be made available. Figure 37 illustrates this.

Since no recent topocadastral Map of Walvis Bay was available, areas within Walvis Bay suitable for such a recommendation could not be demarcated.

The following areas require attention if this recommendation is considered:

- the siting of existing subterranean infrastructure;
- people's willingness to live on smaller erven;

- the legal and procedural requirements of such a development proposal should be seriously considered[82]; and
- the road to be narrowed should not be a major road or a collector.

Figure 37: Subdivision and consolidation of land from big erven and the road reserve

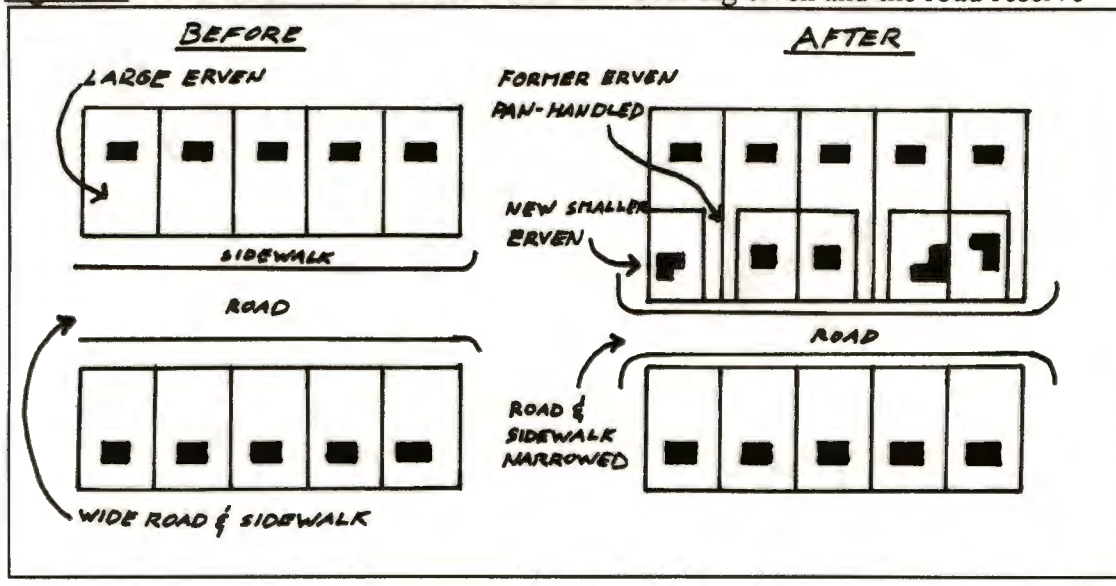
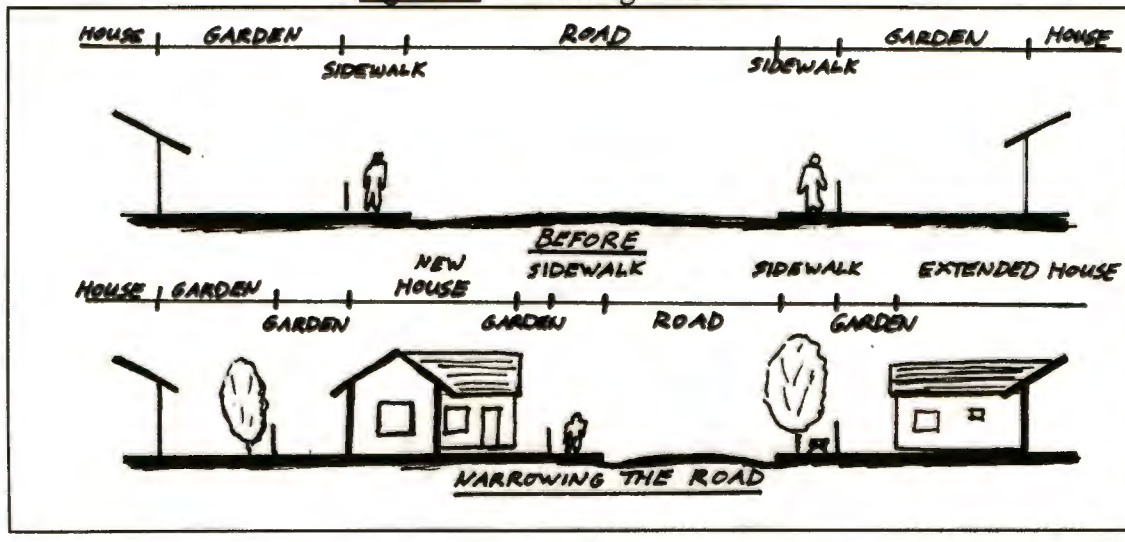


Figure 38: Narrowing of roads



[82]Clause 50 of the Local Authorities Act 23 of 1992 permits local authorities to close public places such as streets. Subdivision and consolidation of land can be done in terms of local authority procedures. In certain cases the expropriation of land may be required and the feasibility of this should be considered. The status of servitudes also needs to be considered and acted upon in a reasonable way.

- *Minimum road width*. Due to low car ownership statistics in Kuisebmond (author's observation), some streets can be reduced in size to a minimum width to accommodate emergency vehicles (see Figure 38). By reducing road reserves, less land is consumed, more dwelling units can be developed and a tighter configuration of land will be created resulting in a compact settlement, where densities are increased, mobility is enhanced and capital, operation and maintenance costs are reduced.

Recommendations for new developments concerning street layout include:

- In new developments smaller road reserves should be designed, with smaller set-backs for the dwelling units from the road, if any setback is necessary at all.
- Orientation of road network should be laid out to provide the maximum amount of shelter from sun, wind, and dust storms. The sun path and wind direction should be given serious consideration in any development. Examples of street layout are illustrated in Figure 26.
- Streets in waterfront coastal developments should not be encouraged to run parallel to the coast, since this encourages sprawl in a linear manner along the coast.

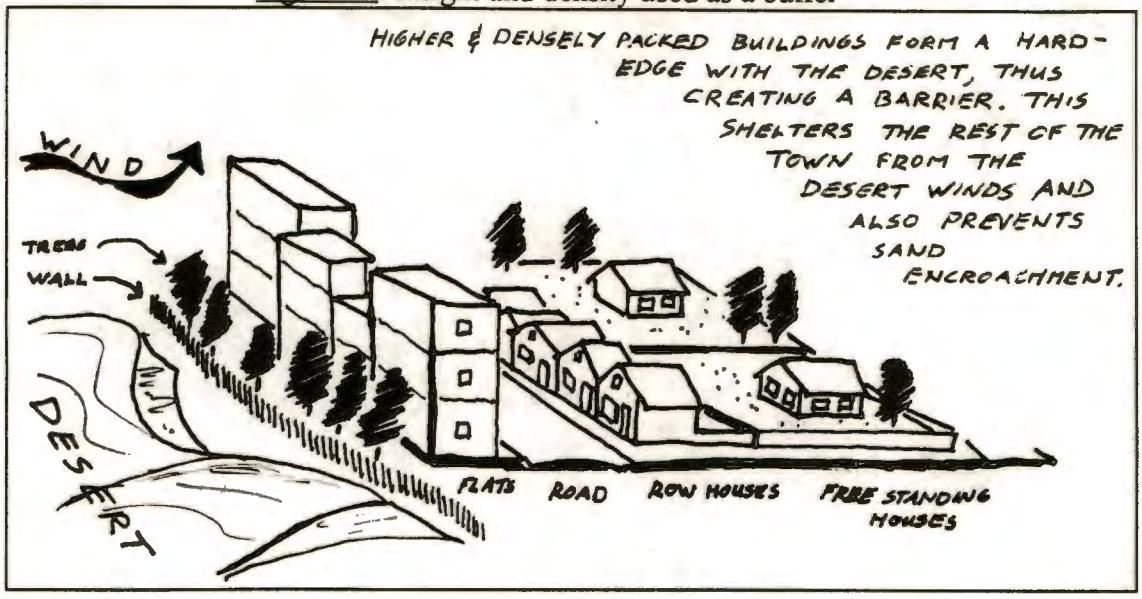
11.2.3. Densities

The present densities in Walvis Bay are very low. This is encouraging urban sprawl and is unsustainable in terms of financial implications, land consumption and energy consumptions and implications.

The following is recommended:

- A density policy be drawn up for Walvis Bay. This policy should divide Walvis Bay into a number of districts with a variety of densities pertaining to each, according to appropriateness and feasibility in terms of subdivision, especially in existing areas. Future areas should be given higher density allowances. Although Walvis Bay has a draft Density Policy Plan, it is recommended that this be revised appropriately. Densities could be increased to around 50 units/ha. This is considered an optimal density that is also feasible for a public transport system.
- If possible, higher densities should be permitted close to the desert edge so as to form a buffer against sand and wind (see Figure 39).

Figure 39: Height and density used as a buffer



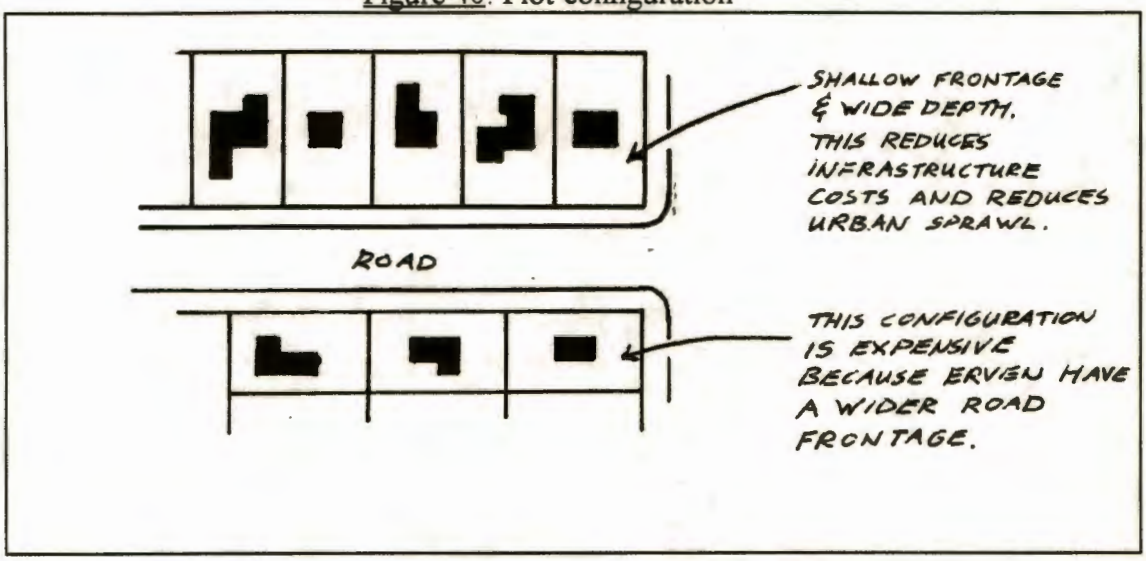
- The process of subdivisions should be made more accessible.
- Development control mechanisms and zoning restrictions (such as height, bulk, floor area ratios and coverage) should be revised so that they permit a compact settlement.
- Smaller erf sizes should be encouraged, especially in new developments.
- For coastline developments, which are predominantly for the upper- and middle-income groups, minimum erf sizes should be encouraged. This is because the present trend of coastal houses is increasing. Smaller erven with higher densities will help alleviate urban sprawl along the coastline.
- The minimum erf size of 300 m^2 should be reduced further. National government should be petitioned to eliminate this as a national set standard, so that the minimum erf size can be determined by local authority discretion.
- Different housing typologies should be considered and encouraged. Medium-density, or low-rise/high-density cluster housing should be considered.
- Planners should control development through specific design criteria and standards as discussed and illustrated in Chapter 9. However, the adoption of standards should not be conservative, since conservative and static standards hinder designers' abilities to adapt the built environment to change. Specific design guidelines should be avoided.

11.2.4. Housing Typology

The dissertation has illustrated that present typologies and styles are inappropriate to the natural environment and therefore unsustainable. Typologies and styles are influenced by erf sizes and dimensions. Before a typology is recommended, recommendations for erf size and dimensions will be discussed first.

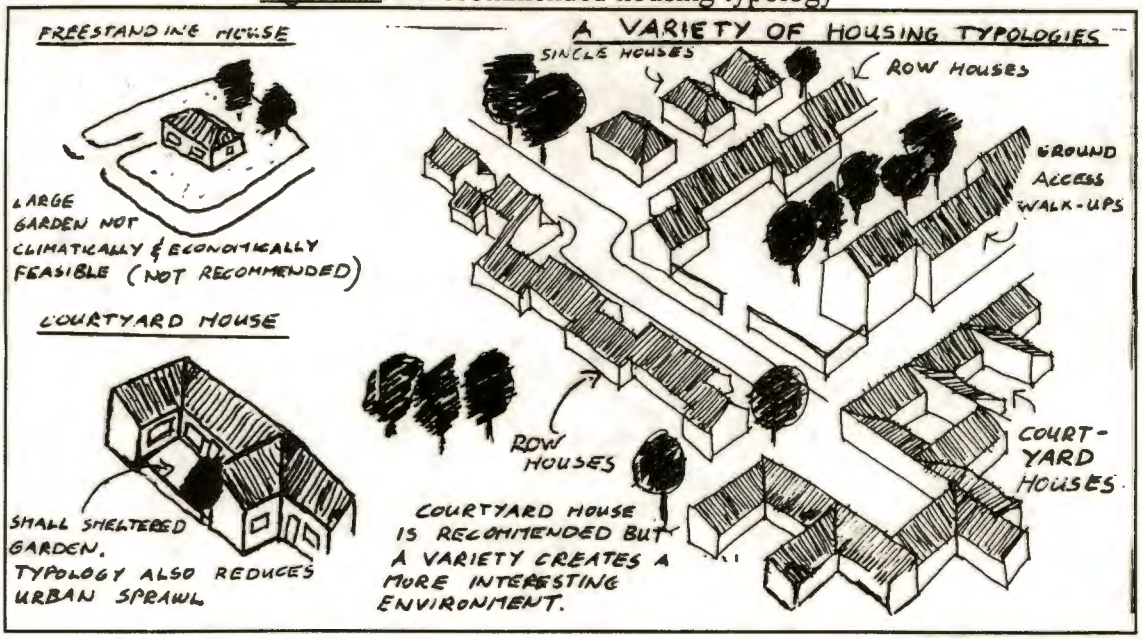
- As mentioned in the previous section erf sizes should be reduced. Possible erf size guidelines could range between 150m² (permitting row-houses) to 600m². This range should be applicable throughout Walvis Bay, since there is no relationship between erf size, quality of life, standards and income groups. Permitting a range of sizes will also enhance diversity and provide choice.
- Plot configurations should have shallow frontages and wide depths (see Figure 40). This reduces the cost of infrastructure and utility networks and influences rates and taxes favourably to the household. Plots can therefore be made more affordable to the lower income groups.
- Mixed housing styles should be encouraged as close as is environmentally and aesthetically possible. Along the waterfront areas, height and bulk should be strictly controlled.
- Residential development should occur on a smaller scale and in a less homogenous way. This will encourage the development of an environment that is diverse, varied, more interesting and permits home ownership choice.

Figure 40: Plot configuration



- The housing typology, should closely resemble the court-yard style. This involves the use of an interior courtyard with a small sheltered garden, rather than a large suburban garden (see Figure 41). However, other typologies such as row-houses, and double-storey walk-ups should be considered as well (refer to Figure 14). Compactness through housing typology does not imply an increase in costs, nor a loss in privacy, provided design is professionally carried out.

Figure 41: A recommended housing typology



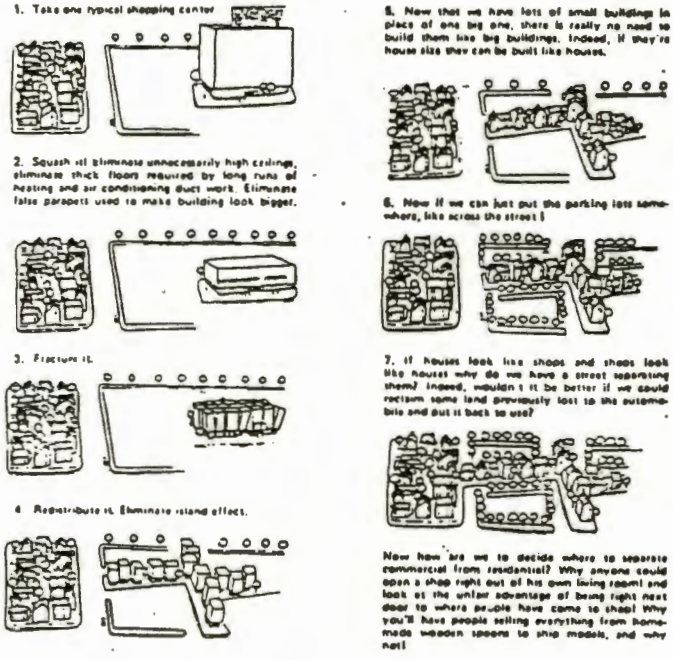
- Since urban form is highly influenced by the residential environment, the provision of housing must not be seen as merely the provision of housing units but rather as structuring elements of a town and its form.

11.2.5. Mixed land uses

Mixed land uses allow a settlement to become more compact (see Figure 42), thereby enhancing accessibility, convenience and comfort, while also providing a more interesting and varied environment. At presently, Walvis Bay is characterised by an urban form that is highly segregated due to rigid zoning. The following is recommended:

- In existing settlements, applications for a change in land use should be considered if the land use applied for is compatible with an existing land use and will not be a nuisance or adversely affect surrounding erven. Furthermore, public consent should be sought. However, control of land use should be achieved through performance and impact zoning and not Euclidean zoning.
- In future developments mixed land uses should be planned for. However, some sites and locations should be zoned for a particular land use such as industry. Separation should be based on economic and environmental grounds.

Figure 42: Example of the impact of mixed uses



(Source: Author unknown)

11.2.6 Public Open Spaces

Extensive public open spaces are unsustainable in desert environments. However, with the advocacy of smaller erven, public open spaces should be provided for passive and active recreation. The following is recommended:

- Small sheltered public spaces should be planned into the existing urban form.
- By improving the street environment with vegetation and other features, the road network could be used as part of an open-space system (for example: woon-erf concept) thereby permitting the multi-use of the street environment.
- Parks and playground should be easily accessible to children and within walking distance.

11.2.7. Public Facilities

At present many public facilities are monofunctional. By using facilities for more than one purpose, spatial requirements and sprawl are reduced. The following is recommended:

- Public facilities should be designed in such a manner that they encourage the multi-use of that facility. This will ensure that they are used to accommodate a variety of activities.
- Once again the road environment can be designed to permit outdoor use. For example, markets can be established in streets and parking lots at certain times.

11.2.8. General Design Principles

So as not to be repetitive, the design principles discussed in chapter 8 (section 8.3.1.) should also be seriously considered, in that all of them can prove to be beneficial to urban life in Walvis Bay.

11.3. CONCLUSION

The recommendations proposed in this chapter are guidelines which could be used to facilitate community discussion and development proposals. They should not be seen as static. If accepted, the guidelines should be adapted to local site characteristics. The planning authority should ensure or maintain some degree of coherence, and in this regard, it is recommended that these guidelines be included in either a Structure Plan or a Coastal Zone Management Plan applicable to urban areas.

The recommendations have transcended from the findings of this dissertation and it is believed that if used as guidelines, they could result in a compact settlement that considers the relationship between humans and their built environment and between the built environment and the natural environment. In so doing, it is believed that Walvis Bay could develop an urban form that is sustainable. However, the attainment of a sustainable urban form, through the adoption of these recommendations (as well as design principles mentioned in Chapter 9) will not occur within the immediate future (i.e. next five years). In fact, many of the recommendations can only be achieved in the long run (ten to fifteen years). In the meantime, the recommendations and the design principles mentioned have laid the basis for a move towards a sustainable settlement.

Finally, these recommendations could also be applied to other coastal towns in the Erongo region, provided the conditions and circumstances are similar. In that case they should only be considered as broadly based guidelines and as a basis that advocates the need for a compact settlement.

"Without obstacles there is no creativity."
(Anon.)

CHAPTER TWELVE : CONCLUSION

There is a sustainable urban form for desert environments, and there are specific design principles which are appropriate in a desert environment.

The above proposition was made according to the Steady-State (Ecological) Worldview highlighted in the introduction and the philosophical approach of the dissertation made explicit in Chapter 2. This proposition was then developed within the context of promoting an urban form that could help urban planners in developing guidelines for urban developments within the desert coastal strip of the Erongo region. It was envisaged that the design principles highlighted in this dissertation, either by asserting or negating the proposition, could help improve the quality of urban settlements within the coastal area of the Erongo region.

In order to test the proposition, extensive research was conducted in a variety of literary fields (theoretical and empirical). Finally, an analysis was conducted in which Walvis Bay was criticised.

Since the proposition has three themes, namely sustainability, urban form theory, and urban design, each of these concepts was explored in detail.

Chapter 3 discussed the theme of sustainability. In this chapter, definitions of sustainable development were presented. Common characteristics of these definitions (such as equity, constant natural capital stock and basic needs) were then discussed. Sustainability was then localised and contextualised on an urban scale, where it was emphasised that many issues of sustainability needed to be addressed at the urban level. It was also mentioned that, even at the urban level, a number of strategies existed for solving issues of sustainability. Here the dissertation decisively stated that little attention had been given to physical urban issues in the past and that this needed to be addressed. General principles of sustainability and sustainable design principles were then highlighted, and formed the basis of this dissertation, in that these principles were reflected both in the use of the dissertation's methodology and in the envisaged process of attaining guiding design principles. The principles were also reflected in the design principles outlined in Chapter 8. Furthermore, a correlation could be noted, between the principles of sustainability and the basic performance dimensions of urban form and urban design principles .

Since environmental matters need to be considered in a holistic manner, and since design is a process, methodologies were discussed in Chapter 4. In this chapter, the dissertation's methodology was highlighted, and shown to correlate with the basic rational process used

in design. The chapter also discussed the importance of decision-making, which is twofold. Firstly it formes the theoretical model for Planning Theory as a branch of urban morphology (as discussed in Chapter 5). Secondly, it illustrates the conscious use of methodology in presenting a discourse that would provide decision-making with informed issues concerning sustainability. Through the use of methodology, planners have an "unprecedented opportunity to practice their procedural skills as educators, as facilitators, and as mediators between politicians and citizens in shaping the sustainability agenda" (Rees, 1995:356). Recognising this, the chapter advocated the conscious use of planning methodology (through decision-making) as an agenda for sustainability.

In Chapter 5, the theories of urban morphology (Planning Theory, Functional Theory and Normative Theory) were discussed in detail, since any discussion on urban form without an understanding of its theory would be useless. This discussion highlighted an important facet of urban form, that of it being influenced by a number of social, economic and environmental factors. However, it also illustrated that, with the exception of ancient settlements, many forms were predominantly influenced from an anthropocentric perspective. A balance with natural influences was lost, especially in many Western settlements. Nevertheless, the chapter's discussion highlighted a number of performance dimensions (such as vitality, sense, fit, access, control, efficiency and justice) that ought to be inherent in all urban forms, and with which urban forms can be measured against, in order to determine how well they function.

The contemporary dilemma between sprawled and compact settlements was discussed in Chapter 6. Critiques were given of both forms, and the way each influenced sustainability was analysed. It became evident that compact settlements provided greater opportunities for a sustainable urban form, and the advantages of compact settlements were stressed throughout the discussion. However, the benefits of a compact settlement were to be explored further in Chapter 10, where Walvis Bay was analysed.

The importance to urban form of urban design was accentuated in Chapter 7. Apart from illustrating that urban design was a major force in shaping urban forms, the discussion pointed out that basic principles of urban design (namely function, order, identity and appeal) could be used in the analysis of urban settlements. Moreover, these principles also represented the vital attributes that all settlements should have in one way or another, and could therefore be used in prescribing changes to existing settlements. Furthermore, this chapter also illustrated the relationship between the natural and the built environments, as well as that between the built environment and humans, and this illustrated that these relationships could be enhanced, through careful design, thereby providing favourable benefits to humans.

Once armed with the basic principles of sustainability, urban form theories and models, and basic elements of urban design, the dissertation reviewed a number of settlements in

desert/arid environments from around the world in Chapter 8. Since Chapter 5 discovered that environmental characteristics did play a major role in settlement form, but that these were overshadowed by human influences, this chapter sought to seek out whether environmental characteristics did influence urban form in desert environments. It was established that urban forms in desert environments were not purely shaped by environmental determinism, and that no dominant urban form existed across the world. However, it was highlighted that settlements in the Middle Eastern countries significantly adapt to their environments. Basic design principles were therefore drawn from these settlements (many of which evolved from ancient cities and were perpetuated through Arabic and Islamic culture). Furthermore, contemporary settlement trends in Israel were revealed to be applying many of these basic principles. These design principles were therefore highlighted, since they could improve the comfort and sustainability of arid settlements.

Chapter 9, briefly listed major points that could help in evaluating a sustainable urban form. These points were based on the previous chapters.

Walvis Bay's urban form and character was analysed in Chapter 10. This analysis revealed that Walvis Bay, at present, has an unsustainable urban form. Its urban form does not accord favourably with the principles of sustainability. Neither does it "score" favourably with the basic performance dimensions of urban form, or with the basic principles of urban design. It revealed by default that a compact city could prove to be more beneficial to its environment. Furthermore, it was noted that basic design principles from the Arabic settlements (as highlighted in Chapter 8) could prove to have social, economic and natural environmental benefits.

Chapter 11, provided a number of recommendations that could be applied to Walvis Bay. These recommendations were based on sustainability, urban design principles, urban form performance dimensions and design principles from the settlements reviewed.

This dissertation has therefore illustrated that the compact city (and its tenets) is the most appropriate urban form for desert environments. Furthermore, basic design principles from the Arabic settlements may prove to be beneficial to the Walvis Bay environment enhancing a future compact form, while shaping it as well. Moreover, by designing in harmony with nature, urban sustainability can be achieved, resulting in social, economic and natural environmental benefits.

Finally, the proposition is correct only if the natural, social and economic environments are considered within a local planning context. However, if the proposition implies a specific urban form, it stands corrected, because the factors that influence urban forms will vary according to local context. In conclusion, basic design principles appropriate to desert environments do exist. However, these need to be regarded as guiding principles and

should be adopted, adapted or discarded according to the local context. Inevitably, the use of these design principles may with time create an urban form that is sustainable, resulting in the development of towns with similar morphological concepts, but differing physical forms.

APPENDIX A : WALVIS BAY'S CLIMATE

Climatic data on Walvis Bay is not easily available, since much of its data is based on Pelican Point, which, due to its location could experience lower temperatures and different wind speeds and directions to that of Walvis Bay. The number of heating degree days (when temperatures are low enough to warrant the installation of artificial heating systems) and heat stress days (when temperatures are high that they warrant artificial cooling systems) could not be determined, due to inappropriate data and lack of physiological climatic standards for Namibia and South Africa. Such information could have provided a greater degree of certainty as to the appropriateness of passive solar gain, housing construction and typology discussed in this dissertation. It is therefore recommended that further research be undertaken in terms of climatic planning for Walvis Bay. Nevertheless, the following information is available.

Walvis Bay, situated in the Namib desert on the west coast of Africa has a unique arid climate, of which its conditions are influenced by several factors, namely the South Atlantic High, diverging South-East Trade winds, the cold Benguela Current and the absence of convection with temperature inversion in the lower atmosphere (Seely & Ward, 1989).

Precipitation occurs in the form of rainfall and fog. Rainfall in Walvis Bay is unpredictable and occurs throughout the year. The mean annual rainfall is 23 mm p.a.. Advective fog caused by the movement of warm air over the cold Benguela occurs in winter, while inversion and radiation fogs occur during the other seasons. Fog produces approximately 35-45 mm of precipitation annually (UCT, 1996).

Walvis Bay's temperature consists of mild summers and cool winters, with an average maximum temperature of 20°C and an average minimum temperature of 11°C. "Berg-winds" (hot easterly winds) occur frequently during the winter months. The berg winds are predominantly responsible for dust storms in the area. In general "cool mornings with cloudy skies and warm clear afternoons are the rule throughout summer" (Jackson, undated:47). In winter, temperature variations fluctuate a lot due to the berg winds.

Relative humidity is approximately 87%; loss of sunshine days is approximately 40 days a year caused predominantly by fog and the evaporation rate can be as high as 55 times that of the annual precipitation.

The dominant winds in Walvis Bay are the south-westerly winds. Less prevalent winds include the easterly berg winds, land and sea breezes which result in daily changes of wind direction (UCT, 1996). Daily changes in wind direction predominantly circulate anti-clockwise around the town and increase in intensity, with slow northerly winds at about 7am to strong south-westerly winds at about 6pm (Jackson, undated).

Walvis Bay's climate can therefore be considered to be typical of coastal desert environments. Climatic planning concepts from hot desert environments are used in this dissertation, since they have been used in other coastal desert cities such as Elat (Israel).

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